

# ILLINOIS BIRDS: Wood Warblers

Jean W. Graber, Richard R. Graber, Ethelyn L. Kirk

Biological Notes No. 118



Illinois Natural History Survey  
Champaign, Illinois - April - 1983

State of Illinois  
Department of Energy and Natural Resources  
Natural History Survey Division

# ILLINOIS BIRDS: Wood Warblers

Jean W. Graber, Richard R. Graber, and Ethelyn L. Kirk

Illinois ornithology reached an important bench mark with the publication of Bohlen's (1978) distributional checklist. This reference provided for the first time a complete, or virtually complete, list of Illinois birds. It is a valuable foundation for the work that still needs to be done.

This paper, the ninth in a series on Illinois bird populations, deals with the wood warblers (Emberizidae, Parulinae). The order of the species in this account follows the 1957 American Ornithologists' Union Check-list, 5th ed., and not the 34th supplement, which was published while this paper was in press. Of the 43 species of warblers that have been reported (4 questionably) in Illinois or its border areas, 23 have been known to breed (19 regularly) in the state. Most of those that breed—along with 16 species that occur only as migrants—are also represented by sizeable transient populations in spring and/or fall (Table 1).

In a previous paper (Graber et al. 1979) we introduced the subject of "dilution"—the possible influence of habitat availability on migrant population density. While breeding populations distribute themselves more or less uniformly in the available habitat, migrant populations arrive in large numbers at a given area and must survive (or not) on the resources they find there. The problem is undoubtedly of great significance to the warblers. They are mainly night migrants and are virtually all arboreal species (Table 1). The habitats which a flight of warblers reach after a night migration may be unknown to the birds except in the perspective that evolutionary history provides, and evolution cannot prepare a wild population for the elimination of habitats at the rates perpetrated by modern man. Because of this change it is increasingly important to know at least (1) what the populations are both qualitatively and quantitatively, (2) which habitats the populations are using, (3) what resources in the habitats are being used, and (4) the availability of those resources.

Although some breeding and winter populations of birds have been measured in some Illinois habitats (Kendeigh 1944, Graber & Graber 1963, and others), the only attempts known to us to measure migrant populations in specific habitats were the studies of Forbes (1907), Forbes & Gross (1923), Twomey (1945), and Calef (1953a, 1953b). Most of the data on migrant populations collected by A.O. Gross and S.A. Forbes at the Illinois Natural History Survey were never published, but Gross' field notes are still in existence, and we have incorporated his warbler data for 1906–1909 in this paper. Gross worked mainly on cultivated habitats, and the data are very valuable, but he gathered little information on

forest habitat. Twomey (1945) and Calef (1953a, 1953b) studied populations in east-central Illinois forests, but their data on migrant populations were not separated by species.

Because of our interest in the problems faced by migrant populations during their sojourn in Illinois, in 1979 we initiated concurrent studies on (1) the numbers of transients in four arboreal habitats and (2) the availability of food resources in these habitats. To gain understanding of the problems of migrants in different situations, we chose to study two very different areas: (1) the heavily forested southern tip of Illinois, where habitat availability for arboreal species appears to be reasonably ample and (2) the very lightly forested prairie peninsula of east-central Illinois, where arboreal species might be pressed to find sufficient resources. The data on food resources are being published elsewhere. The bird population data are included in this paper.

To census the bird population, we used the method used by Gross—counting all birds within a transect 27.4 m (30 yards) wide on a route 6–8 km long through the habitat (Graber & Graber 1963). Routes through each habitat were marked in advance of the censuses and were followed throughout the seasons. The specific study areas in east-central Illinois were (1) mature upland oak-hickory forest, (2) upland forest edge and shrub, and (3) mature bottomland elm-maple-hackberry forest, all at Allerton Park, Piatt County. Study areas in the south were (1) mature upland oak-hickory forest, (2) upland forest edge and shrub, (3) pine forest, all in the Warbluff area north of Golconda in Pope County, and (4) mature bottomland oak-maple-gum forest at Heron Pond Nature Preserve, Johnson County. Because central Illinois bottomlands were flooded during much of the 1981 migration seasons, densities for that habitat include only the 1979–1980 data.

The general policies followed in this paper are the same as in previous papers in the series. Certain matters discussed in many of the species accounts can be explained here for all. With the exception of data from the Christmas bird counts, the counts of birds referred to are counts by single observers, or in the case of the transect censuses, two observers together. Counts by multiple observers are not comparable.

In referring to museum specimens, we have used abbreviations: FMNH for the Field Museum of Natural History at Chicago, EIUC for Eastern Illinois University Collections, INHS for the Illinois Natural History Survey, ISM for the Illinois State Museum at Springfield, ISUC for the Illinois State University Collections at Normal, NIUC for the Northern Illinois University Collections at De Kalb, SIUC for the Southern Illinois University Collections at Carbondale, UIM for the University of Illinois Museum at Urbana, UMMZ for the University of Michigan Museum of Zoology at Ann Arbor, and USNM for the U.S. National Museum in Washington, D.C.

This paper is published by authority of the State of Illinois and is a contribution from the Section of Wildlife Research of the Illinois Natural History Survey. Dr. Jean W. Graber and Dr. Richard R. Graber are Wildlife Specialists, and the late Miss Ethelyn L. Kirk served as a Technical Assistant in the Section of Wildlife Research.

Two or more outside referees recommend each manuscript submitted for publication in the Biological Notes series before it is accepted.

We have also often used abbreviations for the regions referred to in the tables, i.e., N for North, C for central, and S for south. The regions are shown in Fig. 50.

For noteworthy records (dates, numbers of birds, etc.) we have provided the source reference—the name of the observer, if unpublished. Where no reference is cited, the record is our own.

Though we have used metric measurements or conversions for our own data, we have *not* converted measurements from the literature or from other observers to metric, nor have we attempted to assign technical names to vernacular names given in the literature though we have used technical names for our own records.

In the species accounts we have often referred to William Dreuth's data on the migration at Chicago, published by Clark & Nice (1950). To save space, we have often omitted the complete citation by simply referring to Dreuth. We have also frequently compared our counts of birds in east-central Illinois with those of Professor Frank Smith and his students, who made counts in the vicinity of Urbana between 1903 and 1925. The years shown on some of the migration graphs were the years of their highest counts. Smith (1930) published some of those data, but we have extracted counts of individual observers from the original field notes now in our possession. The principal observers were Frank C. Gates (1908–1910), Alfred O. Gross (1904–1906), Thomas E. Musselman (1908–1910), and Smith himself (1903–1925). These data are often cited in the accounts as "Smith et al. at Urbana."

In discussing ratios between numbers of birds seen in spring and fall, we have often presented both the ratio from our regional field counts (1967–1970) and the ratio observed in our census transects (1979–1981). Ratios from the two sets of data usually show the same trend, but sometimes differ in actual numbers by a sizeable margin. Annual variation is one possible explanation of the differences. The censuses are more refined, as there is a better chance of detecting birds in proportion to their actual numbers in the restricted area being searched, but even the censuses probably underestimate the population.

The number of birds that we saw too poorly to identify within the census transects amounted to 6 percent (on average) of the total number of birds counted, with a range in different censuses from 0 to 17 percent. The figures may include some warblers, which means that the density figures in all tables could be underestimates by that much from just this source. There is no way to account for possible misidentifications or birds missed completely.

Data on kills of warblers at television towers have been included in the migration graphs of each species. The graph line for numbers of birds killed (Fig. 1) shows the cumulative numbers killed at all the towers checked on the given dates. Usually only one or two towers were checked, but in a few cases birds were picked up at several towers (e.g., eight towers on 27 September 1972), which distorts the day-to-day comparison (Fig. 1). Most of the data represent towers in central Illinois between Springfield and Fithian; at these towers 13,766 specimens of all species (8,215 warblers) were picked up mainly in fall between 1957 and 1979. Relatively

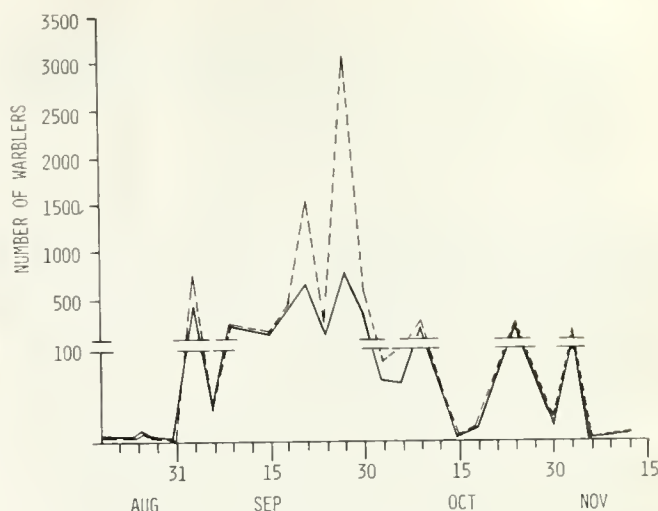


Fig. 1.—Numbers of warblers killed at television towers in central Illinois during the fall migration season, 1957–1979. The solid line represents the largest number of warblers found at any single tower at any date. The dash line shows numbers found at several towers on one date.

few birds were found at towers in spring. Tower areas were not routinely searched, and coverage was very uneven from year to year and month to month.

In the tabulations of population densities (e.g., Table 1) the season for each individual species extended from the date we first encountered that species to the date (inclusive) we last encountered that species, whether it was within or outside the census transect. Because migrants tend to come in "waves" (many on 1 day and on another, none at all), we have omitted the minimum counts, which are often zero. The mean density is the mean for all (including negative) censuses in the season as defined for each species. The data on range of densities refer to census areas of at least 16 ha. Because the early (1906–1909) census data represented mainly cumulations of small census areas (less than 16 ha), maximum densities were not calculable for those years. In the population tables (e.g., Table 3), the column headed "Cumulative Hectares Censused" refers to the transect censuses only. To calculate the comparable figure for breeding bird censuses of the spot map type, one would have to multiply the number of hectares given in the table by the number of years the census was conducted.

We are very grateful to Vernon Kleen of the Illinois Department of Conservation for permission to make extensive use of his important thesis on the prothonotary warbler and to Bill George of Southern Illinois University for data on several species. Marilyn Campbell and her colleagues at the Vermilion County Conservation District and the Vermilion County Audubon Society provided much valuable data, and members of the Champaign County Audubon Society—especially Inez McLure, Robert Chapel, Earl Long, and Beth Chato—contributed many valuable observations. Todd Fink of Belleville and Bowie Hannah of Dix contributed nest records on several species. Dave Bohlen of the Illinois State Museum and Barrie Hunt of Eastern Illinois University shared with us, as they have in the past, their con-

sistently fine field records. They and Dale E. Birkenholz of Illinois State University, Bill Southern and Harlan Walley of Northern Illinois University, William Beecher of the Chicago Academy of Sciences, and Melvin Traylor of the Field Museum of Natural History gave us the use of collections in their care.

We are also greatly indebted to Dr. Birkenholz, to Drs. George Godfrey and John Unzicker of the Illinois Natural History Survey's Section of Faunistic Surveys and Insect Identification, and to Bill George for reviewing the first complete draft of the manuscript. The manuscript benefitted greatly from detailed editing by Dr. Glen C. Sanderson, Head of the Survey's Section of Wildlife Research, and by Robert M. Zawadski, Technical Editor.

In the preparation of the final manuscript we received excellent help from Lloyd LeMere, the Survey's Technical Illustrator, who efficiently completed all of the extensive art work, from Les Woodrum, Survey Technical Photographer, and from Elizabeth Anderson, who accurately interpreted our often badly marked up original manuscripts.

With strong feelings of gratitude, we wish to dedicate this series of papers to our teachers, wonderfully exemplified by Robert H. Kingman, Pearl Maus, Edith Larson, Olin S. Pettingill, Jr., and George M. Sutton.

## General Patterns of Warbler Populations

From radar studies of bird migration across Illinois (Graber 1968), we knew that densities of migrants in the air on a given night were fairly uniform and that many of the same species were landing in southern, central, and northern Illinois. If the same *populations* of transients were landing in southern and central Illinois, we would expect populations of such arboreal species as the warblers to be about inversely proportional to the availability of arboreal habitat—assuming that transients go to their appropriate habitats. The southern counties (Pope and Johnson) in which we censused have about 30 times more forest per unit of area than has

TABLE 1. — Population densities of all warbler species in various habitats in Illinois during migration.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (23 March-31 May)						
Woods, (unspecified)	Central	1907		20		22.6
Pasture	Central	1907		253		2.2
Corn	Central	1907		176		0.2
Small grain	Central	1907		437		1.9
Bottomland forest	Johnson, Massac (S)	1979-1981	22	436	226.4	94.0
Bottomland forest	Piatt (C)	1979-1980	9	185	301.8	129.9
Upland forest	Pope, Alexander (S)	1979-1981	24	454	120.8	26.6
Upland forest	Piatt (C)	1979-1981	17	316	627.8	154.1
Forest edge	Pope (S)	1979-1981	20	412	236.0	71.7
Forest edge	Piatt (C)	1979-1981	13	261	285.2	97.2
Pines	Pope (S)	1979-1981	12	196	334.8	61.6
Fall (31 July-3 November)						
Residential habitat	North	1907-1909		19		13.1
Woods (unspecified)	Central	1906-1909		22		146.0
Woods (unspecified)	South	1908-1909		62		8.5
Orchard	Central	1906-1909		17		54.7
Orchard	South	1908-1909		459		3.8
Pastures	North	1907-1909		484		4.7
Pastures	Central	1906-1909		426		5.7
Hayfields	North	1907-1909		394		0.2
Corn	North	1907-1909		739		0.1
Corn	Central	1906-1909		877		1.7
Corn	South	1908-1909		144		0.6
Small grain	North	1907-1909		445		0.2
Small grain	Central	1906-1909		319		0.2
Bottomland forest	Johnson (S)	1979-1981	23	483	262.3	62.6
Bottomland forest	Piatt (C)	1979-1980	24	484	366.0	152.1
Upland forest	Pope (S)	1979-1981	23	474	79.4	13.7
Upland forest	Piatt (C)	1979-1981	31	600	533.3	57.9
Forest edge	Pope (S)	1979-1981	22	484	58.2	21.6
Forest edge	Piatt (C)	1979-1981	31	586	529.3	183.6
Pines	Pope (S)	1979-1981	10	176	83.6	12.9

Piatt County, where we censused in central Illinois. Considering all species of warblers together (Table 1) and all types of forest together, the spring populations of warblers, 1979–1981, were about twice as dense in east-central forest as they were in southern forest. Thus, although there was a definite concentration of warblers in the available habitat, the relationship was far from a direct proportionality. There are various possible explanations, including that the initial premise was incorrect. Another possibility is that evolutionary selection has modified the migration routes to reduce the number of migrants landing in the prairie peninsula, a region that has not had large forest acreage in the past thousand years. Yet another possibility is that arboreal transients do not go to forest habitat when they descend after a night's migration. The only arboreal habitats which we did *not* census were orchards—present only in small acreage, mainly in the south—and human residential habitat—a habitat which, though rapidly expanding, still makes up a small part of the total land area. The vast majority of land acreage available to transient bird populations in Illinois is cultivated land. The only data available on transient populations in cropland, as well as orchards and residential habitat, are those of A.O. Gross, representing the period 1906–1909 (Table 1). Those data indicate that croplands have low densities of transient warblers by comparison with arboreal habitats, and that orchards have populations somewhat intermediate between those of cropland and forest. A small sample of residential habitat also had warbler densities intermediate between those of cropland and forest. Pastures, which often had at least scattered trees, had higher populations than cultivated fields had but lower than those found in orchards. These data show that transient warblers are indeed going to woody habitats, especially forest, when they land.

Why were arboreal species in cultivated fields at all? One explanation would be that optimal, especially forest, habitats were saturated, i.e., had reached their capacity of warblers, and that populations above a certain level are forced into other less desirable habitats. Warbler densities in all habitats, including cropland, were higher in central than in southern Illinois (Table 1). The densities drop from forest to orchard and residential to pastures to cropland. This decline is what we would expect if birds were forced out of the best habitats. Such common transient warblers as the Tennessee exhibit strong territorial behavior, that includes fighting, in Illinois forests well south of the breeding range. Such behavior surely affects some spacing of the population even if food resources in the forest are great.

In the south where forest is widely available, bottomland forest was clearly the preferred warbler habitat in both spring and fall (Table 1), with three to five times the population density of that in upland forest. In east-central Illinois, where forest habitat was at a premium, densities in the two forest types were more nearly even, at least in spring; i.e., birds occupied all the forest habitat to capacity, as would be expected. In fall though, bottomland forest was clearly the favored habitat even in east-central Illinois, for reasons unknown.

## BLACK-AND-WHITE WARBLER (*Mniotilta varia*)

(Fig. 2 and 3)

### Spring Migration

There are at least three late March reports of black-and-white warblers in southern and central Illinois (Courtney 1917, George 1968, Bohlen unpublished 1976), but the species is not usually detected in Illinois until mid- or late April. Highest numbers (usually less than 10 per day) are seen 24 April–15 May in southern and central Illinois, and 1–18 May in the north (Fig. 4). Counts of 50 in 1 day (6 May, Wade 1916) and 81 (11 May, Frank Smith unpublished) are exceptionally high. The migration probably lasts into early June, but the end of the spring migration is obscured by a thin breeding population (Fig. 5).

Though the highest densities of black-and-white warblers were in bottomland forest and forest edge in both spring and fall, spring populations, on average, did not differ greatly among habitats (Table 2). Transient black-and-whites occur away from arboreal habitats only in very low numbers. Transient males as well as breeding birds sing the high thin song which Butler (1898) phoneticized as: "Easy-easy-easy . . . ."

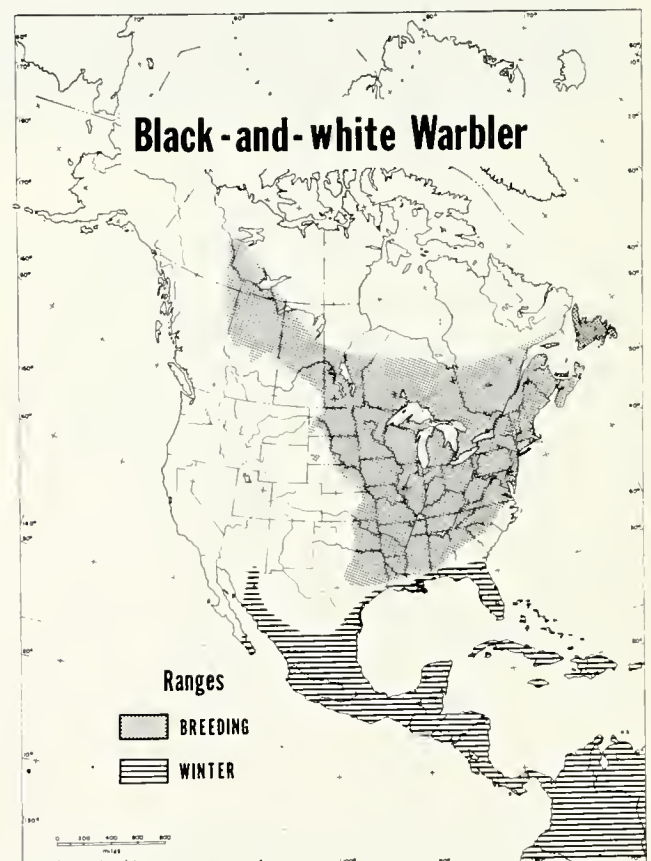


Fig. 2.—General distribution of the black-and-white warbler.



Fig. 3. Female black-and-white warbler about life size. Photo taken 10 September 1970 at Urbana.

## Nesting Habitats and Populations

Ridgway (1889) characterized black-and-white warbler habitat as "dry woods," and the only breeding populations known to us in southern Illinois are in upland forest, but DuMont (1936) referred to the habitat in adjacent Iowa and Missouri as heavily wooded hummocks in bottomland. Still another habitat—the Indiana Dunes (presemably scrub forest)—is mentioned by Sanborn (1921c). Breeding populations of black-and-white warblers in Illinois are very spotty and consistently low. Most of the state's breeding population is probably in southern Illinois, where the highest population we've recorded in 7 years (1.6 birds per 40.5 ha) was in Kaskaskia (upland) Forest, Hardin County. George (1971) reported "scattered pairs" breeding in Union County, but the species was absent there from 1968 to 1970. Morrison & Peterjohn (1977) reported 0.5 territorial male on 15 acres of upland forest in Jackson County in 1976, but the species was not present there in 1977. There are too few population measurements from which to establish any trend. Ridgway (1889) referred to this species as very common, but it is not certain that the reference is to *breeding* populations. Our forest transects for 1957 and 1958 showed no black-and-whites in 1957 and 1 per 40.5 ha in 1958 (Graber & Graber 1963).

In addition to the distribution records shown in Fig. 5, Nehrling (1880) stated that black-and-whites were present in northeastern Illinois every year in June and July, and a record for Jasper County on 24 June may represent breeding (Kleen 1979-1980). There are definite nesting records for Peoria County (precise locality not stated—Loucks unpublished 1892) and the Indiana Dunes (Sanborn 1921c, Cramp 1922, Ford, 1956, Petersen 1964d). The St. Louis nesting record is from Hurter (1884) and probably represents the general area rather than the city per se.

There are no Illinois data on the nesting cycle of the black-and-white warbler except for Friedmann's (1963) notation of cowbird (*Molothrus ater*) parasitism of the species in the state. Sanborn (1921c) referred to a nest with four eggs that ultimately fledged young at the "Dunes," and DuMont (1936) referred to a nest with three fresh eggs on 4 June 1901 near Keokuk, Iowa (see also Anderson 1907).

## Fall Migration

July records of black-and-white warblers in Illinois represent either local breeding birds or transients (Sanborn 1911, Petersen 1965b, Fawks 1968b, Kleen 1974c). In southern Illinois Richard Brewer counted 14 on 22 July (Mayfield 1950b), and Ferry (1907b) found the species common, 10-24

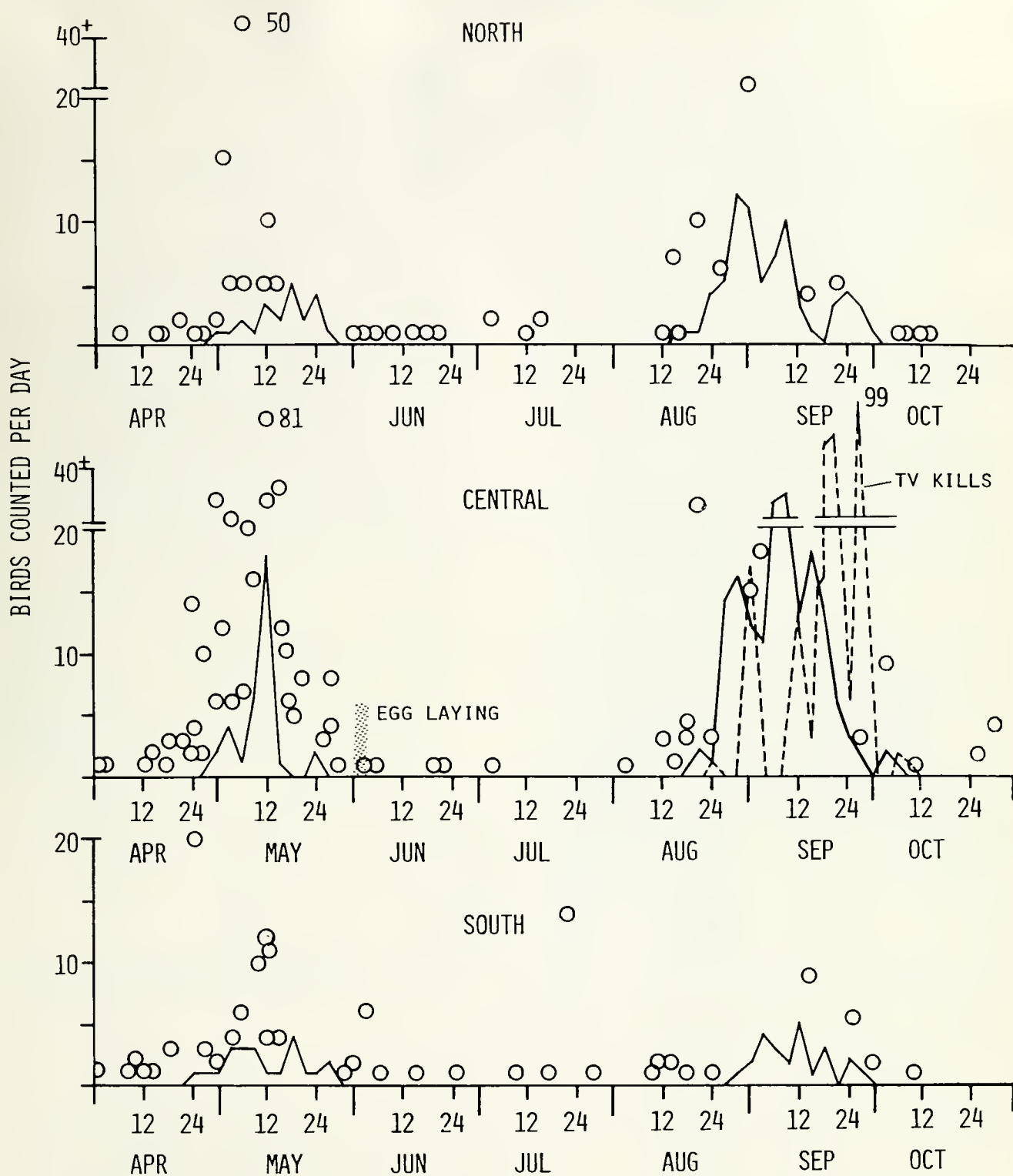


Fig. 4.—Migration seasons of the black-and-white warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The shaded area shows the span of dates during which egg laying has been recorded. The dash line shows numbers killed at television towers during fall migration in central Illinois.

August. In northeastern Illinois Gault's (1901*d*) earliest fall record was 11 August, and Brodkorb (1926*a*) reported "flocks of black-and-whites" on 15 August 1926. The earliest record we have of a bird killed on a television tower (central Illinois) was 24 August.

Our fall counts indicate the peak of black-and-white migration in the period 29 August–10 September in northwestern Illinois, but in the northeast Balch (1970) saw a large wave of black-and-whites on 22 September. Our peak counts in central Illinois occurred 28 August–18 September, but the television tower data show large numbers present on 27 September. (Fig. 4). A total of 361 black-and-whites have been picked up at Illinois television towers. In southern Illinois, where the counts were conspicuously lower than to the north, peak numbers were seen 3–17 September. By the end of September most black-and-whites have passed Illinois, but nine were seen at Urbana on 4 October, and four on 30 October (Frank Smith unpublished 1903); single birds have been seen virtually throughout October (Fig. 4). The latest fall records are 6, 8 and 10 November in northern and central Illinois (Fawks 1966*a*, Eiseman & Shank 1962, T.E. Musselman unpublished 1961). An exceptional record was an adult female black-and-white warbler at Horseshoe Lake, 30 December 1974 (Kleen 1975*b*).

A comparison of the spring (April–May) and fall (August–October) counts shows ratios of 1.0 to 3.3 black-and-whites in northern Illinois (at Chicago the ratio observed by Dreuth was 1.0 to 1.6); in central Illinois the ratio was 1.0

to 4.3, but in the south only 1.1 to 1.0. Our censuses of 1979–1980 showed that the spring-to-fall ratios varied with habitat (Table 2), bottomland forest having the highest ratios—1.0 in spring to 5.6 in fall in the south, and 1.0 to 26.5 in central Illinois. In upland forest the ratios were 1.0 to 3.5 (south) and 1.0 to 5.5 (central). Black-and-white warblers favored bottomland forest in both spring and fall, but especially in fall. The age ratio in a sample of 112 black-and-whites killed at central Illinois television towers was 73 adults (65 percent) to 39 immatures (35 percent), the equivalent of a 1.0 to 1.5 spring-to-fall ratio if the same populations passed in spring and fall—a premise for which there is no justification.

There appear to be notable differences between western and eastern Illinois in the numbers of transient black-and-white warblers seen. Bennett's (1952) counts (2 hours daily) of black-and-whites at Chicago were higher in most years than our counts (8–12 hours daily) in northwestern Illinois. The difference may relate to differences in (1) observers, (2) years, or (3) habitat availability, including the effect of Lake Michigan. In central Illinois we saw three times more black-and-whites in eastern than in western Illinois in spring, and six times more in the east in fall. Every count in the east was greater than the corresponding count in the west, and all counts were made by the same observer in the same year. Habitat availability differs greatly between west and east, being on average in the counties censused, nine times more abundant in the west than in the east.

TABLE 2.—Population densities of black-and-white warblers in different regions and habitats of Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (11 April-20 May)						
Bottomland forest	Johnson (S)	1979-1981	18	370	4.0	0.8
Bottomland forest	Piatt (C)	1979-1980	6	122	3.9	1.2
Upland forest	Pope (S)	1979-1981	20	395	1.9	0.2
Upland forest	Piatt (C)	1979-1981	10	204	14.3	2.4
Forest edge	Pope (S)	1979-1981	16	315	6.1	1.5
Forest edge	Piatt (C)	1979-1981	8	163	5.4	1.7
Pines	Pope (S)	1979-1981	10	162		0
Pasture	Central	1907	26	205	1.0	0.2
Breeding (3 June-3 July)						
Upland forest	South	1974-1980	30	602	1.6	0.1
Fall (12 August-10 October)						
Bottomland forest	Johnson (S)	1979-1981	19	398	19.0	4.0
Bottomland forest	Piatt (C)	1979-1980	15	305	73.2	12.1
Upland forest	Pope (S)	1979-1981	17	348	12.9	0.8
Upland forest	Piatt (C)	1979-1981	19	369	45.9	7.3
Forest edge	Pope (S)	1979-1981	19	367	10.0	1.0
Forest edge	Piatt (C)	1979-1981	21	396	45.0	8.3
Pines	Pope (S)	1979-1981	9	160		0
Forest (unspecified)	South	1908-1909	13	33	1.6	1.2
Forest (unspecified)	E. Central	1906-1909	7	21	27.3	24.8
Pasture	North	1907-1909	11	212	1.6	0.2

# Black-and-white Warbler

## BREEDING RECORDS

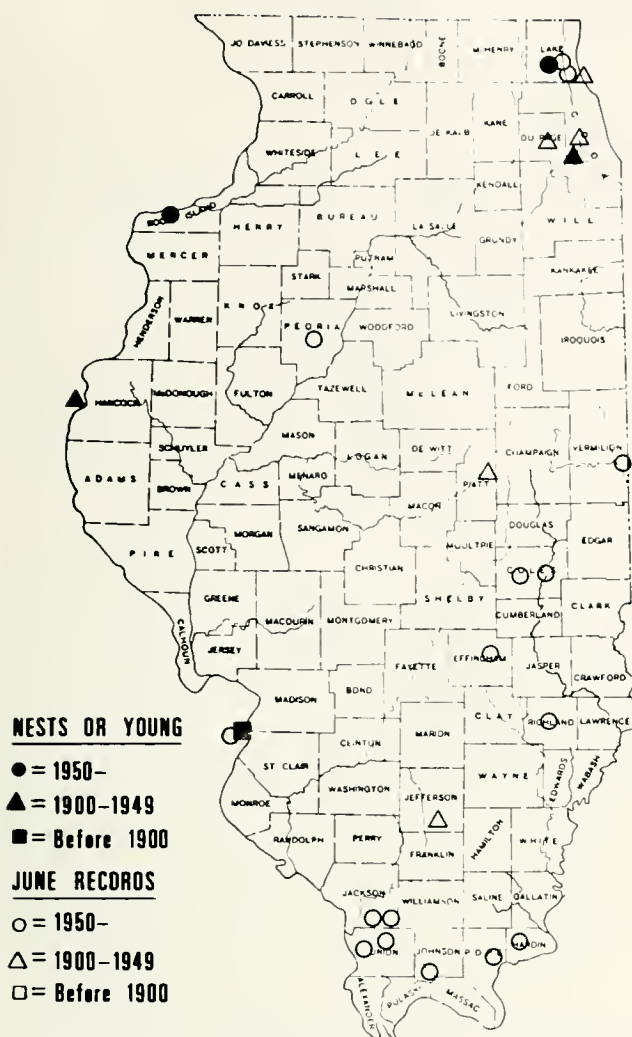


Fig. 5. — Breeding records of the black-and-white warbler in Illinois.

As with warblers in general, fall migration of black-and-whites usually lasted longer than spring migration: north, 27 days in spring to 45 days in fall; central, 27 days to 51 days; and south, 33 to 30.

## Specimen Data

The ranges of gross weights of black-and-white warblers killed at central Illinois television towers between 10 September and 1 October were: 22 adult males, 9.3–11.6 g (mean = 10.68, SE = 0.14); 10 immature males, 9.8–12.4 g (mean = 10.79, SE = 0.29); 24 adult females, 8.9–11.9 g (mean = 10.22, SE = 0.17; and 16 immature females, 9.2–11.5 g (mean = 10.48, SE = 0.20).

# PROTHONOTARY WARBLER

(*Protonotaria citrea*)

(Fig. 6 and 7)

## Spring Migration

The earliest spring records of the prothonotary warbler in or near Illinois are 1 April 1950 (St. Louis area, Wilhelm 1957) and 9 April (Chicago area, Bartel & Reuss 1932), but more typically, the spring arrival of this species is first noted about 5–10 April in the south, 15–20 April in the central region, and late April or early May in the north (Fig. 8). At its peak the spring population was about twice the level of the breeding population, but few prothonotaries were seen out-

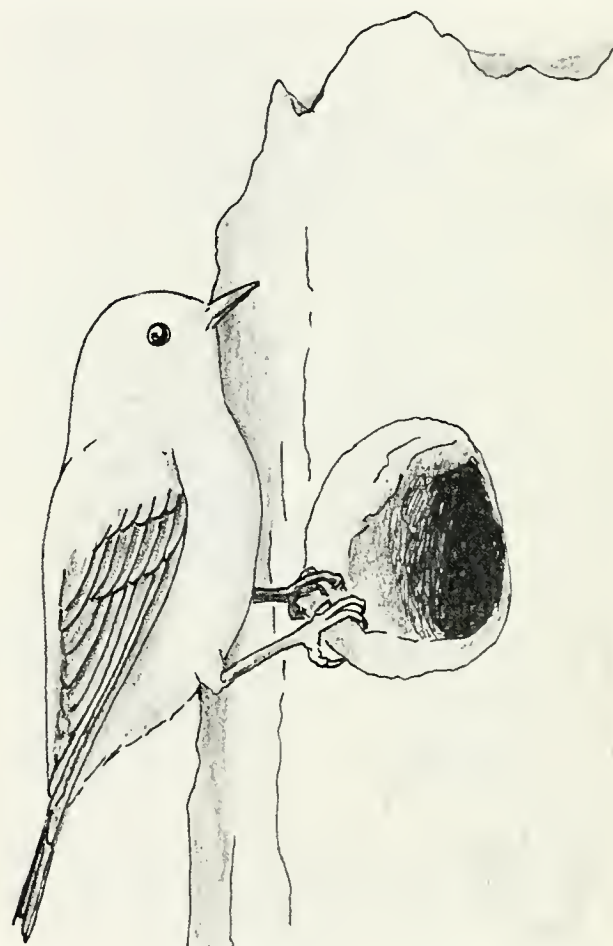


Fig. 6. — Prothonotary warbler at nest cavity.

side of the lowland breeding habitat (Table 3). Peak numbers were seen 20 April–19 May in the south (14–42 per day).

Loucks (1894) and Butler (1898) suggested that prothonotary warblers migrated up the Mississippi River to the Ohio, Kaskaskia, and Illinois rivers, but the migration has never been observed directly, and is probably nocturnal (see Fall migration).

Spring counts were consistently higher in western than in eastern Illinois by a factor of about 8 times in the south and 16 times in the central region.

## Distribution

The breeding distribution of the prothonotary is shown in Fig. 9. Prothonotaries have been generally uncommon in northeastern Illinois, but Beecher (1942) found a dense population in Lake County in 1937 (Table 3). In addition to the records plotted in Fig. 9, there are nest records from unspecified localities in Adams and Marion counties (Norris 1890*b*), Cook County (Goelitz 1917), Fulton County (Abbott 1915), Madison County (USNM oological collection), the Fox River (Ford 1939), and the Kankakee River (Bodensten 1939).

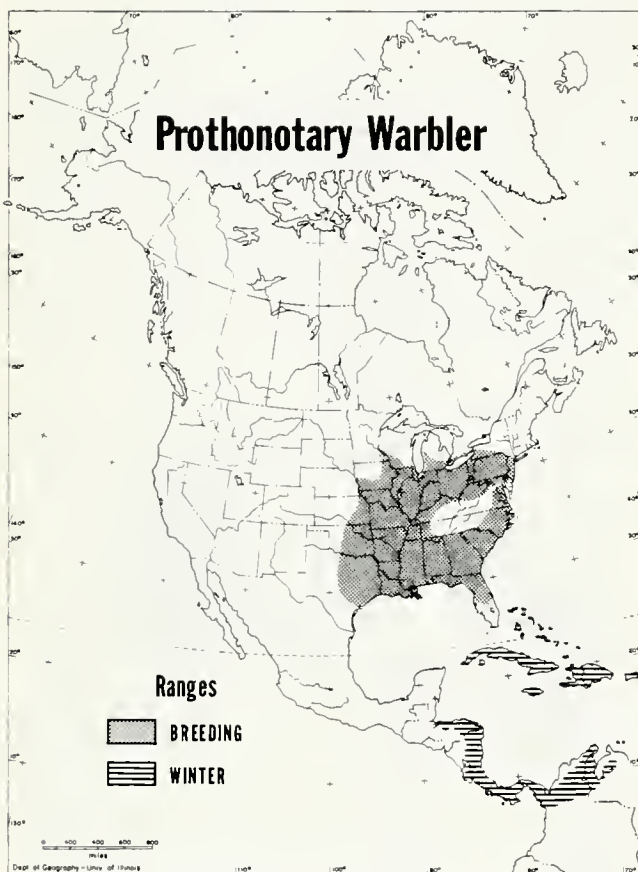


Fig. 7. — General distribution of the prothonotary warbler.

## Nesting Habitats and Populations

Ridgway (1882, 1889) characterized the habitat of the prothonotary as swampland, especially where the growth of willow was extensive. Others have noted the importance of willow in the habitat (Baird et al. 1874, Brewster 1878*d*, "Collector" 1895, Gates 1911, Strode 1918, Musselman 1921, Smith 1946), but Widmann (Loucks 1894) stated that it does not matter whether the habitat is deep forest or only a fringe of willows around a lagoon. The most commonly mentioned plant other than willow in the habitat is buttonbush

—*Cephalanthus occidentalis* (Brewster 1878*d*, Ridgway 1882). In the south, cypress swamps are a prime habitat (Cahn & Hyde 1929).

Of 168 specific nest sites mentioned in the Illinois literature and unpublished notes available to us, the majority (110) were in either willows (64—3 noted as live) or dead trees or stumps (46); other nest trees mentioned were elm, 8; oak, 5; soft maple, 4; cottonwood, 4; river birch, 2; sycamore, 2; ash, 2; pecan, 1; and cypress, 1. (Brewster 1878*d*, Norris 1890*b*, Loucks 1894, Strode 1916, 1918, Stine 1959). All are characteristic plants of the floodplain. Most of the records represent central and northern Illinois; the southern Illinois data are too few for comparison, but included the only nests recorded in river birch and cypress. The broad variety of artificial nest sites used by prothonotaries includes Chinese lanterns, nest boxes and tin cans, bridge struts, building corners, a bulldozer, a coat, a pump, a bucket, a freight car coupler, a rubber tire, and a ferry boat (Poling, 1887, Loucks 1894, Schantz 1912, Musselman 1932, 1933, 1936, 1939, 1945, Moyer 1933, La Force 1939, and Mayfield 1948) and implies either a shortage of nest sites or great tolerance by the warbler.

Recorded heights of 99 prothonotary nests ranged from about 8 cm to 8 m and averaged 1.85 m, with no noteworthy difference between regions. Silloway (1895) found most nests in the Havana area to be around 9 ft (2.7 m) high. Standing or flowing water appears to be an important part of prothonotary habitat, and nest sites are often over water (Barnes 1889, Loucks 1894, Coursen 1947). Loucks believed that before nesting prothonotaries waited for water levels to recede, and many nests have been found over dry lagoons (Brewster 1878*d*, Silloway 1895). Flooding is a common cause of nest mortality (Frisbey 1892, Barnes 1927, Johnson 1942, Petersen 1965*b*). A dense population of prothonotaries in southern Illinois nested where water depth was 3–24 inches (Kleen 1973). Prothonotaries often forage near the water's edge and on water-soaked logs (Brewster 1878*d*).

Prothonotary warbler populations tend to be spottily distributed. Data provided by Kleen (1973) indicated populations of 54 (1972) and 65 prothonotaries (1970–1971) per 40.5 ha on about 15 ha of prime habitat near Crab Orchard Lake. *Average* densities on larger areas tend to be much lower (Table 3), but Snyder et al. (1948) recorded 24 per 40.5 ha in a virgin floodplain forest in central Illinois, and Beecher (1942) recorded a very high density (43 per 40.5 ha on 11 ha) in northern Illinois (Table 3). A bias against this species is built into our transect censuses because the transects are run, for the most part, on dry ground or where water is shallow enough to walk through easily. Prothonotaries prefer wetter habitat. The large number of prothonotary nests recorded in willows suggests a tie between warbler and plant. Willows are not numerical dominants in bottomland forest except in the wettest places. Some willows occur on our study areas at the lowest margins. Of 10 bottomland study areas in southern Illinois, the 2 areas with the highest willow populations were also the areas with highest prothonotary populations, but whether the relationship is between warbler and plant or warbler and water (or both) is

not clear. The willow is a soft, short-lived tree and may simply provide the most cavities. A comparative study of prothonotary populations in cypress swamps and willow swamps might resolve the question. Yeager (1949) noted a popula-

tion increase of prothonotaries after flooding, but the data are extremely crude and do not deal with the question of annual variation. Stream (i.e., floodplain) size may be an important factor in the habitat, as prothonotaries do *not* as-

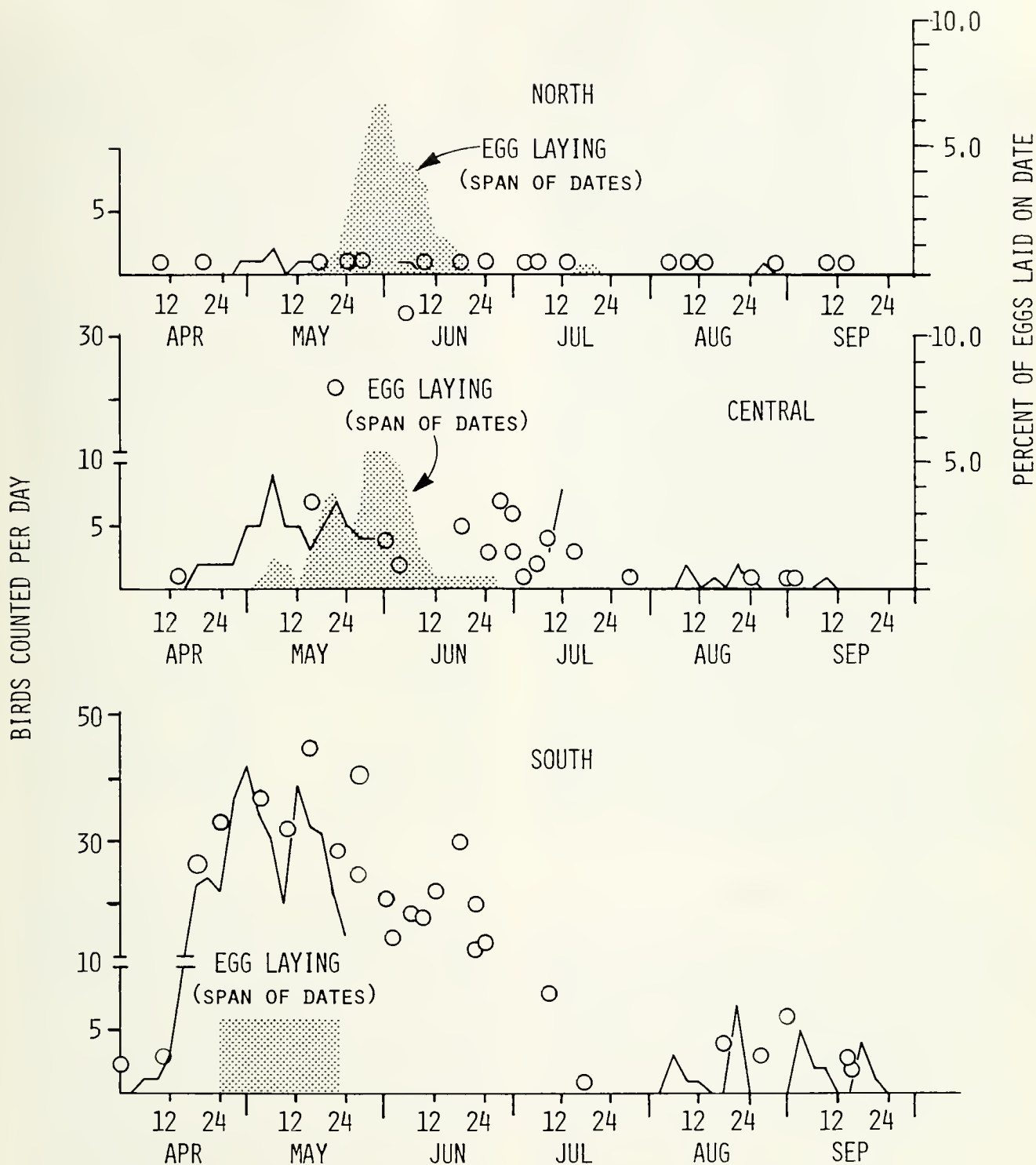


Fig. 8. — Egg-laying and migration seasons of the prothonotary warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Shaded areas indicate the percentages of eggs laid on each date and the span of dates during which egg laying has been recorded.

cend into the upland stream branches, as do some other bottomland species—e.g., gnatcatchers and acadian flycatchers.

Prothonotary warblers appear to be very tolerant of people (Ridgway 1887, Beecher 1942, Moyer 1933, Musselman 1945), but urban habitat is not suitable for the bird.

In general, the prothonotary population declines greatly from south to north (Fig. 8) and is especially reduced north of the Illinois River. There is some evidence of population increase in the prothonotary and also of great fluctuation in its numbers. Within historic times, the species has been common along the Kankakee River, where Dunn (1895) and Woodruff (1907) considered it abundant and Sanborn (1922*b*) found many nests, but where Clark (in Kleen & Bush 1973*d*) noted a great increase in the population in the 1970's from a low level in the 1940's. In Cook County Nelson (1876) found the warbler rare, as did Eifrig (1919) and Schantz (1921), and even in recent years it has been uncommon as a nesting species in the area (Rosenband 1976). At about the same latitude on the Mississippi River, Giddings (1897) found the prothonotary very rare, as did Burtis Wilson around 1900 (Hodges 1954). By the 1940's the species was nesting regularly in the area (Johnson 1942, Hodges 1949) even as far north as Dubuque, and at Credit Island, Hodges (1951) recorded densities which we calculated to be about 3–6 prothonotaries per 40.5 ha. On the Illinois River in Marshall County, Barnes (1927) reported the population greatly reduced from its 1890 level, but there have been no actual measurements of that population.

The transect data of 1907–1909 and 1957–1958 suggest a downward trend in prothonotary densities, but the data are fragmentary. Prime habitat for this species, and thus the total prothonotary population, is undoubtedly declining (Graber & Graber 1976). Annual variation ranged from 2.2 to 233.8 percent per year (Mean, 78.7).

Territory size of 13 breeding male prothonotary warblers measured at Crab Orchard Lake by Kleen (1973) varied from 0.3 to 3.0 acres and averaged about 1.2 acres in 1970 and 1971 (1.7 acres when a tape recorder was used to locate territory boundaries). Some males returned to the same territory in consecutive years. In central Illinois one territory measured 1.6 acres (Fawver 1947*b*).

## Nesting Cycle

Though Illinois data on the prothonotary life cycle are fragmentary, there is an excellent study from nearby southern Michigan by Walkinshaw (1953). Prothonotaries are persistent singers, the common song being a vibrant but rather monotonous "Peet-tsweet-tsweet-tsweet," usually of six or seven syllables (Loucks 1894). Brewster (1878*d*) described a second, sweeter and more musical flight song that suggests the song of a canary. The common call note is a high, sharp "Tship." The seasonal duration of singing has not been recorded. Kleen (1973), working with a banded population at Crab Orchard, observed that all pair bonds formed at the beginning of the season were held throughout the season though mates were sometimes changed from one season to the next.

# Prothonotary Warbler

## BREEDING RECORDS

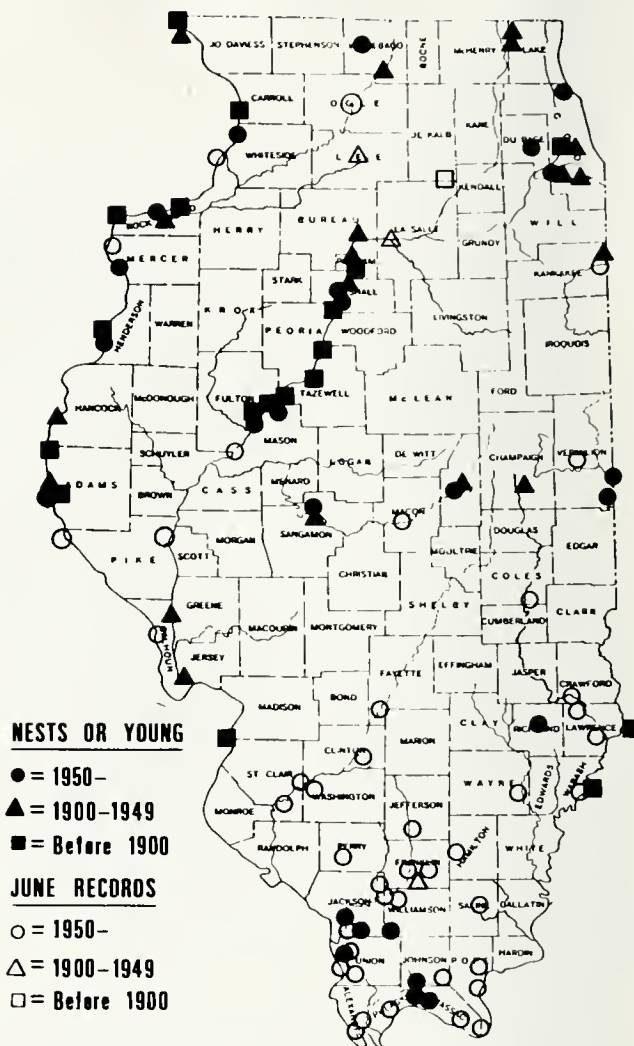


Fig. 9. – Breeding records of the prothonotary warbler in Illinois.

Prothonotaries show great latitude in the choice of nest site, but the most common site is a cavity in a dead stump (see Nesting Habitats and Populations). At Havana, Silloway (1895) observed that cavities were all in rotten wood, having been excavated the previous fall or winter by downy woodpeckers or chickadees. The typical cavity was about 3 inches in diameter, and 5–7 inches deep with an entrance hole 1½ inches in diameter. Barnes (FMNH oological collection) measured a nest cavity in a 13-inch silver maple branch; it was 3 inches in diameter and 8 inches deep.

Loucks (1894) suggested the nest building was timed to receding water. Barnes (1899) observed that about a week elapsed between the arrival of the birds and the onset of nest construction. Nest building, presumably for first nestings, has been observed in southern Illinois between 22 April and

11 May, in central Illinois 2–14 May, and in northern Illinois 15 May–4 June. On the Kankakee River most prothonotaries were just beginning to build 20–22 May (Sanborn 1922*b*). Nest construction is performed by the female (Brewster 1878*d*, Loucks 1894) with little or no help from the male (Barnes 1889) and requires a week to 10 days. The most frequently noted nest material is green “tree moss” from nearby trunks and fallen logs, but fine stems, grasses, dry leaves, strips of grape bark, rootlets, feathers, and hair may go into the structure (Poling 1887, Barnes 1889, Silloway 1895, Strode 1916). Typically, the warbler fills the cavity to within 3–4 inches of the entrance, often with moss, which makes up the bulk of the structure (Loucks 1894).

The eggs are highly variable in shape as well as marking but are usually glossy, creamy white, speckled, and blotched with various shades of chestnut, cinnamon, lilac, olive, and gray (Poling 1887, Norris 1890*b*, Frisbey 1892). Descriptions and measurements of many sets from the Illinois and Mississippi valleys are given by Norris (1890*b*). The eggs are laid on consecutive days, beginning as early as 24 April in southern Illinois, although this may be unusually early, as Brewster (1878*d*) did not find eggs in most nests until after 4 May. In central Illinois, the laying season lasted from about 3 May to 27 June, with peak egg production from 15 May to 6 June (Fig. 8). The latest egg-laying date for northern Illinois was about 21 July, but the peak production was only about a week to 10 days later than in central Illinois.

There are few recent data on clutch size, but 198 (May and June) clutches—mainly pre-1900 oological records

representing the Illinois and Mississippi valleys in central and northern Illinois—showed this distribution: 3-egg clutches, 2.5 percent; 4-egg, 15.5 percent; 5-egg, 21 percent; 6-egg, 46 percent; 7-egg, 13 percent; and 8-egg, 2 percent. The average clutch was 5.4 eggs. A set of 9 eggs (Poling 1890) and a set of 10 eggs (Loucks 1894) are anomalous. July clutches had only one to three eggs (Loucks 1893). Twenty sets from southern Illinois averaged 4.8 eggs, with most of the clutches consisting of 4, 5, or 6 eggs. No sets with cowbird eggs were included in these figures. Other possible sources of error (e.g., sets observed before the clutch was completed, or eggs lost, or any tendency by oologists to collect large or otherwise exceptional clutches) are unaccounted for in these percentages. Norris' (1889) observation that clutch sizes in nests from the Burlington area differed from those observed by Barnes at Lacon might be related to one or more of these sources of error. The Burlington clutches were very large (6.5 eggs, on average).

Incubation is performed only by the female and takes about 2 weeks (Barnes 1889, Loucks 1894). Bent (1953) gave the incubation period as 12–14 days. The incubating female is fed to some extent at the nest by the male (Holmes 1950, Van Horn 1952). Holmes observed a male feed its mate on the nest once in 45 minutes before the observation was interrupted.

La Force (1939), at Burlington, recorded the period of one nesting cycle from the onset of building (15 May) to the fledging of young (17 June), i.e., 34 days. In southern Illinois, Scherer & Shaw (unpublished 1965) recorded the dura-

TABLE 3.—Population densities of prothonotary warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
					Maximum	Mean	
Spring Migration (16 April-27 May)							
Bottomland forest	Johnson (S)	1979-1981	19	391	31.2	13.9	This paper
Bottomland forest	Piatt (C)	1979-1980	9	186	3.9	1.3	This paper
Forest edge	Pope (S)	1979-1981	17	337	2.0	0.2	This paper
Breeding (June)							
Modified woodland	Lake (N)	1937		11		43.4	Beecher 1942
Bottomland forest	Kankakee (C)	1978		20		8.1	This paper
Bottomland forest	Mason (C)	1978-1979		42	6.6	5.7	This paper
Bottomland forest	Central	1978-1979		132	8.1	3.0	This paper
Virgin floodplain forest	Sangamon (C)	1948		31		24.0	Snyder et al. 1948
Virgin floodplain forest	Piatt (C)	1947		20		4.0	Fawver 1947 <i>b</i>
Grazed bottomland woods	Macon (C)	1955		21		3.8	Chaniot & Kirby 1955
Bottomland forest	Vermilion (C)	1966		6		26.0	Karr 1968
Bottomland forest	South	1973-1979	50	1,086	17.3	4.0	This paper
Forest (all types, including edge)	South	1907-1909		24	7.6	5.0	Graber & Graber 1963
Forest (all types, including edge)	South	1957-1958		138	1.8	1.5	Graber & Graber 1963
Fall Migration (17 August-14 September)							
Bottomland forest	Johnson (S)	1979-1981	10	216	10.9	4.6	This paper

tion of nestling life at one nest as 11–12 days. Both adults feed the nestlings. Musselman (1945) stated that the food was gleaned from willow trees, but precisely what the food is for either adults or young is unknown.

Reference in the literature to second and even third clutches by a pair (Frisbey 1892, Loucks 1893) are not necessarily indicative of double broodedness, but rather, of nest failure and renesting (Kleen 1973). The laying curves (Fig. 8) also imply only one brood (i.e., successful nesting) per pair.

The only Illinois data on nesting success were provided by Kleen (1973) at Crab Orchard, where 9 of 13 nests under observation each fledged one or more young. There are no Illinois data on productivity. Causes of nest failure are unknown on any quantitative basis. Causes noted have been flooding (Barnes 1927, Johnson 1936) and predation by snakes (Loucks 1894, Strode 1918). Considering that it is a cavity nester, the prothonotary is fairly commonly parasitized by cowbirds (Friedmann 1963). For a central Illinois sample (mainly pre-1900) of 154 nests, 24 (15.6 percent) had been parasitized, but in northern Illinois (69 nests) the incidence was only 1.4 percent. Data from Poling (1890) also indicated a relatively high parasitism rate (at least 15.7 percent) in central Illinois. In southern Illinois, 1 of 21 nests was parasitized. The effect of the parasitism on the host population is unknown. There are some observations pertinent to the question of competition for nest sites. Dunn (1895) observed an altercation at a cavity between a prothonotary and a house sparrow in which the warbler dominated, but in another instance Lee Johnson (unpublished) observed that house sparrows prevailed over a pair of warblers. In central Illinois Poling (1890) noted intraspecific competition among prothonotaries, which suggested a shortage of nest sites in the Quincy area, where later, Musselman (unpublished 1940) recorded a high rate of occupancy of nest boxes (12 of 14), which he had placed in a willow swamp. Subsequent observations showed a loss of prothonotary nests to house wrens (Smith & DuMont 1944b). In southern Illinois, Ridgway (1874c) suggested the possibility of competition between Carolina chickadees and prothonotaries. Kleen (1973) found no evidence of competition for nest sites, as indicated by the complete lack of use of 59 nest boxes provided in the habitat during the seasons of 1971 and 1972.

Survivorship of adult prothonotaries is indicated by Kleen's (1973) study of a banded population in which 9 of 10 males banded in 1970 returned in 1971, but only 2 returned in 1972. For adult females the figures were five in 1970, three in 1971, and only one in 1972.

## Fall Migration

As is typical of southern-ranging species, the fall population of prothonotaries in Illinois is obscure—progressively so northward (Fig. 8). Fewer and fewer birds are seen after June, and when the southward migration begins is unclear. As molting begins and song ceases, the birds become less conspicuous. In southern Illinois prothonotaries in the molt have been observed on 22 July (Brewster 1878a) and in early

August. A bird seen on 21 August appeared to be in fresh plumage. In central Illinois a prothonotary in the molt was seen on 28 July (Bohlen unpublished 1979).

The occurrence of a prothonotary warbler among specimens of night migrants killed on 2 September 1972 at a television tower near Springfield (Seets & Bohlen 1977) implies night migration for the species and indicates an actual flight date. Southern species are generally uncommon as tower casualties, and the prothonotary has been represented by only one bird of about 1,600 picked up at central Illinois towers in the period 1 August–15 September.

The ratio of our spring (April–May) to fall (August–September) counts of prothonotaries reflects the obscurity of the species in fall. Considering all counts, we saw about 19 in spring to 1 in fall in southern Illinois and 10 to 1 in the central region. For the bottomland forest censuses the spring-to-fall ratio was 5.4 to 1.0 in southern Illinois. As in spring, there were far more prothonotary warblers on the western side of the state than on the east by a ratio of 34 to 1.

Bent (1953) referred to a record for the prothonotary in northern Illinois on 17 October—an exceptionally late date. More typical as “last-seen” dates are 14 September for the north (Clark & Nice 1950) and 21 September for the south (Fawks 1971b, Fig. 8).

## SWAINSON'S WARBLER (*Limnothlypis swainsonii*)

(Fig. 10)

The distribution of spring records of Swainson's warblers in Illinois (Fig. 11) suggests a definite tendency toward over-migration in this species (Bohlen 1978–1979), the earliest spring record (13 April) being from the Chicago area, i.e., far north of the known breeding range (Clark & Nice 1950, Fig. 11). Similar northern records for the species were for early and mid-May (Gardiner 1959, Graber 1962b, Dillon 1971, Petersen 1963b).

In southern Illinois, where the species breeds, “first-seen” dates have been recorded fairly regularly after 15 April (Hardy 1955, Kleen & Bush, 1972b, 1973c, Kleen 1974–1975, 1976b). The species occurred much more frequently in our spring transects than in our June transects. Densities were consistently low, ranging from 0 to 1.9 birds per 40.5 ha (mean, 1.4) at Heron Pond between 30 April and 28 May. The species was detected only in bottomland forest.

The breeding range of Swainson's warbler (Fig. 11) is still poorly known, and counties to the north and east of Jackson and Johnson are particularly in need of exploration. Ridgway's (1878) record for the Wabash valley is strangely lacking in details and apparently seemed questionable to Brewster (1885). A plant with which Swainson's is often, but not always, associated is giant cane (*Arundinaria gigantea*) (Meanley 1971), and this species is known from Illinois counties north only to about the latitude of St. Louis (Mohlenbrock & Ladd 1978). Excellent looking cane habitat in Pope

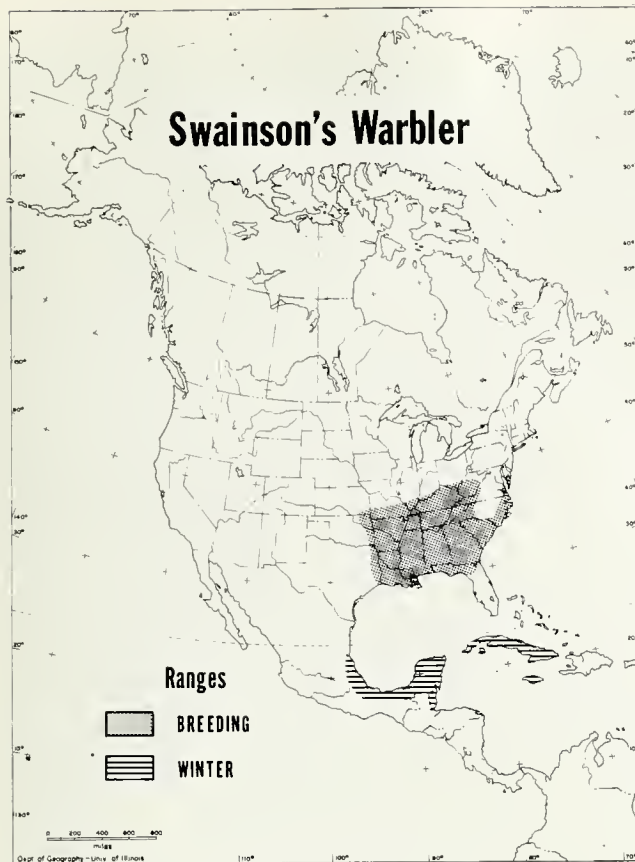


Fig. 10.—General distribution of Swainson's warbler.

and Saline counties (Saline River), where we censused in June (1974–1976), lacked Swainson's warbler, but little of the total area has been explored. Gross' (1908) record for Perry County indicates the need for more investigation of the tributaries of the Little Muddy and Big Muddy rivers.

Meanley (1971) described optimum habitat for Swainson's warblers as rich, damp woods with deep shade and moderately dense undergrowth. The warblers forage in well shaded areas on the ground. Nesting areas are in the drier portions of floodplain forest. Eddleman (1978) and Eddleman et al. (1980) pointed out specific parameters of the habitat in southern Illinois. Dominant trees were box elder, silver maple, sycamore, sweet gum, elm, and ash (typical floodplain species) with areas of thick understory and areas of dense (80 percent or more) overstory. Sometimes the species was in relatively young (25–30 years) forest. Trees taller than 8 m and canopy coverage of more than 55 percent seemed necessary. Swainson's appear to be associated with muddy (old), not rocky, streams. The two presently known breeding areas (Cave-Cedar creeks tributary of the Big Muddy River and Heron Pond-Cache River) are on relatively small streams.

We have observed singing male Swainson's in June and July in habitat with little cane, but we believe that these birds were unmated, and there is, as yet, no evidence that such marginal habitat actually supports breeding populations. Eddleman (1978) stated that Swainson's warblers favored

areas where the density of shrub stems was at least 5,000 stems per ha, and many of his plant quadrats on Swainson's territories had densities of 10–20 thousand stems, especially *Arundinaria*, green brier, grape, spice bush, *Carpinus caroliniana*, and seedlings of the overstory species. Our data on 10 mature bottomland forest tracts indicate the same relationship, though we did not place quadrats specifically on Swainson's warbler territories as Eddleman did (Table 4).

We detected Swainson's warblers near our June transects several times, but only once within the transect. On that basis, the highest density for a single tract (Horseshoe Lake Sanctuary) was 2.28 birds per 40.5 ha, but the average density for all tracts in all years was only 0.04 birds per 40.5 ha. The Cave-Cedar Valley area in Jackson County has supported breeding Swainson's warblers since at least 1951 (Hardy 1955, Brewer 1958a, George 1969, 1972, Kleen 1976c). As many as 22 single males were detected in this area (approximately 500 ha of floodplain) by Eddleman (1978) in 1976, when 5 were also found at Heron Pond (Kleen 1976b). Some of these records represent spring rather than summer and therefore perhaps include transients or overmigrants.

## Swainson's Warbler

### BREEDING RECORDS

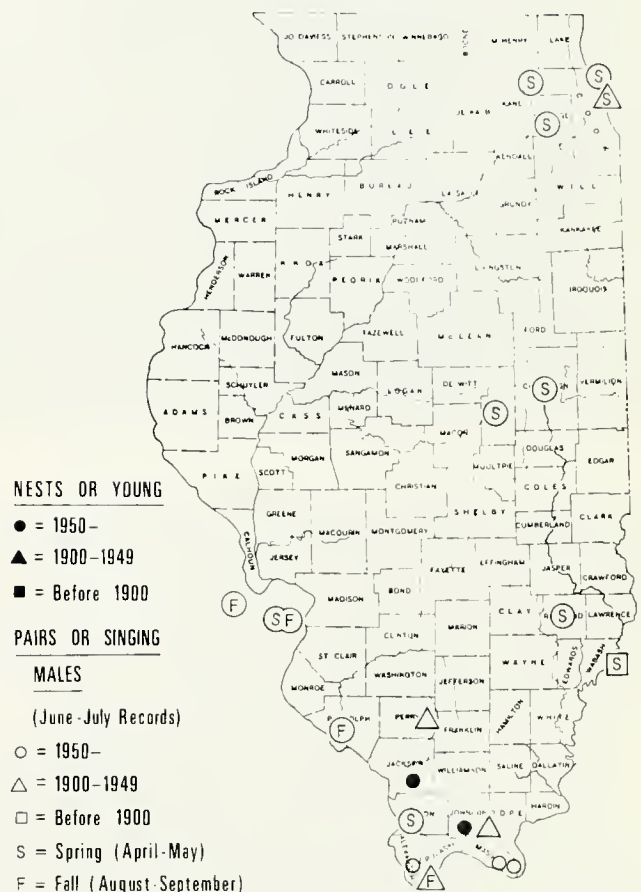


Fig. 11.—Distribution of Swainson's warbler records in Illinois by season.

TABLE 4.—Swainson's warbler populations in relation to shrub (1–3 inches dbh) understory in mature bottomland forest in southern Illinois.

	Swainson's Warblers Detected per Hour		Understory Woody Stems <sup>a</sup> (1,000's per ha)
	Range	Mean	
Heron Pond	0.2–0.6	0.4	10.3
Horseshoe Lake	0–0.9	0.2	7.7
Fort Massac (Riparian)	0–0.3	0.1	8.8
(7 other forests)	0	0	3.4–6.4 (4.8)

( $r = 0.810$ ,  $P = < 0.01$ )

<sup>a</sup>Does not include *Arundinaria*.

Anderson (1968) speculated that the loss of cane habitat in southeastern Missouri was reducing the Swainson's warbler population (see also George 1972), and floodplain forest, in general, is being destroyed in Illinois, surely representing a threat to this species.

The song is noted for its volume and is suggestive in phrasing of the song of the Louisiana waterthrush (Meanley 1971). There are few published records on the nesting cycle of Swainson's in Illinois and none on nesting success or productivity. Kleen (1974–1975) showed homing of a Swainson's at Heron Pond; a singing male banded in 1973 was back on the same area on 28 April 1974. George (1969) at Cave Creek and Kleen (1974a) at Heron Pond recorded fledgling Swainson's warblers being fed on 8 and 31 August.

The only records which indicate the duration of stay of Swainson's warblers in fall are for 1 September (Ammann 1939) and 16–17 September in nearby Missouri (Anderson 1973).

## WORM-EATING WARBLER (*Helmitheros vermivorus*)

(Fig. 12 and 13)

Worm-eating warblers tend, in spring migration, to overshoot the northern limits of their main nesting range (Griscom 1942, Bohlen 1978–1979), as the numerous records for northern Illinois imply (Kleen 1974b, 1975c, 1976f, Fig. 14). The earliest record for the species in Illinois is 6 April—in the central region (Kleen 1977c)—and it is seen fairly regularly in southern and central Illinois after 15 April (Fig. 14). In northern Illinois the earliest record is 22 April, the frequency of observation increasing after 28 April.

Usually in central and northern Illinois no more than one or two worm-eating warblers are seen per day. A count of 12 in the north on 12 May was exceptional (DuMont 1947), but surprisingly, Nehrling (1880) found this species one of the most common warblers during his visit to northern Illinois. Other "high" counts in spring were six on 25 April and six each on 1 and 8 May in central Illinois (H.D. Bohlen unpublished 1976, Kleen 1979e), six at Pere Marquette State

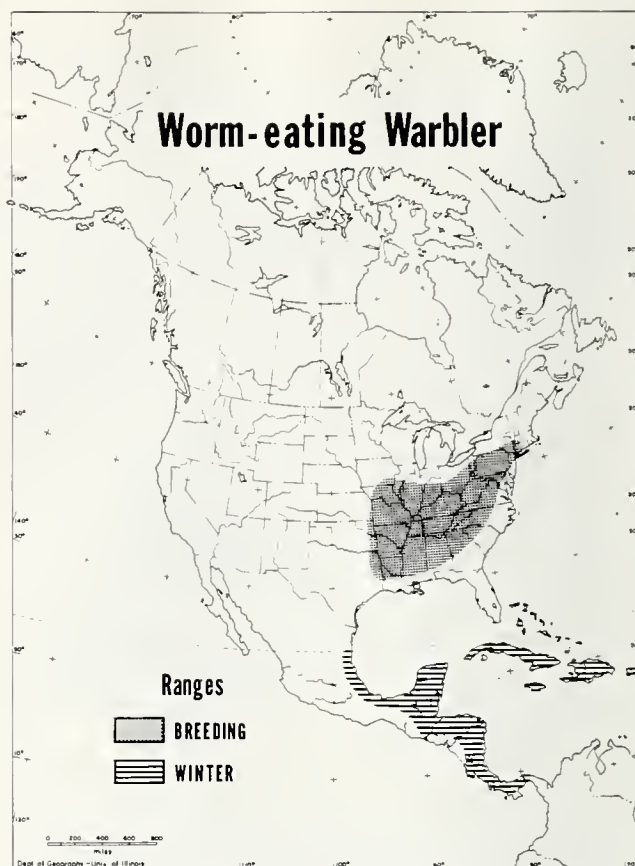


Fig. 12. General distribution of the worm-eating warbler.

Park on 22 April (Petersen 1964c, and seven in Pope County, 27 April (Fig. 14). Spring population densities of worm-eating warblers were about the same as breeding densities in prime upland ravine habitat in southern Illinois, where both populations were censused, but in spring they also occurred in bottomland forest and forest edge (Table 5). In a central Illinois county (Piatt) where the species is not known to breed, low spring populations were detected in both upland and bottomland forest (Table 5). Barnes' (1890) old nest record for Marshall County was unique, as the species was very rare even then. Bent's (1953) reference to breeding worm-eating warblers at Hinsdale seems questionable, and the significance of June records north of Coles County (Fig. 15) is as yet, unknown. Suitable looking habitat does exist in the northern half of Illinois, especially west of the Illinois River, where R. Sandburg (unpublished 1980) reported a June population (five males) in Pike County.

The species is not abundant anywhere—the highest population we have measured was in old upland beech-maple forest in Union County (Table 5). Worm-eating warblers also nest in mature upland oak-hickory ravines. We associate this warbler with extensive tracts of old forest, but even in prime habitat pairs are widely spaced. There are no measurements of territory size. Some of our June counts (Fig. 14) are higher than the spring counts because the June censuses were made in particularly good habitat.



Fig. 13.— Worm-eating warbler about life size. Photo taken 5 June 1973 in Pope County, Illinois.

In six upland forest areas in southern Illinois for which we have plant and bird population data the number of worm-eating warblers was positively correlated with the importance (Y) of grape ( $r = 0.852$ ,  $P = 0.02$ ) and the density of understory (2–8 cm DBH) stems ( $r = 0.829$ ,  $P = 0.05$ ). Populations were highest in forests with high stem density (2–8 cm DBH) of beech, but the two species (beech and worm-eating warbler) were not significantly correlated. We did not measure slope of terrain, but breeding worm-eating warblers were all in ravines or on relatively steep slopes. Slope direction may be important; the few nests we have found were on north- and east-facing slopes.

There are no data from which to judge whether this warbler is changing in population. Within historic times, it has apparently always been uncommon. Old-growth

forest—prime worm-eating warbler habitat—is probably declining.

The nesting cycle in Illinois is essentially unknown. The song is a distinctive, rather soft, long trill that sometimes rises at the end. The common call note is a typical warbler "Tchip." In Pope County one nest was being built, and nearly complete, on 2 May. Nests are built on the ground on the forest slope, somewhat embedded in surrounding leaf litter and sometimes partially covered by fern, or other plant leaves (Ridgway 1889). Two nests for which we have laying dates in Pope County indicate a laying season from at least 7 May to 1 June. A nest in the St. Louis area held incubated eggs on 22 May (Cooke & Widmann 1883). Barnes (1890) mentioned a nest with 4 eggs in Marshall County in June, but provided no other details. A nest in Pope County also had 4

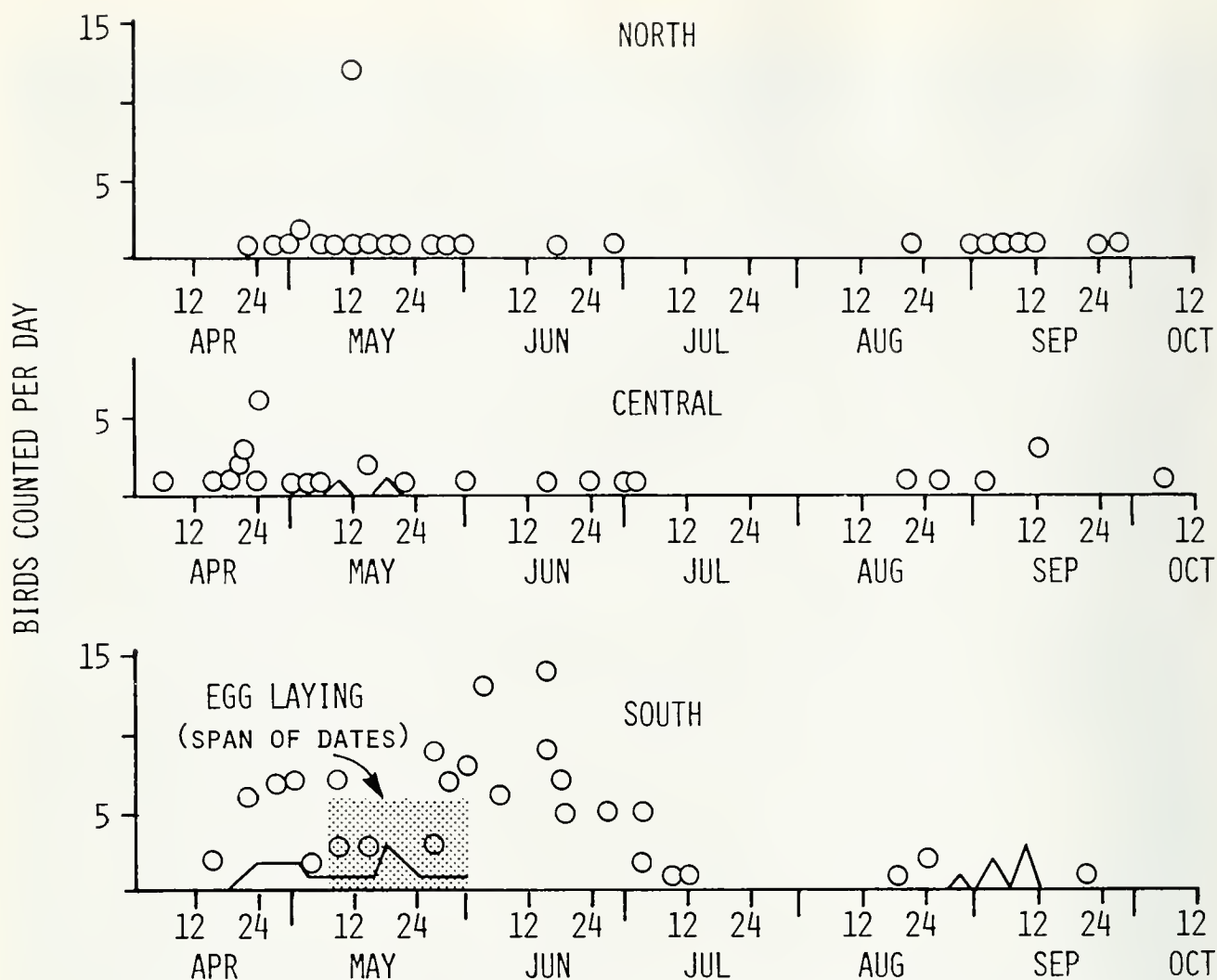


Fig. 14. Egg-laying and migration seasons of the worm-eating warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The shaded area shows the span of dates during which egg laying has been recorded.

TABLE 5. — Population densities of worm-eating warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring Migration (19 April-28 May)						
Mature upland forest	Pope (S)	1979-1981	17	350	6.6	1.9
Mature upland forest	Piatt (C)	1979-1981	14	279	1.9	0.1
Mature bottomland forest	Johnson (S)	1979-1981	16	333	1.9	0.2
Mature bottomland forest	Piatt (C)	1979-1980	8	165	1.9	0.2
Forest edge and shrub	Pope (S)	1979-1981	16	317	4.1	0.4
Breeding (June)						
Mature upland forest	Union (S)	1957-1958		42	14.5	12.6
Mature upland forest	South	1974-1979		580	8.9	2.2
Fall Migration (18 August-10 September)						
Mature upland forest	Pope (S)	1979-1981	9	174	8.8	0.7
Mature bottomland forest	Johnson (S)	1979-1981	6	128	1.8	0.3
Forest edge and shrub	Pope (S)	1979-1981	9	177	2.0	0.5

# Worm-eating Warbler

## BREEDING RECORDS

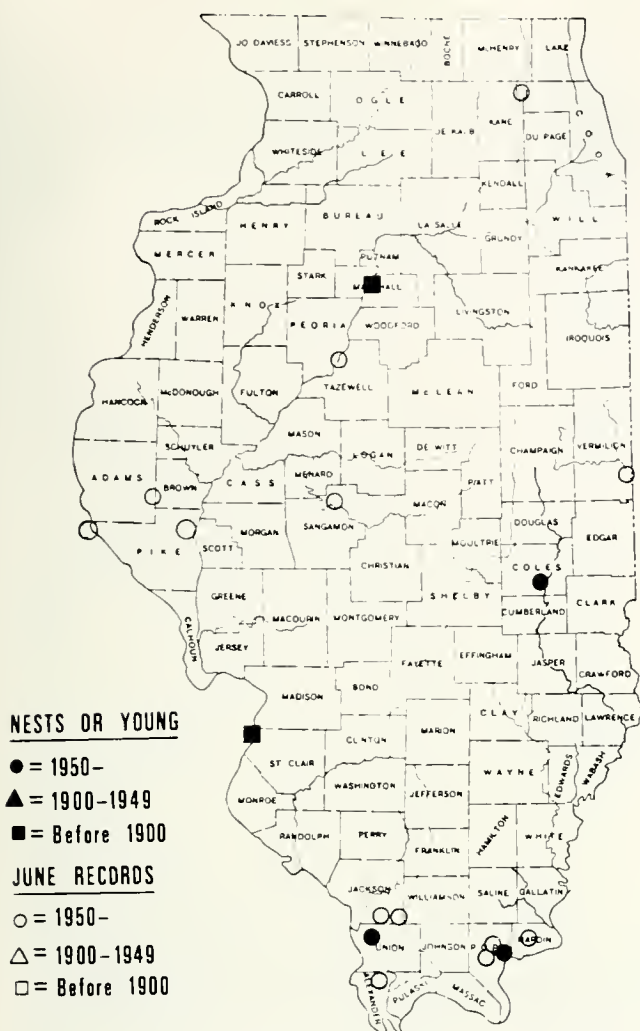


Fig. 15.—Breeding records of the worm-eating warbler in Illinois.

eggs, and another, 4 neonatal young. There are no data on nest success or productivity. Of three southern Illinois nests for which there are partial histories through the incubation period, one was parasitized (two cowbird eggs). A nest in Coles County was also apparently parasitized (Kleen & Bush 1972c).

There are few July or early August records of worm-eating warblers in Illinois (Fig. 14), their inconspicuousness being related to the absence of song. We have seen worm-eating warblers in Pope County away from their nesting habitat in early July. One seen on 8 July was not obviously in molt and had unworn plumage. A bird seen on 3 September was in fresh plumage.

Scattered records for late August and September (Fig. 14) indicate early September to be the peak of migration in southern Illinois. Especially in northern and central Illinois not more than one per day is usually seen in fall; a record of

three or four at Bloomington on 12 September is exceptional (Fawks 1971-1972). The latest fall sightings for the species in Illinois were on 28 September in northern Illinois (Fawks 1971a), 6 October at Decatur (Graber 1962a, and 20 September in the south (Widmann 1907, Wilhelm 1957). In southern Illinois we saw about three worm-eating warblers in spring to one in fall. The population densities showed a similar ratio (Table 5).

## GOLDEN-WINGED WARBLER

(*Vermivora chrysoptera*)

(Fig. 16)

### Spring Migration

The earliest reported occurrence of the golden-wing in Illinois is 7 April in northeastern Illinois (Abbott et al. 1933), but the species is more typically first seen after mid-April in southern Illinois and after 20 April in central and northern Illinois (Fig. 17). Most of the golden-wing population has passed through Illinois by 20 May, with a very small number remaining into June. Some of these late birds are potential breeders, and some merely late transients. Farwell (1919) recorded one male that remained on territory in Lake County from 25 May through at least 8 June, then disappeared. Pitelka (1938) found golden-wings singing near Deerfield on 13 June, but could find none on 27 June. A golden-wing present on 6 June in the St. Louis area was probably a late migrant (Comfort 1942).

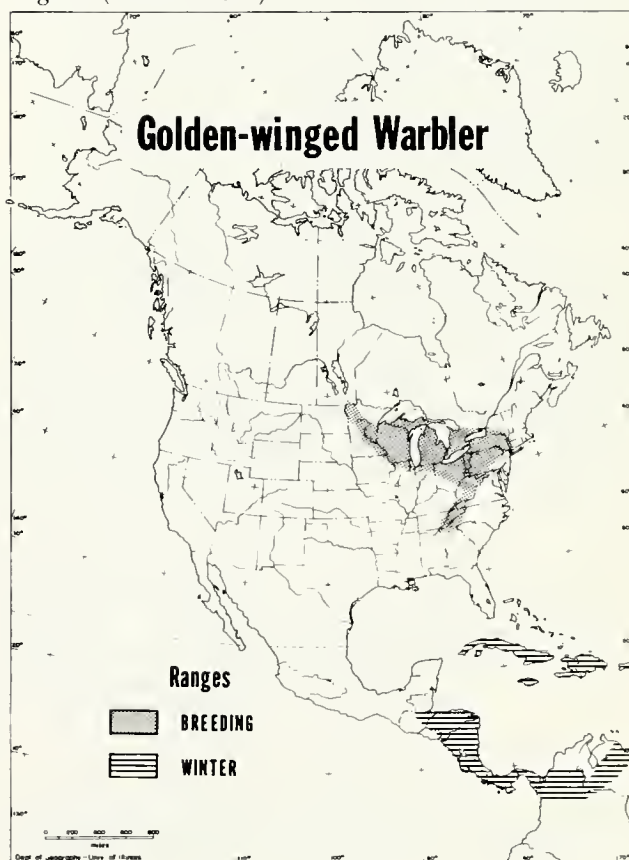


Fig. 16.—General distribution of the golden-winged warbler.

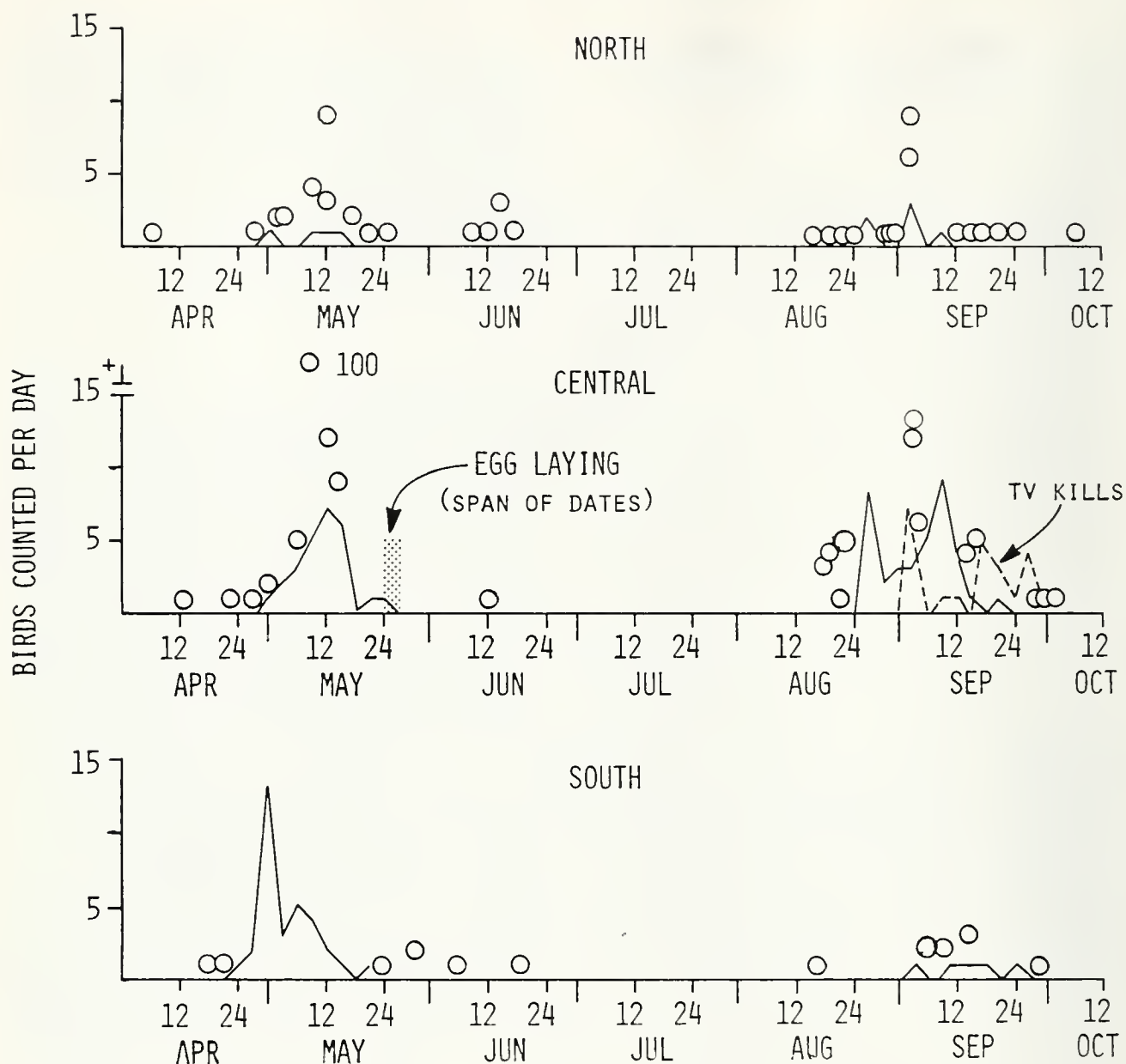


Fig. 17. Egg-laying and migration seasons of the golden-winged warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The shaded area shows the span of dates during which egg laying has been recorded. The dash line shows numbers killed at television towers during fall migration in central Illinois.

Even at the peak of spring migration we have usually seen fewer than 10 golden-wings per day, and an estimate of 100 at Urbana on 8 May (P. Norton unpublished 1962) was exceptional. Our counts were especially low in northwestern Illinois (Fig. 17), where Schafer (1917-1918) and Johnson (1936) also found the species rare in spring.

### Distribution and Nesting

There are few confirmed breeding records for the golden-winged warbler in Illinois or its border areas (Fig. 18). Ridgway's (1889) reference to its breeding in prairie

areas of Richland County was vague. A female golden-wing that scolded us persistently from a swampy shrub area west of Vernon, Illinois, 19 June 1979, may have been a very late migrant. Nests in the Mississippi Valley near Quincy and Keokuk (Norris 1890a, DuMont 1936) were found in the last century. It is unknown whether a population still exists in that area. Only in northeastern Illinois have (presumed) breeding golden-wings been found in more recent times, and even for this area data are very sketchy (Coffin 1909, Boulton & Pitelka 1937a, Pitelka 1938, 1939b, Kleen 1978-1979). In nearby Indiana Dunes, Pitcher (1974, 1975, 1977, 1978, 1979) has found (presumed) breeding golden-wings in



TABLE 6. — Population densities of golden-winged warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring Migration (27 April-16 May)						
Mature bottomland forest	Piatt (C)	1979-1980	4	81	5.5	1.5
Mature bottomland forest	Johnson (S)	1979-1981	9	183	3.7	0.9
Mature upland forest	Piatt (C)	1979-1981	7	147	3.4	0.5
Mature upland forest	Pope (S)	1979-1981	8	183	1.9	0.2
Forest edge	Piatt (C)	1979-1981	5	105	2.1	1.5
Forest edge	Pope (S)	1979-1981	7	138	6.1	0.9
Fall Migration (22 August-25 September)						
Mature bottomland forest	Piatt (C)	1979-1980	9	185	21.8	5.7
Mature bottomland forest	Johnson (S)	1979-1981	11	234	5.4	0.9
Mature upland forest	Piatt (C)	1979-1981	12	234	14.3	2.4
Mature upland forest	Pope (S)	1979-1981	11	218		0
Forest edge	Piatt (C)	1979-1981	14	265	26.3	3.1
Forest edge	Pope (S)	1979-1981	10	215	4.0	1.0

Plumage descriptions of hybrids seen in Illinois represent the types known as "Brewster's," and "Lawrence's" warblers, ranging from birds (Brewster's) with golden wing bars or a solid wing patch and clear white underparts (e.g., Petersen 1959, INHS Wgh-1) to birds with white wing bars and yellow breasts (e.g., Pitelka 1939b). Pitelka's (1938) reference to a Brewster's with no wing marks could possibly have been a (late June) bird in molt.

Freeman (1951) described a Lawrence's with the pattern of an immature male orchard oriole, i.e., black bib and no black on the side of the face behind the eye. Smith (1941a) mentioned a hybrid with a narrow black eye stripe and golden wing mark which she called Lawrence's. Neither is well known as a plumage pattern of Lawrence's warbler, but backcrosses with crossovers could produce a variety of patterns, not all of which are clearly definable as a particular (named) type.

Some of the Illinois records of so-called Lawrence's warblers may be misidentifications. Lawrence's has been consistently rare (e.g., Berger 1958), yet there are nearly as many reports (20 in spring and June) of Lawrence's in northern Illinois as of Brewster's (23) in the same region and

seasons. The ratio seems widely out of line with expectations based on the genetics of the complex (Parkes 1951) and observations elsewhere. Nearly all of the Illinois records for Lawrence's are for the northern, especially northeastern, region in May (mainly) and June. Records in addition to those noted by Ford (1956) are Bartel & Reuss (1932), Smith (1946), Fawks (1936, 1969b), and Kleen (1975e, 1979b). Reports of two Lawrence's, 25 May and 16 June (Smith 1942b), and three on 9 May (Smith 1946), if true, are exceptional. Ford (1956) reported Freeman's observation (Mayfield 1949b, Freeman 1951) of a male Lawrence's as being a pair of Lawrence's. Mayfield (1949b) and Freeman (1951) almost unquestionably refer to the same observation. Reports of Lawrence's warbler in central Illinois (Frank Smith unpublished 1904 and 1905, Graber 1962b) and in the southern region (Mayfield 1950a, Comfort 1953) are all subject to question because of lack of documentation.

Brewster's warbler, though more common than Lawrence's, is uncommon in Illinois and even diligent observers do not ordinarily find more than one per year. The earliest records of Brewster's are 14 April in Cook County (Fawks 1967b), one in Coles County 27 April (Bohlen 1978),

TABLE 7. — Matings between golden-winged and blue-winged warblers and/or their hybrids in or near northeastern Illinois.

Location (Area)	Date	Male Parent	Female Parent	Progeny		Reference
				No.	Type	
Deerfield	June 1937	Blue-wing	Brewster's	1	?	Boulton & Pitelka 1937a Pitelka 1938
Deerfield	June 1938	Brewster's?	Brewster's	2	Blue-wing Brewster's	Pitelka 1939b Boulton & Pitelka 1938b
Deerfield	June 1938	Golden-wing	Blue-wing	3	Blue-wing	Pitelka 1939b Boulton & Pitelka 1938b
Wilmington	June 1949	Lawrence's	Blue-wing	2	Blue-wing	Mayfield 1949b, Freeman 1951
Indiana Dunes	June 1948	Lawrence's	Blue-wing	No nest found		Mayfield 1948

and a tower casualty in central Illinois on 28 April (INHS Wgh-1). Most of the reports are for May (especially 5-15 in central Illinois and 10-26 in the north). Brewster's is not known to nest outside the northeast (Table 7), but two June records for Allerton Park, Piatt County (Roth 1967, Hudson 1968) suggest the possibility. There are few fall records for Brewster's, scattered from 26 August to 20 September (Fawks 1971a), mainly for central Illinois (Bohlen unpublished 1974 and 1978, Kleen 1979a, Brown 1965, Princen 1969). A Brewster's at Edwardsville on 30 August (Comfort 1954b) is the only fall record for southern Illinois.

Songs of Brewster's have been reported as being identical to the song of the blue-wing (Pitelka 1939b, Roth 1967) and also as having the quality of the golden-wing's song—four buzzes, all on the same pitch (Petersen 1959). A Lawrence's warbler reportedly sang four notes, the first lazy and higher pitched and the last note lower (Smith 1941a).

## BLUE-WINGED WARBLER (*Vermivora pinus*)

(Fig. 19 and 20)

### Spring Migration

The earliest arrival dates for the blue-winged warbler in or near Illinois are 9 April in the St. Louis area and 12 April in southeastern Illinois (Fig. 21). There are blue-wing records for central Illinois as early as 11 April (J. Polk unpublished 1978) and 13 April (UMMZ 30128), but the earliest report for northern Illinois is 27 April (Abbott et al.

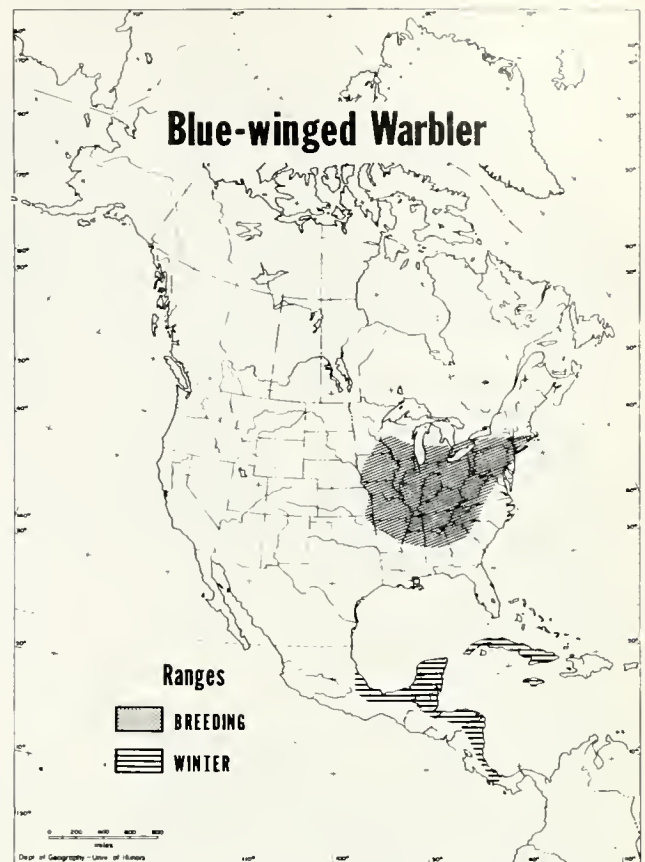


Fig. 20. - General distribution of the blue-winged warbler.

1933), with numerous records from 1 May (e.g., Gault 1901c). Peak populations were observed 23 April-9 May in



Fig. 19. Blue-winged warbler on its nest. Photo taken 18 May 1980 in Pope County.

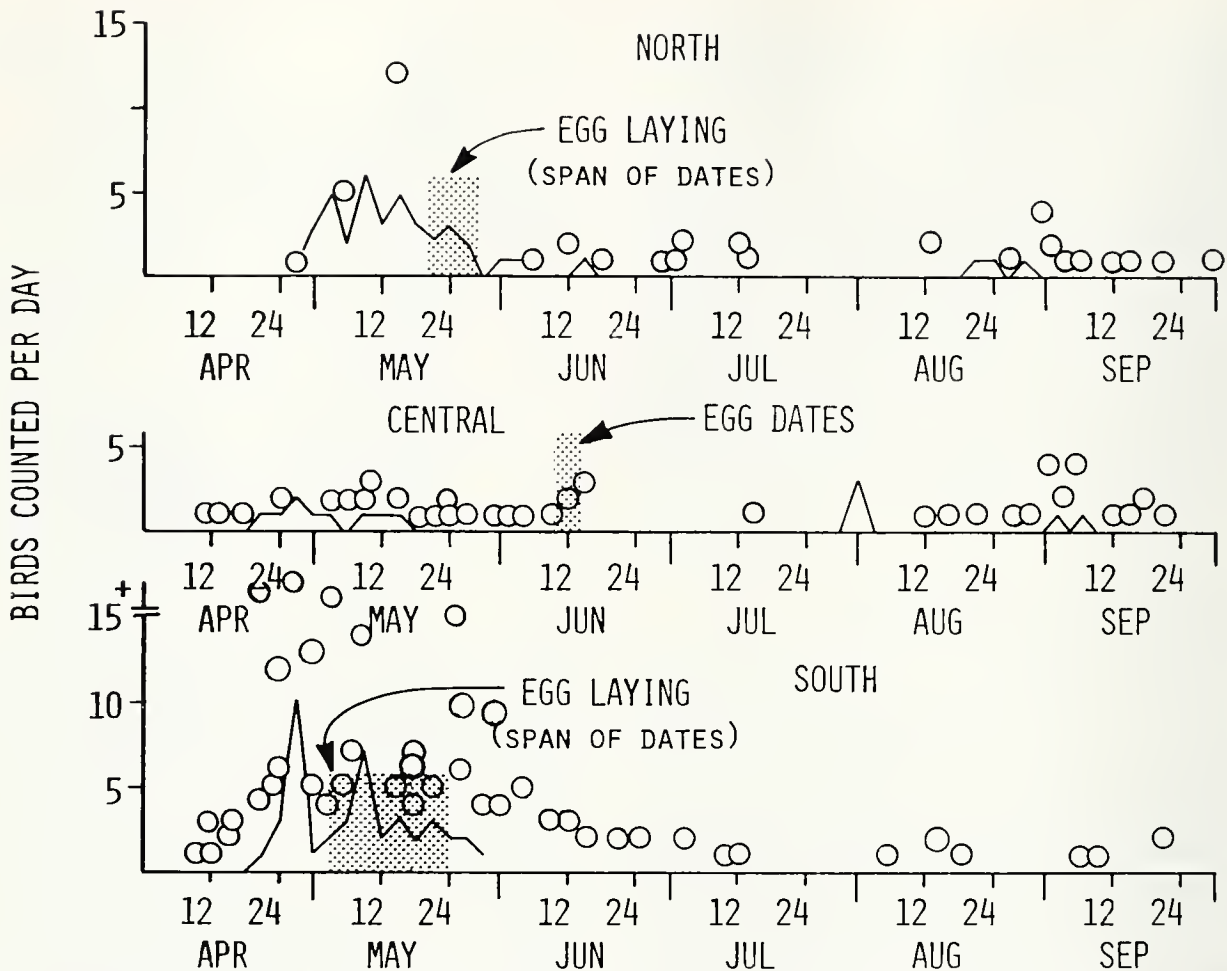


Fig. 21.—Egg-laying and migration seasons of the blue-winged warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Shaded areas show the span of dates during which egg laying has been recorded.

southern Illinois (5-20 per day) and 3-14 May in the north (5-12 per day). Counts in east-central Illinois have been consistently low (Fig. 21) both recently and in the time of F. Smith and his students (1904-1925).

Spring populations, like breeding populations, were highest in forest-edge habitat (Table 8), but transients also used mature forest—both upland and bottomland—in southern Illinois.

### Distribution and Nesting

Breeding populations of blue-wings in Illinois are generally low and appear very spotty (Fig. 22). In addition to the records shown, there is a June record for an unspecified locality in Ogle County (Kleen 1980-1981). We would expect at least a few pairs in most of the counties. Neither Ridgway (1874b) nor Nelson (1876-1877) indicated that the blue-wing warbler occurred in northern Illinois. Woodruff (1907) implied that blue-wings began to appear in the Chicago area around 1890-1895—when Giddings (1897) considered the species to be a rare breeder at the same

general latitude in the Mississippi Valley. In Marshall County the blue-wing was common *before* 1890 (Barnes 1890). The northward extension of the blue-wing's range was a widespread phenomenon (Short 1963), and the established breeding range now extends well north of Illinois (Fig. 20). Schorger considered the blue-wing to be a common breeder in southwestern Wisconsin (Kumlien & Hollister 1951), and there is suitable looking habitat in many areas of western Illinois, but the densest populations known have been in Lake County (Pitelka 1939a, Smith 1941a, Kleen 1977-1978) and southern Illinois (Table 8, Ridgway 1878).

Ridgway (1878, 1887, 1889) described two types of habitat for the blue-wing—half-cleared fields grown up to sprouts and rich, open bottomland woods where cane [*Arundinaria*] formed a “considerable” portion of the undergrowth. We have never detected this species in bottomland forest during the breeding season. Cahn & Hyde (1929) noted the habitat in Union County as bushy clearings in the oak-hickory association—the habitat to which our population measurements also refer (Table 8). In Lake County, Ford (1914) found blue-winged warblers in damp

# Blue-winged Warbler

## BREEDING RECORDS

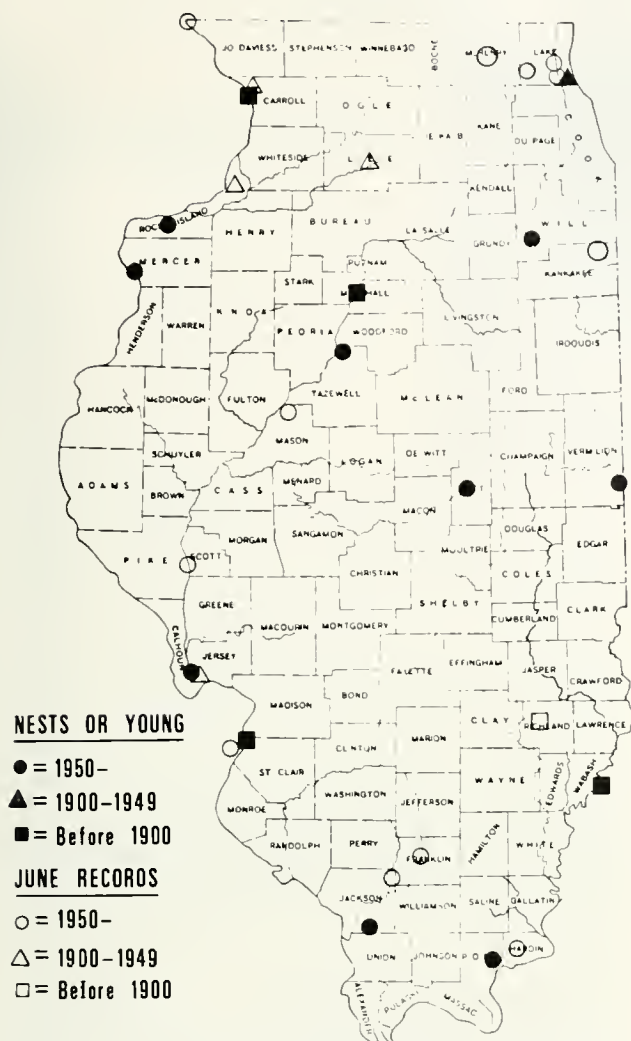


Fig. 22.—Breeding records of the blue-winged warbler in Illinois.

Blue-winged warblers have at least four distinct songs—three of which we have heard from the same bird in Pope County. The so-called “inhale-exhale” song (Pitelka 1938), which we phoneticize “Zee-baw,” is the one most frequently heard from both transient and breeding birds. Pitelka (1938) described the second song (Type II) as “Zee-zee-zee-zee-zwee.” Our phonetics for (probably) the same song is “Tick-ticky-zeeee” (last note prolonged and ascending). A third song, given in flight, is similar to the second but longer and more fervent, described by Pitelka (1939a) as “Tsip, tsee-zee-zec-zee-zee-zee-zwee” (last note ascending). The fourth song, which we have heard in Pope County, is a long flat trill, somewhat suggestive of a chipping sparrow song.

Neither the duration of the nesting cycle nor any of its phases has been measured in Illinois. The nest is placed on or very near the ground, more or less supported by but not necessarily attached to adjacent shrubbery (Giddings 1897, Ford 1914, Pitelka 1939b). The nest (Fig. 23) is an open cup, fairly bulky and loosely made of a cushion of dry leaves or strips of the inner bark of trees (e.g., basswood), lined with grass, grape bark, and hair (Baird et al. 1874, Ridgway 1889, Giddings 1897, Ford 1914). Clutch size has been recorded for only six blue-wing nests in Illinois. One nest contained 6 eggs; three, 5 eggs; and two, 4 eggs. Nests with eggs have been found from about 2 May to 25 May in southern Illinois and in central Illinois as late as 14 June (Fig. 21). Laying dates were 20–29 May in northern Illinois. One nest (of two observed in 1980) in Pope County was parasitized by the cowbird (3 warbler eggs and 1 cowbird egg). Nesting success and productivity have never been measured in any Illinois population of blue-wings.

## Fall Migration

As is typical of the more southern-ranging species, the blue-winged warbler's fall migration is very inconspicuous

forest edge on low slopes, and Pitelka (1939a) found them in semiopen, grassy woodland thicket. Near the northwest Illinois border in adjacent Iowa, Giddings (1897) found blue-wing nests in the edge of thickets. The reference in Table 8 to mature upland forest as breeding habitat probably relates to a small amount of edge covered in the censuses. The Indiana Dunes have had breeding blue-wings for many years (Nolan 1952, Ford 1956, Pitcher 1978), but the only measured populations (Pitcher 1974, 1975, 1977, 1978, 1979) have been low (0–1.8 territorial males per 40.5 ha).

Both Barnes (1890) and Widmann (1907) observed that blue-winged warbler populations were declining, but there were no actual population measurements on which to base such a conclusion. Much work is needed on both the habitat requirements and population measurements of the blue-wing.



Fig. 23.—Nest and eggs of the blue-winged warbler.

TABLE 8.—Population densities of blue-winged warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
					Maximum	Mean	
Spring (12 April–26 May)							
Riparian	Lake (N)	1941	1	65		6.2	Smith 1941a, Ford 1956
Forest edge	Piatt (C)	1979–1981	10	164	6.2	1.5	This paper
Forest edge	Pope (S)	1979–1981	17	337	18.3	7.7	This paper
Mature bottomland forest	Piatt (C)	1979–1980	8	144	1.9	0.3	This paper
Mature bottomland forest	Johnson (S)	1979–1981	16	329	1.9	0.1	This paper
Mature upland forest	Piatt (C)	1979–1981	12	200		0	This paper
Mature upland forest	Pope (S)	1979–1981	19	371	3.9	0.3	This paper
Breeding (June)							
Woods (unspecified)	Rock Island (N)	1917–1923	7	22	4.5	1.1	J.J. Schafer unpublished 1917–1923
Forest edge	Pope (S)	1979–1981	3	62	7.4	3.3	This paper
Mature upland forest	South	1974–1979	30	580	3.7	0.3	This paper
Fall (14 August–17 September)							
Forest edge	Pope (S)	1979–1981	11	217	5.9	1.1	This paper
Bottomland forest	Piatt (C)	1979–1980	8	164	3.9	0.5	This paper
Upland forest	Piatt (C)	1979–1981	11	215	3.0	0.3	This paper

(Fig. 21). We have never recovered a specimen from the television towers. Scattered records indicate that the migration is most noticeable from 1 to 20 September. The latest records are 29 September—an immature in Cook County (B.T. Gault unpublished 1920), 22 September in Vermilion County (M. Campbell unpublished 1973), and 20 September in the St. Louis area (Wilhelm 1957).

The ratio of our spring to fall counts was 12 blue-wings seen in spring to 1 in fall (4 to 1 in the central region and 17 to 1 in the south within the census transects).

## BACHMAN'S WARBLER

### (*Vermivora bachmanii*)

This extremely rare, possibly extinct, warbler (Stevenson 1972) has not been recorded in Illinois with absolute certainty, though a substantial breeding population once existed in southeastern Missouri (Widmann 1897b, 1898), and the southern Illinois swamps probably contained adequate habitat.

All Illinois reports of the species—Ridgway (Gault 1922), Fawks (1936), Smith (1941a, see Brewer 1958a), Mayfield (1950a)—are subject to question. On 20 July 1958 in rather open swampy forest with a dense understory of *Rubus* thickets near Cache, Illinois, we saw what we believed at the time to be a singing male Bachman's warbler (George 1971).

We saw and heard it only briefly, and searches on later dates proved futile. By the following spring the entire forest had been cleared with bulldozers. The rarity of the species, the brevity of our observation, and our lack of prior (or subsequent) experience with the species, all tend to discount the record.

## TENNESSEE WARBLER

### (*Vermivora peregrina*)

(Fig. 24 and 25)

### Spring Migration

One of the most abundant warblers in Illinois, Tennessees have been recorded as early as 1 April in the St. Louis area (Wilhelm 1957), and 6 April at Olney (Ridgway 1915a). Early records for central Illinois are 14 and 15 April and for northern Illinois, 26 April (Ford et al. 1934). The species is common from about 20 April to 18 May in southern Illinois and in nearly all of May in the central and northern regions (Fig. 26). The spring migration waves are especially conspicuous because the Tennessee is one of the most constant and vigorous singers (Farwell 1919), and its song—a loud double-noted, staccato trill—is a dominant sound in Illinois woodlands in May. Though most of the population has passed north of Illinois by the end of May, the last fairly regularly linger into June, with one record as late as the 12th in the St. Louis area (Wilhelm 1957) and a singing bird seen



Fig. 24.—Tennessee warbler about life size; photo of captive at Urbana in fall 1968 by Elwin Warrick.

on 28 June at Glen Ellyn by B.T. Gault (unpublished 1910). During their sojourn, some Tennessees appear to establish territories, which they defend vigorously for a number (unknown) of days before moving on. Many of the Tennessee warblers in southern Illinois appeared to have their territories in the wettest areas of the bottoms. Bottomland forest had densities three times higher than those in upland forest. That pattern did not hold in central Illinois, where densities were highest in the *upland* (Table 9); thus, we conclude that high population densities are related to the site rather than to the habitat. Tennessees were most numerous where oaks predominated, but their numbers were not correlated with abundance of oaks. Silloway (unpublished 1921–1923) noted them particularly in blossoming oaks and hawthorns and in willows and elms. Nelson (1876–1877) suggested that Tennessee warblers tend to stay in the tree tops in spring and descend lower in fall.

Tennessee warblers are known to be nocturnal migrants and are common victims at television towers in fall (Fig. 26), but we know of only one spring (16 May) casualty (Brewer & Ellis 1958).

### Fall Migration

Tennessee warblers have been recorded in northern Illinois at least twice in July (Ford et al. 1934), Petersen 1964a). Coursen (1947) found the species "very plentiful" in northern Illinois on 10 August 1936, and in central Illinois Bohlen (unpublished 1979) found one on 12 August. In most years they are not seen in numbers until after mid-August, and there are surprisingly few August records for southern Illinois (Fig. 26). In northern and central Illinois the bulk of the fall population of Tennessee warblers is present from about 27 August to 8 October, and in the south from 3 September to 15 October (Fig. 26). A few Tennessees linger probably every year to late October, and there are a few records even for November, as late as the 14th (Ford 1956,

Kleen 1975a, 1976d). Many Tennessee warblers are killed at television towers in Illinois, the largest kills occurring generally in the period (i.e., September) when most are seen in the field (Fig. 26). An adult specimen killed on 10 September near Argenta was still in the postnuptial molt, and Raveling (1965) reported Illinois specimens of adult Tennessees in heavy molt.

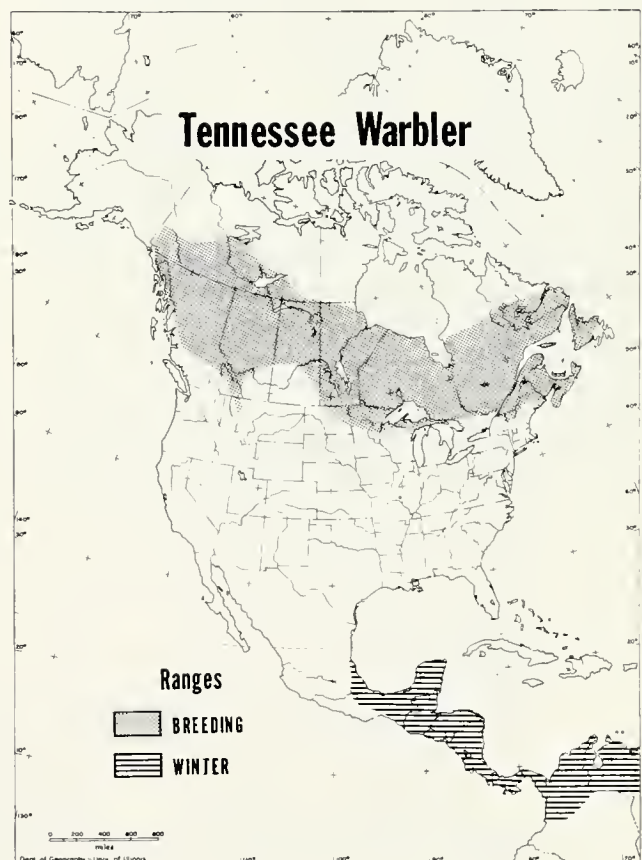


Fig. 25.—General distribution of the Tennessee warbler.

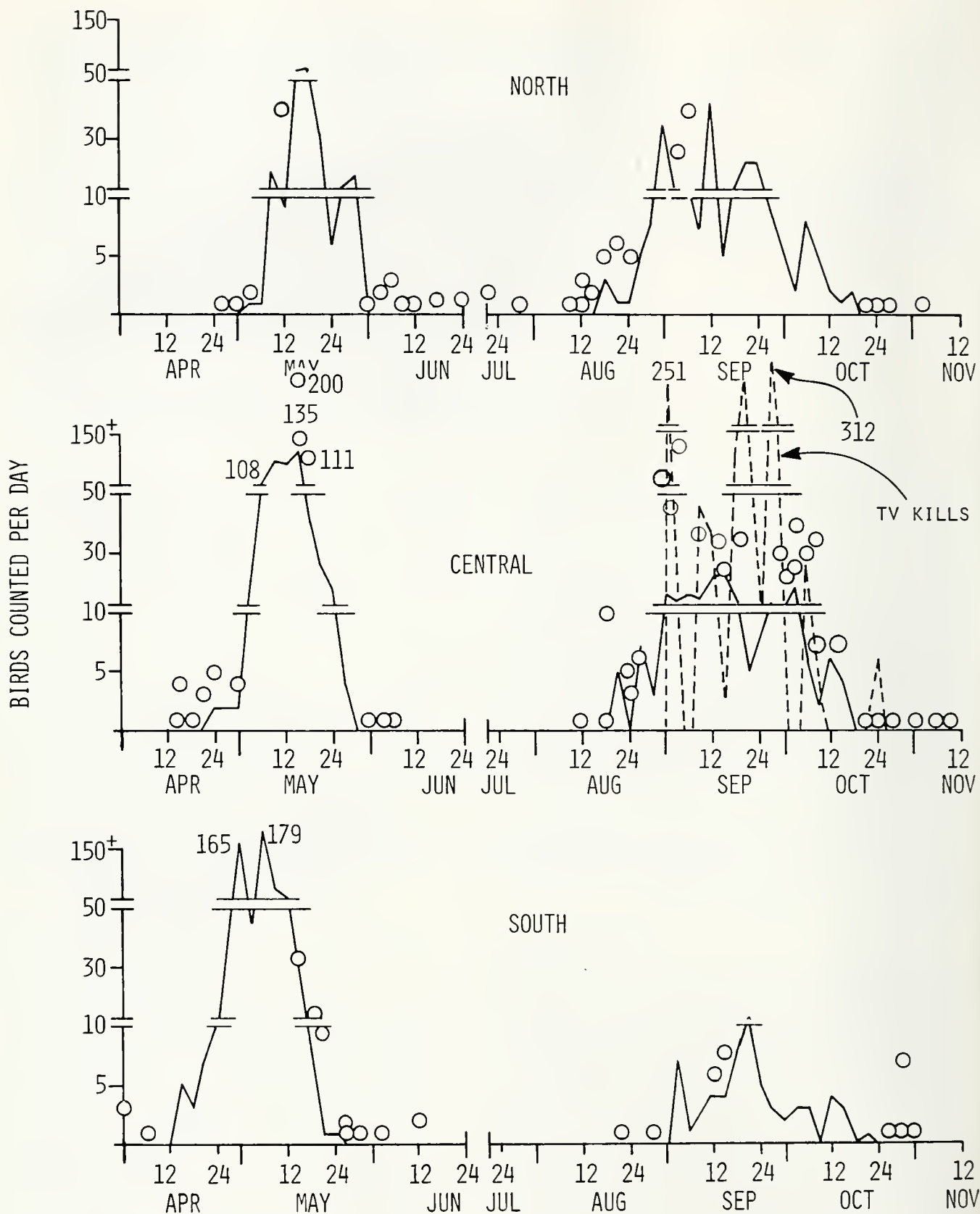


Fig. 26. Migration seasons of the Tennessee warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

TABLE 9.—Population densities of Tennessee warblers in various Illinois habitats.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (17 April-26 May)						
Mature bottomland forest	Piatt (C)	1979-1980	7	144	114.9	41.6
Mature bottomland forest	Johnson (S)	1979-1981	15	311	72.3	23.7
Mature upland forest	Piatt (C)	1979-1981	11	220	246.1	88.2
Mature upland forest	Pope (S)	1979-1981	17	349	44.1	7.9
Forest edge	Piatt (C)	1979-1981	9	162	95.7	36.3
Forest edge	Pope (S)	1979-1981	16	317	85.4	15.3
Pines	Pope (S)	1979-1980	8	145	4.5	1.1
Fall (18 August-30 October)						
Orchard	South	1908		235		1.2
Pasture	North	1909		172		3.5
Pasture	Central	1906		217		1.6
Corn	North	1909		199		0.2
Corn	Central	1906		277		0.6
Mature bottomland forest	Piatt (C)	1979-1980	17	348	123.9	20.2
Mature bottomland forest	Johnson (S)	1979-1981	14	291	16.2	4.2
Mature upland forest	Piatt (C)	1979-1981	23	445	87.9	8.5
Mature upland forest	Pope (S)	1979-1981	11	231	11.2	1.8
Forest edge	Piatt (C)	1979-1981	23	436	255.3	41.9
Forest edge	Pope (S)	1979-1981	13	246	6.0	1.6
Pines	Pope (S)	1979-1980	7	122	17.2	2.3

While the migration of Tennessees lasts about 35 days in spring and about 60 days in fall in northern and central Illinois, we counted fewer in fall than spring. The ratio becomes increasingly skewed southward. In northern Illinois the ratio of our counts was even, but at Chicago, Dreuth saw about four Tennessees in fall to one in spring. In central Illinois about 3 were seen in spring to 1 in fall (2+ to 1 in the census transects), and in the south the ratio was 12 to 1 (6 to 1 in the transect censuses). The age ratio in a sample of 321 specimens of Tennessees from central Illinois television towers, picked up between 24 August and 24 October, was 1.00 adult to 1.24 immatures (i.e., the equivalent of about 1 bird in spring to 2 in fall).

A record of a Tennessee warbler seen repeatedly between 27 January and 6 March 1975 at Charleston is strange, but interesting, because the bird survived temperatures as low as

-8°F (Kleen 1975b). A Tennessee warbler was also found at Charleston on 13 December 1979 (Kleen 1980b).

### Specimen Data

Three May specimens of Tennessee warblers showed great variation in weight: two males, 7.3 g (little fat), 11.2 g (very fat); one female, 9.4 g (some fat).

Fall (24 August-24 October) specimens from the central Illinois towers ranged in weight (with mean and standard error) as follows: 41 adult males, 9.2-16.0 g ( $11.06 \pm 0.23$ ); 42 immature males, 8.8-14.6 g, ( $11.03 \pm 0.21$ ); 38 adult females, 8.2-14.2 g ( $10.07 \pm 0.18$ ); and 67 immature females, 8.4-14.4 g ( $10.29 \pm 0.16$ ). Tennessees of average weight were quite to very fat, and many were very to extremely fat. Raveling (1965) identified the origins of transient Tennessees killed on television towers, in the Midwest and found that some of those killed in Wisconsin came from as far as northwestern Canada.

## ORANGE-CROWNED WARBLER (*Vermivora celata*)

(Fig. 27)

### Spring Migration

Orange-crowned warblers have been seen in Illinois in winter several times, and one stayed at St. Louis from 27 February to 31 March (Kleen 1980d). The earliest spring transients were reported on 15 April in both the southern (Wilhelm 1957) and central regions (Bohlen unpublished 1977) and on 22 April in the north (Smith 1951a). Orange-crowns are present in the state in small numbers until about mid-May (Fig. 28). A record of an orange-crown in the Chicago area on 2 June (Ford et al. 1934) is very unusual.

The spring numbers of orange-crowns are consistently low, with high counts usually less than five per day. Our population measurements were similarly low (0-2 per 40.5 ha) in spring, between 20 April and 14 May, when average densities were 1.5 in both central and southern regions in the

most frequented habitat—forest edge and shrub. Bohlen (1978) observed that they also frequent conifers, but we did not detect orange-crowns in pine habitat in the south. Both Ridgway (1889) and Comfort (1961) commented on the great annual variation in the population. During their spring sojourn in Illinois, orange-crowns sing a soft trill, so weak that it does little to increase the bird's conspicuousness.

### Fall Migration

There are a number of reports of orange-crowned warblers in northern Illinois in August (Woodruff 1907, Brodkorb 1926b, Coursen 1947, Clark & Nice 1950) as early as the 20th (Blake & Smith 1941), and even one for 28 July (Gault 1901e), but such early arrivals must be exceptional. More typically, fall transients are first detected in Illinois between mid-September and early October, most of the orange-crowns passing through the state in October (Fig. 28). Specimens from tower kills (a total of 26 picked up) show about the same seasonal distribution as our counts. A few orange-crowns are probably present in most years in early November, but records as late as 22, 25, and 28 (Boulton & Pitelka 1938a, Kleen 1976d, 1980a) are unusual. Because of the orange-crown's extensive northern breeding populations (Fig. 27), the potential for variation in migration behavior is great, as reflected by the number of Illinois (plus border area) records for the species in December (Smith 1950, Chaniot 1960, Mumford 1960b, Petersen 1966a, Westcott 1970, Funk & Funk 1976, Sanders 1976, 1980) and January (Kleen & Bush 1972a, Kleen 1980b, Homoya 1976).

Though Ridgway (1874a) implied similar populations of orange-crowns in spring and fall, our counts were much higher in fall, with great variation between regions: north, 1.0 in spring to 29.0 in fall; central, 1.0 to 6.1; south 1.0 to 1.5; and for the state overall, 1.0 to 9.1. Our censuses of transients showed spring-to-fall ratios of about 1 to 13 (central) and 1 to 2 (south). As in spring, orange-crowns were detected in fall almost entirely in forest-edge habitat, where densities between 18 September and 1 November ranged in Piatt County from 0 to 10.4 birds per 40.5 ha (mean, 3.4) and in Pope County from 0 to 4.2 (mean, 1.1 birds per 40.5 ha).

### Specimen Data

Bohlen & Kleen (1976) worked out a method of aging fall specimens of orange-crowned warblers by plumage. The considerable variation in brightness of color among Illinois specimens is probably related to age and season. The 12 specimens we have examined are of the nominate form.

Two males, one adult and one immature, weighed, respectively, 9.4 and 9.2 g. Both were moderately fat.

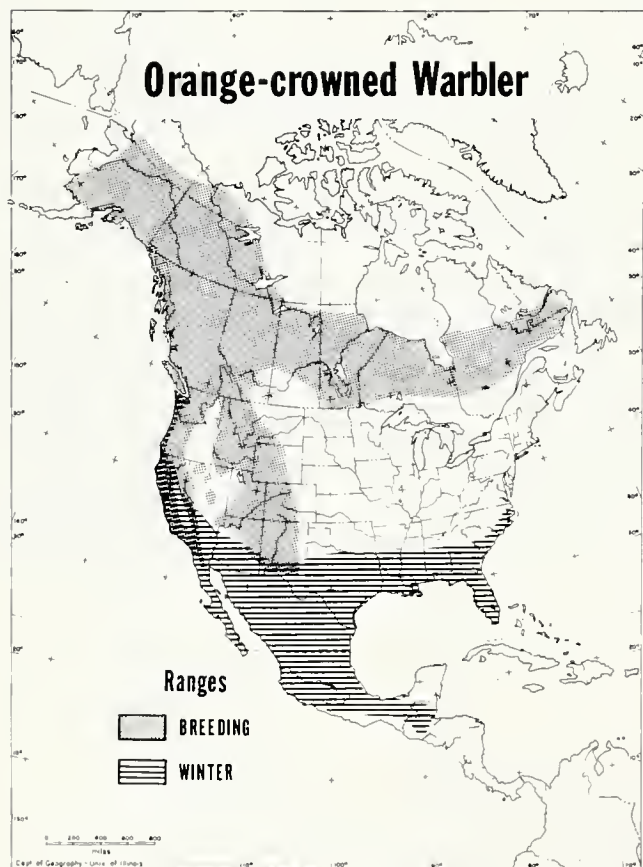


Fig. 27. — General distribution of the orange-crowned warbler.

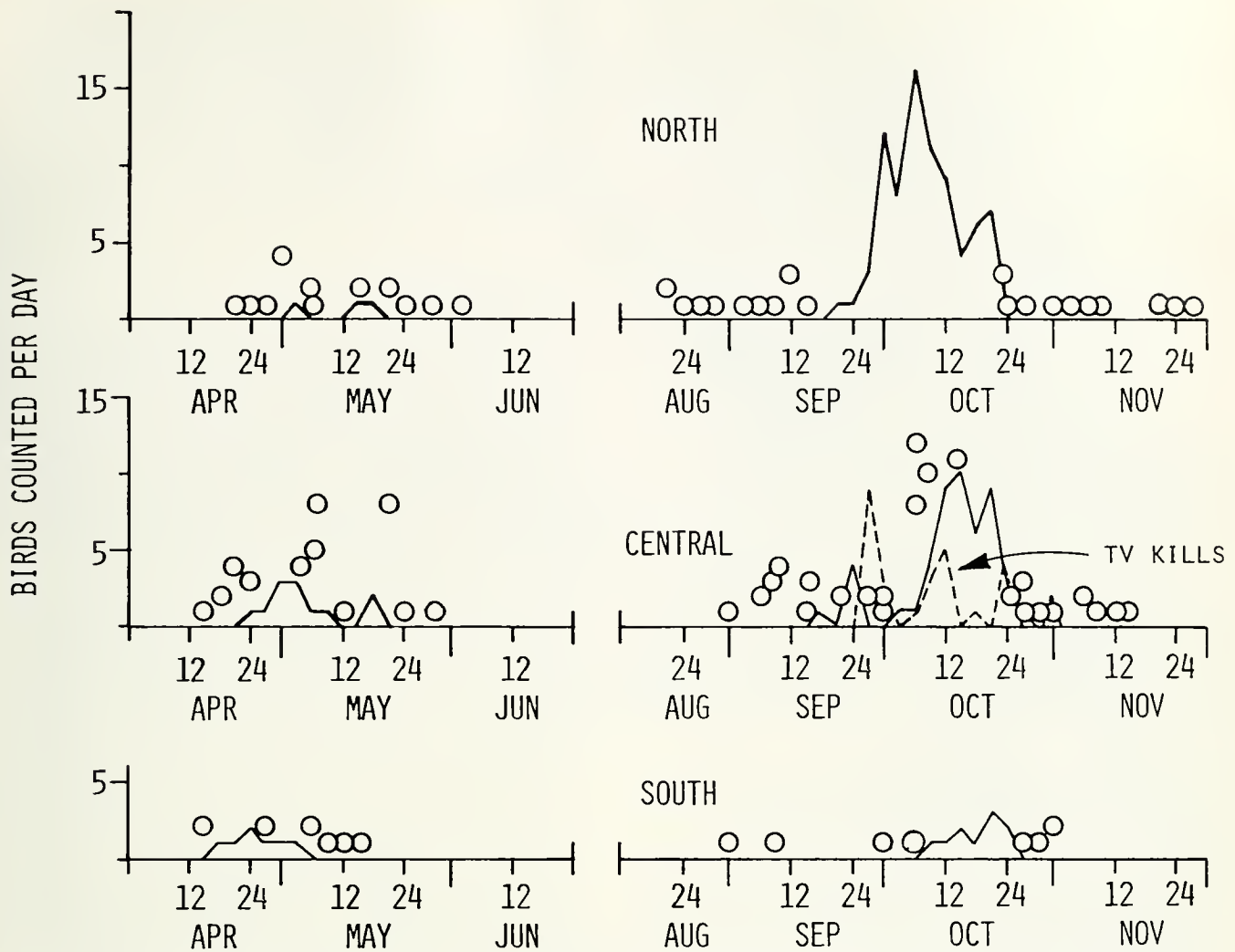


Fig. 28. - Migration seasons of the orange-crowned warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

## NASHVILLE WARBLER (*Vermivora ruficapilla*)

(Fig. 29)

### Spring Migration

The earliest reports of Nashville warblers in or near Illinois are 9 April in the St. Louis area (Wilhelm 1957), 14 April in east-central Illinois (R. Chapel unpublished 1977), and 19 April in northwestern Illinois (J.J. Schafer unpublished 1913). Peak populations are present from about 20 April to 10 May in the south and 1-15 May in the central and north, with counts usually less than 20 per day (Fig. 30). Most of them have passed the southern region by mid-May with late records of 22 May (Cooke 1888) and 8 June (Wilhelm 1957). Other late spring records are 10 June for central Illinois (Kleen 1980-1981) and 5 June in the north

(Ferry 1908). The Nashville has been recorded as a breeding bird in Illinois and adjacent Wisconsin, and there is always the possibility that June records (Ford et al. 1934), Clark & Nice 1950, Ford 1956, Kleen 1977d), especially in the north, may represent local breeders. However, the Nashville is extremely rare as a breeding bird in Illinois.

Nashvilles showed a consistent habitat preference in our spring transects, the highest populations being in forest edge (Table 10). The counts of Smith, et al. at Urbana (1904-1925) were consistently below our more recent counts.

Nashville warblers (males) are persistent singers, and like the Tennessee, are conspicuous during their sojourn in Illinois. The song, though not loud, is distinctive and carries well. Silloway (unpublished 1921) described it as "Tsee-tsee-tsee-chip-per-yee"—a series of "sweet" notes followed by a trill.

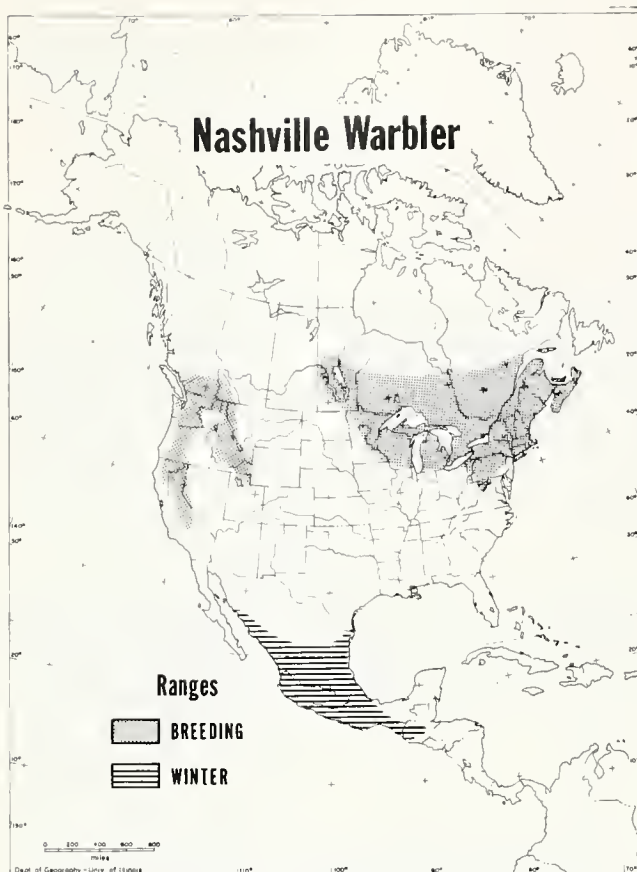


Fig. 29. — General distribution of the Nashville warbler.

## Breeding

Pitelka (1940) summarized the breeding records of the Nashville in Illinois but omitted without explanation a paper by Tuttle (1918), who provided the history, with photographs, of a nest he found at Lake Forest. The nest contained five eggs in mid-June and was located on the ground on a steep slope overgrown with birches and azalea and having ground cover of moss, wintergreen, and arbutus. Pitelka's (1940) observation of a female Nashville apparently feeding young, 14–18 June, was also in Lake County, but in mesic climax oak-maple-hickory forest with dense undergrowth and with a marshy willow thicket nearby. Two records of Nashvilles in the state in July (Fawks 1967c, R. Russell unpublished 1962) also refer to Lake County, particularly the Des Plaines River area.

Pitelka's (1940) summary of Smith's (1888) paper indicated that a sizeable breeding population of Nashvilles existed in Fulton County in the 1870's. Smith found four nests in 1 day—12 May 1879, and a total of 20 nests of the species. There is no recent evidence of breeding by the Nashville in central Illinois, and the Fulton County records, if true, may also have represented the last of a population that was receding to the north. The habitat in Fulton County

was shrubby hazel (*Corylus?*) growth on a hillside. The precise locality for these records was apparently not stated. There are no measurements of breeding populations of the Nashville warbler in Illinois.

In his sample of 20 nests, Smith (1888) reported that clutches were 4–6 eggs (average, 5). The Lake Forest nest had 5 eggs which hatched, though the nest ultimately failed (Tuttle 1918).

## Fall Migration

A record of a Nashville warbler in northern Illinois on 28 July (Ford et al. 1934) could have represented either the rare breeding population or the beginning of the southward migration. The next earliest fall records—12 August in central Illinois (R. Chapel unpublished 1977) and 13 August in the south (Wilhelm 1957)—definitely represent migration, with a flood of records after mid-August (e.g., Cooke 1905a, Blake & Smith 1941, Clark & Nice 1950). Peak numbers pass through the state from September to mid-October (Fig. 30). Though few Nashvilles are seen in Illinois after 20 October, there are a number of records of stragglers in northern and central Illinois in November (Ford 1956, Fawks 1966d, 1973a, Kleen 1974a, 1975a, 1976d, Kleen & Bush 1973a) and one for 9 December at Monmouth (Kleen 1980b). The seasonal distribution (3 September–31 October) of kills of Nashvilles at television towers in central Illinois (a total of 226 picked up) is similar to that of our field counts (Fig. 30).

The ratio of our spring-to-fall counts for the Nashville showed a familiar pattern of progressive change from north to south: north 1.0 bird in spring to 1.8 in fall; central, 2.2 to 1.0; south, 4.9 to 1.0; and for the state overall, 1.9 to 1.0. The transect censuses showed a similar pattern (1 to 1 in the central region and 28 to 1 in the south). A sample of 149 Nashville specimens picked up at the television towers, 10 September–24 October, had a ratio of 1.5 adults to 1.0 young (the equivalent of 1.0 bird in spring to 1.7 in fall). The fall migration was protracted (57 days) in northern and central Illinois by comparison with that of the south (36 days, Fig. 30) and by comparison with the spring migration. As Graber explained (1968), we believe the fall migration of this species (in contrast to those of most Illinois warblers) to be westward.

There are a few winter records for the Nashville warbler in northern (Sanders 1976) and central Illinois (Kleen 1975b, 1977b, 1980b, Kendeigh 1977). There are no data on winter survival.

As is spring, habitat preference for forest edge was exhibited by Nashvilles in fall though other woody habitats—forest, orchard, and residential habitat—had relatively high populations (Table 10).

## Specimen Data

The Nashville, like the orange-crowned warbler, varies noticeably in brightness of color, the later fall birds being particularly bright. This color variation probably relates

mainly to age and sex. In our small series of specimens, the adult males were nearly all late September-October birds, whereas all the early September birds were immatures. The ranges of gross weights of Nashville warblers killed at televi-

sion towers 10 September–12 October were: for 38 adult males, 7.8–10.2 g (mean = 8.71, SE = 0.11); for 18 immature males, 7.4–11.8 g (mean = 8.85, SE = 0.25); for 33 adult females, 7.4–9.6 g (mean = 8.47, SE = 0.11); and for

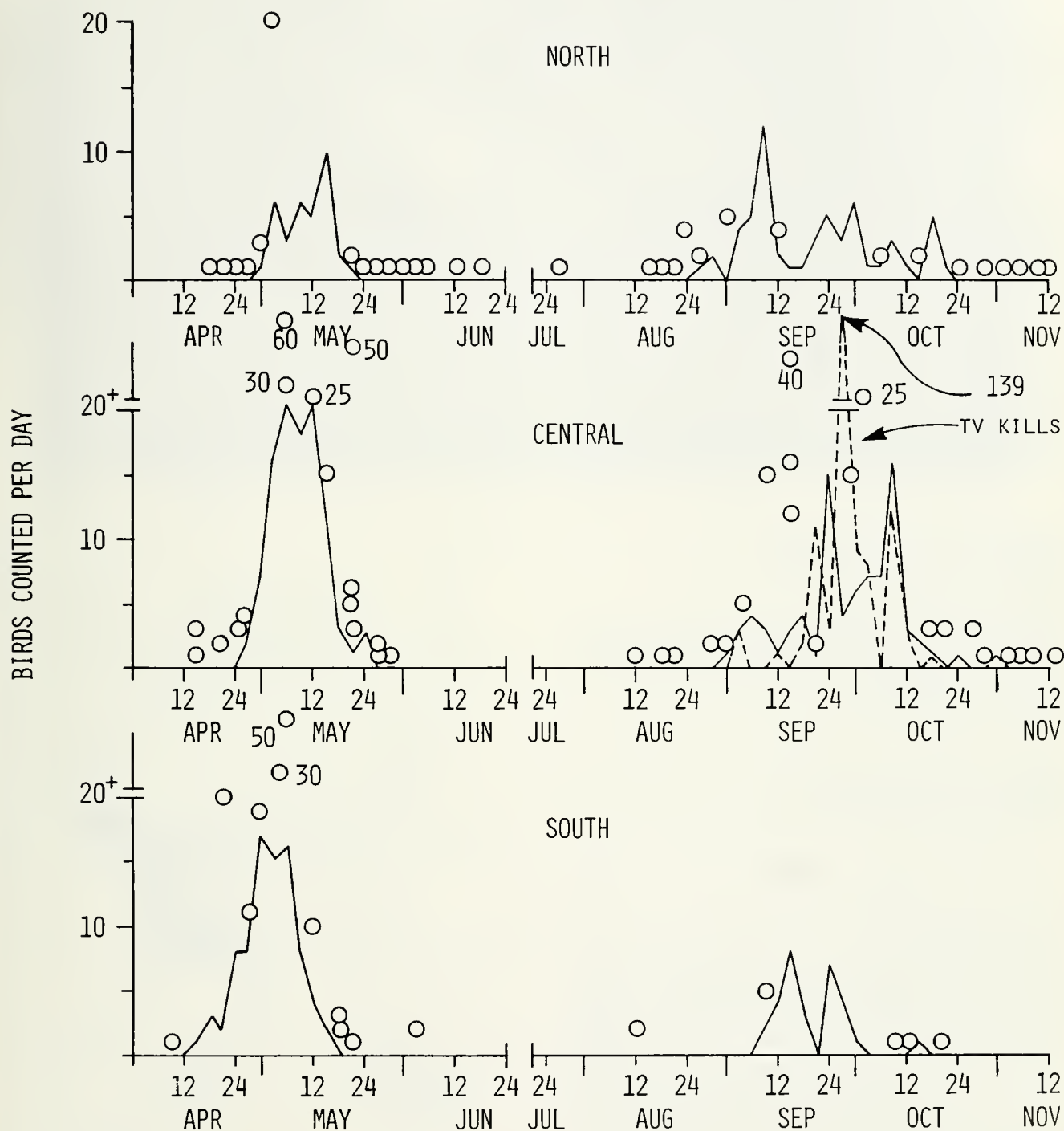


Fig. 30.—Migration seasons of the Nashville warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

TABLE 10. — Population densities of transient Nashville warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (18 April-22 May)						
Mature bottomland forest	Piatt (C)	1979-1980	7	123	12.9	2.6
Mature bottomland forest	Johnson (S)	1979-1981	14	290	14.9	2.4
Mature upland forest	Piatt (C)	1979-1981	8	169	11.8	4.5
Mature upland forest	Pope (S)	1979-1981	14	290	2.0	0.4
Forest edge	Piatt (C)	1979-1981	8	161	34.3	12.3
Forest edge	Pope (S)	1979-1981	14	277	18.2	5.4
Loblolly pine	Pope (S)	1979-1980	7	127	4.8	1.3
Fall (1 September-30 September)						
Residential	Winnebago (N)	1909		17		2.4
Forest (unspecified)	Central	1906-1909		19		2.1
Mature bottomland forest	Piatt (C)	1979-1980	10	204	14.0	2.4
Mature upland forest	Piatt (C)	1979-1981	13	252	12.4	0.9
Mature upland forest	Pope (S)	1979-1981	8	167	3.8	0.5
Forest edge	Piatt (C)	1979-1981	16	299	44.2	7.2
Orchard	South	1908		235	9.2	1.9
Small grain stubble	Central	1906-1909		233		0.2

32 immature females, 7.5-10.4 g (mean = 8.82, SE = 0.14). Specimens of average weight were moderately fat (2-3 on a scale of 0-5), few were very fat, and only one (11.8 g) was extremely fat.

spring populations was in bottomland forest, which is also the prime breeding habitat, but transients also occurred in upland forest and forest edge (Table 11).

The breeding distribution of the parula warbler is peculiar in that there are extensive populations of the species

## VIRGINIA'S WARBLER (*Vermivora virginiae*)

The chance of this southwestern species reaching Illinois seems very remote, but one was reported at Evanston on 6 May 1979 (Kleen 1979b).

## NORTHERN PARULA (*Parula americana*)

(Fig. 31 and 32)

### Spring Migration

The parula warbler has been recorded as early as 31 March in southern Illinois (George 1968), where the species regularly appears in the first week of April (Fig. 33). There are records for central Illinois as early as 3 and 9 April (Kleen 1978c, 1981b) and for the north, 11-12 April (Mumford 1959a, Clark & Nice 1950) (Fig. 33). Hanselmann (1963-1964) stated that the nesting population of parulas in the St. Louis area was present by late April and that the transient parulas passed through in May. Peak counts in the south were usually 20 or fewer per day and in the central and north, less than 5 per day. A sighting of 20 or more in Cook County on 31 May (Lewis 1924) is exceptional. Most of the

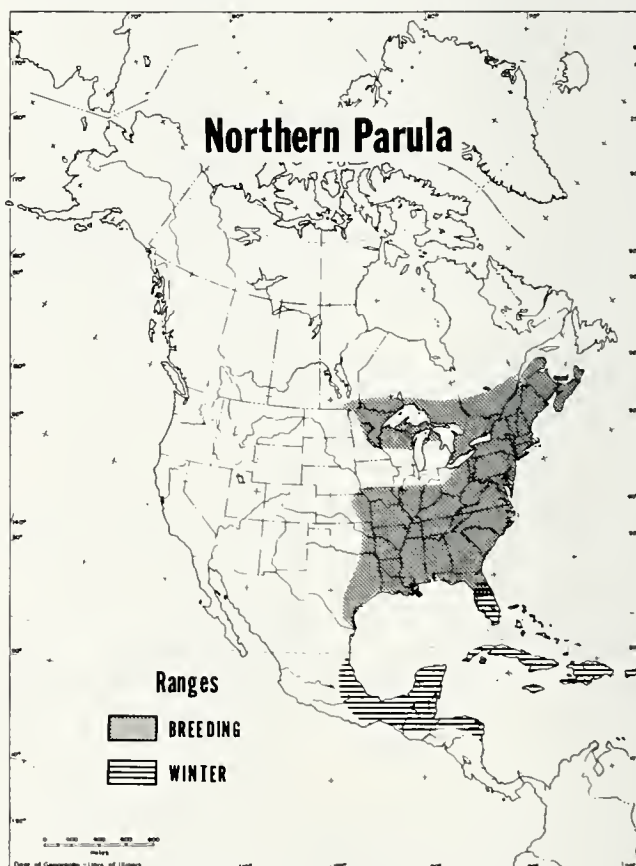


Fig. 31. — General distribution of the northern parula.



Fig. 32.—Northern parula female coming to its nest in *Usnea*-draped pines in northern Michigan.

north of Illinois (Fig. 31), yet apparently it is, and within historic times has been, rare as a breeding bird north of about 40 degrees latitude in Illinois (Fig. 34).

The single record (eggs at ISM) for Marshall County, where so much intensive zoological collecting occurred between 1880 and 1940, is indicative of the bird's rarity. The bottomland forest of the Mississippi and Illinois valleys would seem to be potential habitat for the parula, generally considered to be a riparian species. Nelson (1876–1877) considered the parula a rare breeder in northeastern Illinois, and Jones (1895) called it uncommon in summer in Winnebago County. R. Russell (unpublished 1962) found the species to be fairly common only one summer (1962) in northeastern Illinois. Gault (1901*b*) called the parula a summer resident at Glen Ellyn, but his notes contain no June or July records.

In southern Illinois the parula is one of the species that occur even along the higher streamlets miles from the large-river bottoms. Population densities were consistently higher in bottomland forest than upland (Table 11). Annual variation in the population was less in bottomland forest, where the range from 1973 to 1979 was 7–111 percent per year (average, 48.8), than it was in upland forest, with a range of 5–529 percent (average, 161.5). Parula populations in our southern Illinois study areas were positively correlated with the Importance (Y) of sycamore, *Platanus occidentalis*, ( $r = 0.545$ ,  $P = 0.05$ ). No other habitat characteristic that we measured correlated with parula populations. Ridgway's (1889) statement that parulas particularly favored forest with *Usnea* probably refers to areas other than Illinois, where

*Usnea* rarely if ever attains the heavy growth seen in the north (Fig. 32). Widmann (1907) was puzzled by this fact and wondered where parulas placed their nests in the absence of hanging lichens. Davie (1898) commented on the situation, stating that in regions lacking the "moss" parulas nest in dead leaves that have caught on branches during freshets. He mentioned such a nest near St. Louis. Few nests have been found in Illinois, none in upland forest. In adjacent Missouri, nests in sites like that described by Davie (1898) have been observed (Widmann 1907, Moore 1947). At least one of six Missouri nests was in a birch, another was high in a sycamore, another only 5 feet high, and another 15 feet—all on the tips of branches.

Two nests in Pope County were in river birches (*Betula nigra*) and *not* at the tips of branches. The nests, respectively, were about 6 and 12 m high, the higher nest hidden among grape foliage on the tree. The lower nest was attached to the loose bark of a main branch near the trunk of a large birch on a stream edge. The female was building on 8 May, and the largely completed structure was dislodged by 12 May. It was composed mainly of fine grass stems, leaf skeletons, and bits of birch bark lined with sycamore fluff or something very similar. The only three nests of which the fates are known all failed. At least one Missouri nest was parasitized by the cowbird (Moore 1947).

Parulas are persistent singers, and their singing perches are often in sycamores. Farwell (1919) compared the parula's song to that of the cerulean warbler and described it as a trill with an upward break at the end. We suspect that parulas and cerulean warblers learn each other's songs sometimes, as

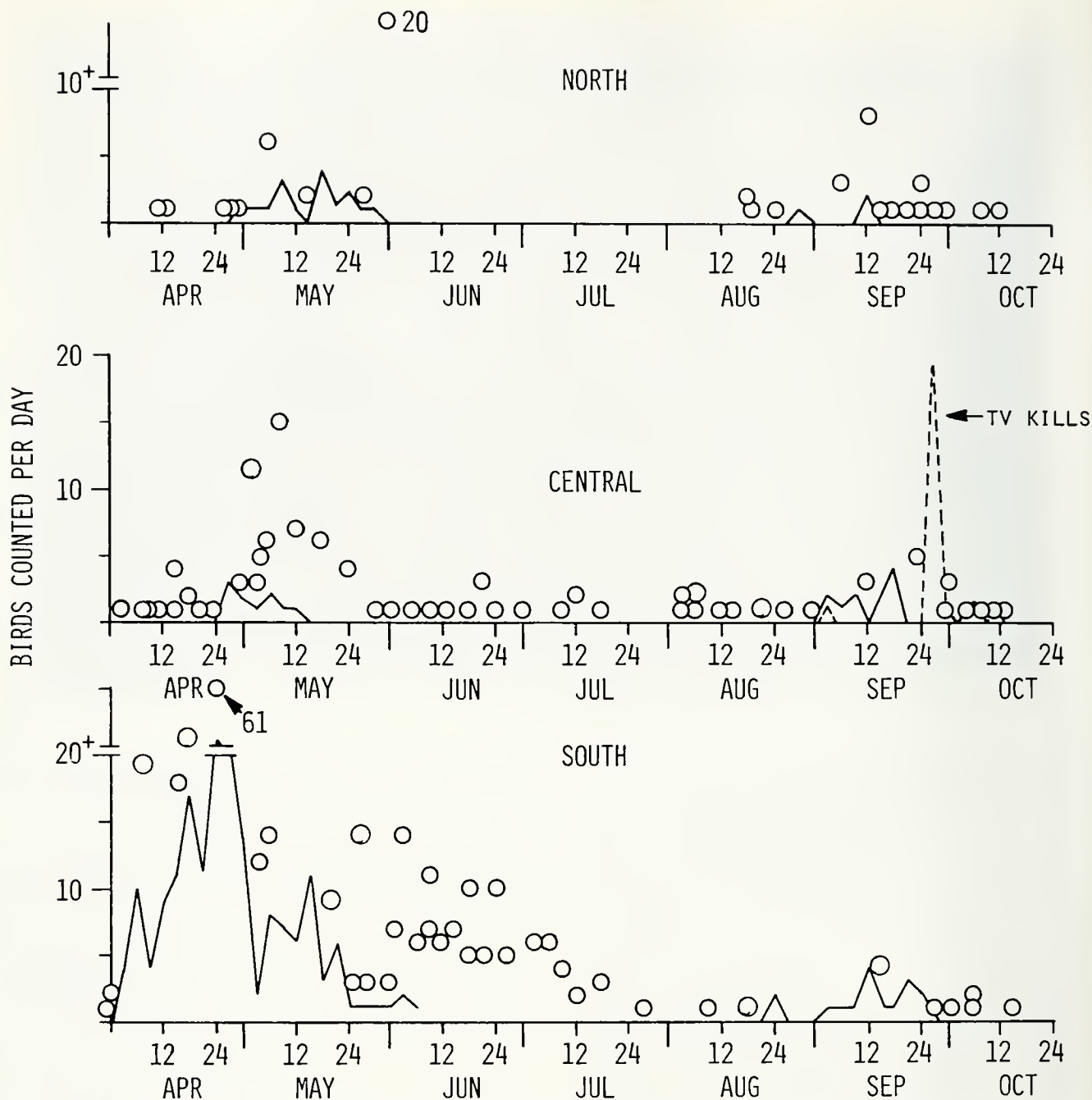


Fig. 33.—Migration seasons of the northern parula in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

we have watched as birds of both species uttered songs that sounded typical of the other species. Identification by song is thus not totally reliable though a high percentage deliver the appropriate song.

A singing male parula warbler in Pope County was already obviously in molt on 25 June, and well grown juveniles were in the early stages of the molt on 14 June. Brewster (1878a) reported juveniles in molt on 17 July in Wabash County.

TABLE 11.—Population densities of parula warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
					Maximum	Mean	
Spring (6 April-28 May)							
Mature bottomland forest	Piatt (C)	1979-1980	8	165	9.7	4.4	This paper
Mature bottomland forest	Johnson (S)	1979-1981	22	436	21.3	9.7	This paper
Mature upland forest	Piatt (C)	1979-1981	15	296	3.9	0.5	This paper
Mature upland forest	Pope (S)	1979-1981	20	433	5.8	0.5	This paper
Forest edge	Pope (S)	1979-1981	17	337	5.3	0.8	This paper
Breeding (June)							
Bottomland forest	Vermilion (C)	1966		6		26.0	Karr 1968
Mature bottomland forest	Central	1978-1980	7	154	3.7	0.5	This paper
Mature bottomland forest	South	1973-1980	62	1,108	9.6	1.7	This paper
Mature upland forest	South	1974-1980	30	602	7.1	0.9	This paper
Upland forest	Jackson (S)	1976-1977		6	33	23.0	Morrison & Peterjohn 1977, Morrison 1978
Fall (7 August-25 September)							
Mature bottomland forest	Piatt (C)	1979-1980	11	225	4.0	1.1	This paper
Mature bottomland forest	Johnson (S)	1979-1981	14	300	9.5	2.2	This paper
Mature upland forest	Piatt (C)	1979-1981	14	276	12.0	1.2	This paper
Forest edge	Piatt (C)	1979-1981	16	298	11.2	1.1	This paper

## Fall Migration

We have seen parula warblers out of their nesting habitat as early as 7 July in southern Illinois and 17 July in central Illinois, but it is uncertain when the actual migration begins. In northern Illinois parulas have been seen as early as 18 August and with increasing frequency in September (Fig. 33, F.C. Gates unpublished 1906, Gault 1901*d*, Blake & Smith 1941). In southern Illinois two parulas seen with a flock of birds on 23 August were possibly transients. A parula was killed on a central Illinois tower on the night of 1–2 September. The latest kill date involving the parula was 13 October, about coincidental with late field observations—11–12 October in the north (Ford et al. 1934, Ford 1956), 13 October in central Illinois (Bohlen 1978), and 15 October in the south (USNM 82878). The latest record is that of a bird banded at Springfield on 4 November (Kleen 1981*a*). Few parulas have been killed at television towers—a total of 27 have been picked up.

The ratios of our counts of parula warblers in spring and fall were: 6.3 (spring) to 1.0 in the north, 1.0 to 1.0 in the

central region, and 15.3 to 1.0 in the south. At Glen Ellyn (north) Gault (unpublished 1883–1923) recorded about three in spring to one in fall. As in spring and summer, in fall parulas were detected mainly in bottomland forest habitat at densities much below those found in spring (Table 11). The spring-to-fall ratio shown in the census data was 1.0 to 1.0 for central Illinois and 7.2 to 1.0 for the south.

## Specimen Data

Illinois specimens of parula warblers have been ascribed to the races *Parula americana usnea* (= *pusilla*), *P. a. americana* (Brewster 1896) and *P. a. ramalinae* (Ferry 1907*b*, Brodtkorb 1929), but Parkes (1954) found no consistent significant morphological differences between northern, southern, and western populations on which to warrant the recognition of subspecies.

In our small series of fall specimens from the towers weights were: one adult male, 8.6 g (little fat); one adult female, 7.9 g (very fat); two immature males, 8.5 and 8.7 g (some fat); and one immature female, 7.0 g (some fat).

# Northern Parula

## BREEDING RECORDS

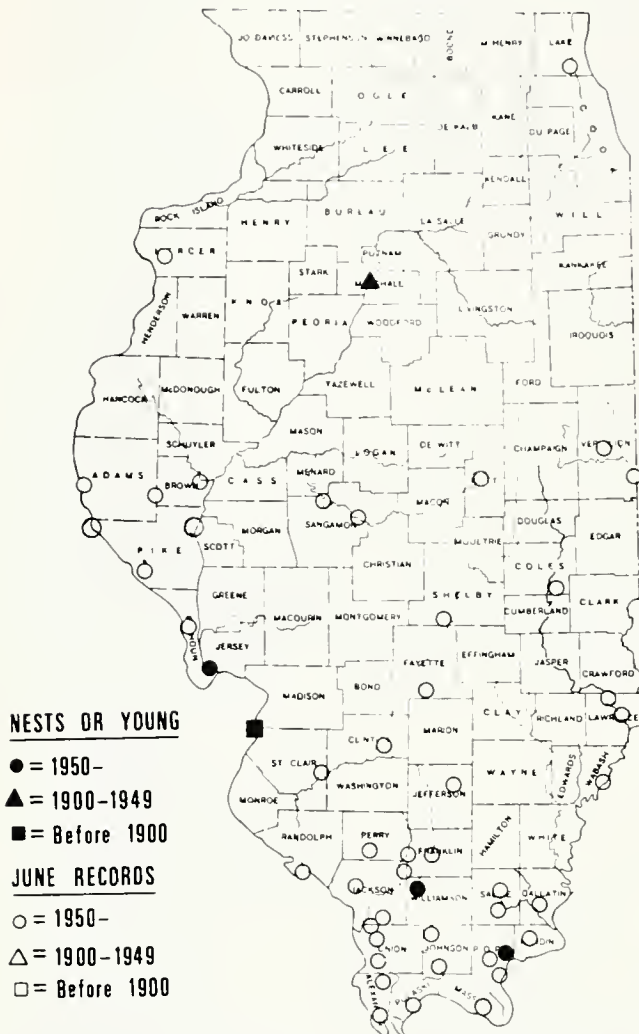


Fig. 34.—Breeding records of the northern parula warbler in Illinois.

## YELLOW WARBLER (*Dendroica petechia*)

(Fig. 35)

### Spring Migration

Records for the yellow warbler in northern Illinois as early as 1-2 April (Bartel 1935, Bartel & Reuss 1932) must be exceptional. More representative as first spring records for the species are 14 April in southern Illinois (Ridgway 1874a), 19-20 April in east-central Illinois (G. Wilford and M. Campbell unpublished 1976-1978), and 24 April in northern Illinois (Bartel 1935, Smith 1942a). Usually not more

than a week passes between the arrival of the first yellow warblers and their appearance in numbers (Fig. 36). High counts are usually less than 20 per day, and in very recent years, less than 5 per day.

In central and southern Illinois, where we made counts on both the western and eastern sides of the state, numbers of yellow warblers were consistently higher on the west (Fig. 36). This distribution is puzzling, as the species has an enormous breeding range, including much of Illinois (Fig. 35).

The most frequented habitat in spring was forest edge and shrub (Table 12), which is also the primary breeding habitat. Population densities were consistently low both in the central and southern regions (Table 12).

### Distribution

We would expect the yellow warbler to nest in every township in the state, but as yet the available records do not show that (Fig. 37). In addition to the records plotted, there are nest records for unspecified localities in these counties: Cook, Lake, Champaign, Piatt (Goelitz 1915, 1917, Sanborn & Goelitz 1915), Logan (DuBois 1918), Peoria (Loucks unpublished 1891), and Lee (Thompson & Robinson 1963).

### Nesting Habitats and Populations

Widmann (1907) and Ridgway (1915b) in the south and Hess (1910) in east-central Illinois noted that, although

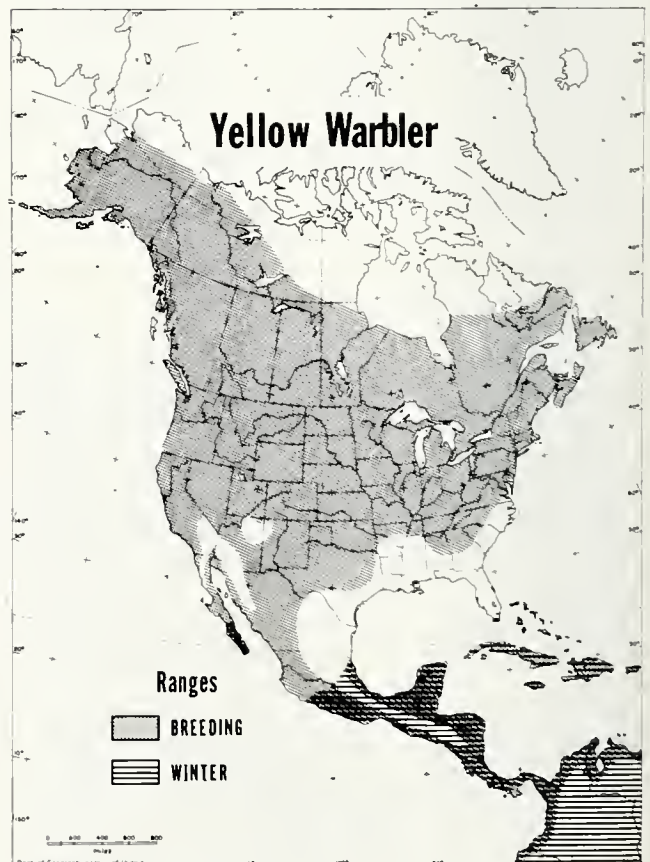


Fig. 35.—General distribution of the yellow warbler.

yellow warblers do not generally inhabit natural old-growth forest during the breeding season, they sometimes nest in shade trees in towns (see also Schantz 1927). Hess (1910) also stated that woods along the Illinois River *did* have yellow warblers (see also Holland 1930). In northern Illinois, Beecher (1942) found a good population of yellow warblers in woodland modified by the presence of human housing (Table 12, Ford 1931), and residential habitat in rural areas

may still support some yellow warblers, but few, if any, can survive in modern urban habitat. The possible exception is *new* (young) urban residential habitat, where a small number of yellow warblers may abide. Anderson (1964*b*) found a pair of yellow warblers nesting in a new urban development 5-9 years after development. In strip-mined land, Brewer (1958*b*) found yellow warblers mainly in the 10-to-13-year-old growth after stripping, with fewer in the

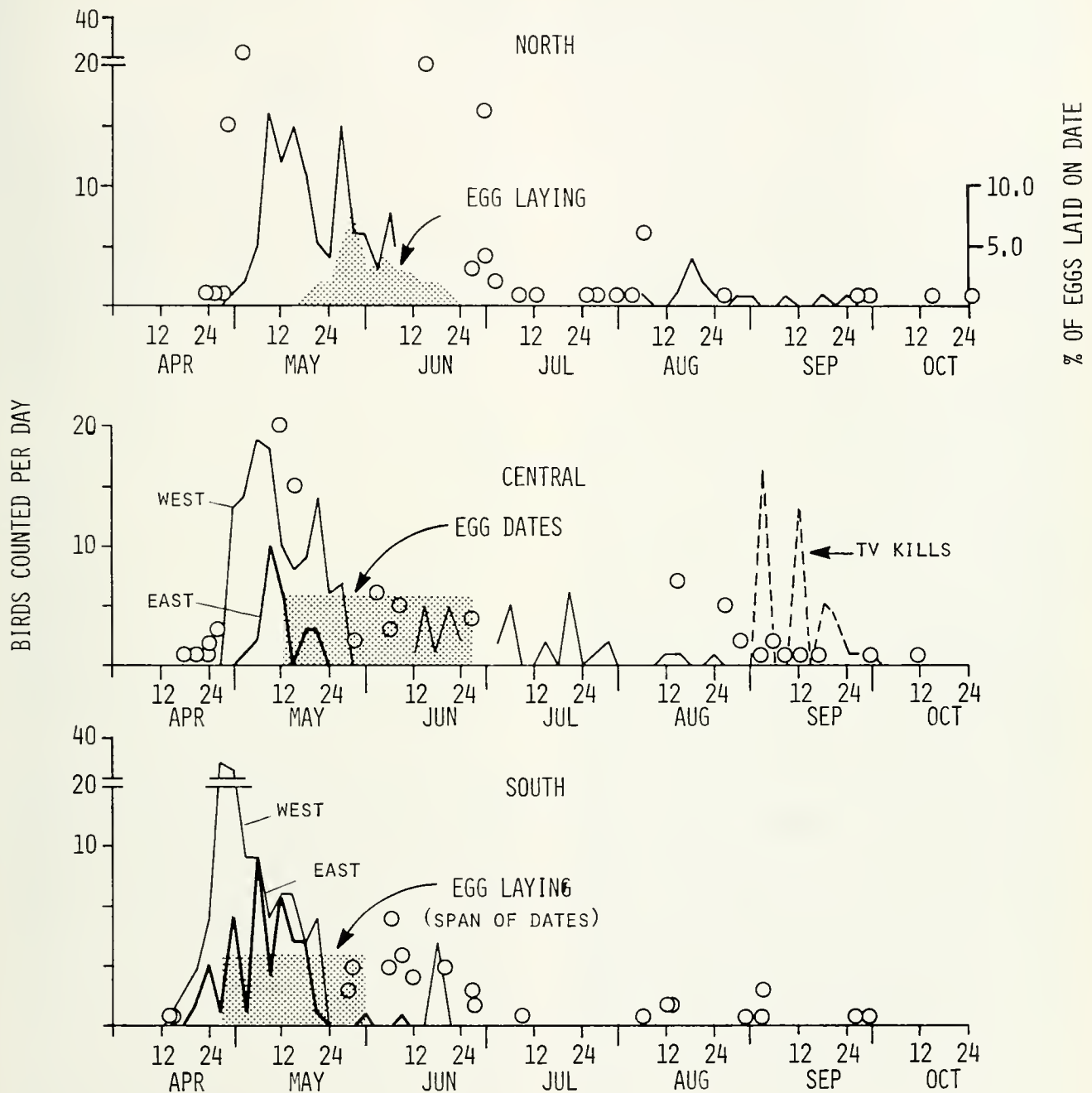


Fig. 36. Egg-laying and migration seasons of the yellow warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Shaded areas show the span of dates during which egg laying has been recorded and the percentage of eggs laid on each date in the northern region. The dash line shows numbers killed at television towers during fall migration in central Illinois.

TABLE 12. — Population densities of yellow warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
					Maximum	Mean	
Spring (19 April-15 May)							
Forest edge and shrub	Piatt (C)	1979-1981	7	145	2.1	0.6	This paper
Forest edge and shrub	Pope (S)	1979-1981	10	200	2.0	0.2	This paper
Mature bottomland forest	Johnson (S)	1979-1981	10	226	1.9	0.2	This paper
Breeding (June)							
Thicket	Lake (N)	1937		3		339.0	Beecher 1942
Modified woodland	Lake (N)	1937		11		79.5	Beecher 1942
Cut-over woods	Rock Island (N)	1937-1938		6	93.3	80.0	Fawks 1937, 1938
Disturbed prairie with shrubs	Grundy (N)	1975-1976		16	20.2	15.2	Linkletter 1975, 1977
Disturbed prairie	Grundy (N)	1978-1979	2	57	1.4	1.4	This paper
Early shrub	Vermilion (C)	1966		9		72.0	Karr 1968
Late shrub	Vermilion (C)	1966		9		18.0	Karr 1968
Forest (unspecified)	Central	1957-1958		87	2.1	0.9	Graber & Graber 1963
Shrub area	Central	1957-1958		20	2.9	2.0	Graber & Graber 1963
Orchard	South	1907-1909		18	15.8	6.7	Graber & Graber 1963
Orchard	South	1957-1958		32		0	Graber & Graber 1963
Swamp thicket	Jackson (S)	1950		5		46.0	Brewer & Hardy 1950
Shrub area	South	1957-1958		52	4.5	2.3	Graber & Graber 1963
Edge shrub	South	1957-1958		7	12.1	5.4	This paper
Mature bottomland forest	South	1973-1979	29	1,056	0.4	0.1	This paper
Fall (15 August-5 September)							
Forest edge and shrub	Piatt (C)	1979-1981	6	177	7.1	0.7	This paper
Orchard	South	1908		235	5.1	0.5	This paper

18-to-22-year-old growth. In past times, orchards provided some yellow warbler habitat (Ridgeway 1887, Barnes 1890, Hess 1910), but the more intensively managed modern orchards apparently do not (Table 12). The upland shrub areas in southern Illinois, where prairie warblers nest, apparently support few, if any, yellow warblers.

Widmann (1907) noted the importance of wet areas to the yellow warbler, and prime habitat for the species is probably riparian or other lowland with relatively young woody growth (Johnson 1950). The woods on the Illinois River referred to by Hess (1910) and Holland (1930) were probably very open in places with heavy shrubby growth, as they are still. High populations of yellow warblers have been reported from such wet shrub areas (Holland 1930, Beecher 1942, Brewer & Hardy 1950). Holland, a very competent observer, found 23 active (contemporaneous) nests on an island of about 5 acres in the Illinois River. Other high densities have been reported on small areas (Table 12). Johnson (1950) estimated a density of 12.5 yellow warblers per 40.5 ha on a square mile in northern Illinois that included areas of good habitat. The high densities recorded for small areas suggest an ability by the yellow warbler to pack into small areas of good habitat. Johnson (1950) found nests (contem-

poraneous?) as close to one another as 21 feet in nest trees as close as about 15 feet. Brewer (1955) in southern Illinois found "home ranges" for four pairs of yellow warblers to range from 0.15 to 0.94 acre (mean, 0.42 acre).

References to a decline in Illinois populations of the yellow warbler date back to at least the turn of the century (Craigmile 1904, Sanborn 1921c, Brodtkorb 1928b). Ridgway (1887) considered the yellow warbler one of the most abundant breeding species in the Mt. Carmel area but noted that by 1915 virtually all of the population was gone (Ridgway 1915b). In nearby Richland County at Bird Haven Sanctuary, Stine (1959) reported only one nesting in 45 years. Other evidence of real population decline is (1) the lack of high densities of yellow warblers in any habitat in the most recent years, (2) the fact that the highest "single-observer" counts of yellow warblers by Frank Smith and his students in spring between 1904 and 1910 in east-central Illinois were 50-100 percent higher than our highest counts in the same area between 1957 and 1969, and (3) that our most recent counts (1979-1980) are by far the lowest counts of all — only about 6 percent of the 1904-1910 counts and 10 percent of the 1957-1969 counts.

Eifrig (1937) blamed the decline of the yellow warbler

# Yellow Warbler

## BREEDING RECORDS

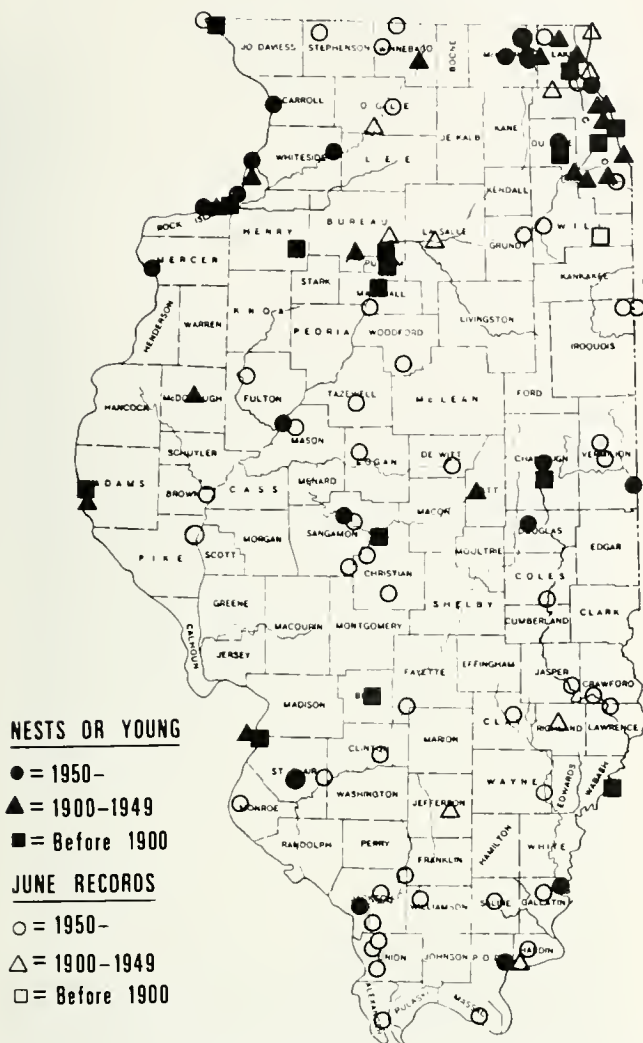


Fig. 37. — Breeding records of the yellow warbler in Illinois.

population on cowbird parasitism, and the available data suggest that the incidence of parasitism has increased since 1900 from about 6 percent before 1900 to 40.5 percent after 1900 (Table 13). Possible sources of error include the possibility of geographic or habitat differences in rates of parasitism and any tendency by oologists to avoid (or not) the collecting of parasitized sets. Most of the observations were one-time observations and thus were not totally reliable on either clutch size or parasitism rates. Table 13 includes only nests with eggs. A number of records of yellow warblers feeding cowbirds and/or nestling warblers were excluded. Johnson's (1950) study of yellow warbler nests in the Rockford area revealed a parasitism rate of 87 percent, which is extremely high even for the yellow warbler (Friedmann 1963). The yellow warbler always may have been fairly heavily parasitized by the cowbird. Nehrling (1880) observed that many yellow warbler nests in northeastern Illinois had cowbird eggs, sometimes two or three, but he gave no actual

figures on nests examined or rates of parasitism. Sanborn & Goeltz (1915) stated that the species most imposed upon by the cowbird in Lake County were the yellow warbler, redstart, and vireos. The alterations of bottomland habitats may have been important in the decline of yellow warblers (Grabert & Graber 1976).

Several authors have noted the association of yellow warblers with willows (Loucks 1891, Musselman 1937), Johnson 1950, Swink 1976, and others). Plant species recorded as nest sites in Illinois are listed in Table 14. There are no studies on plant use in relation to plant availability or of nesting success in relation to nest location. The average height for 56 nests mainly in northern Illinois was 2.5 m, with a range from 0.3 to 10.7 m and with modes at 1.2 and 3.0-4.6 m. These data do not include average figures from the literature.

## Nesting Cycle

Johnson (1950) observed that male yellow warblers select the taller trees in the habitat for singing perches. They sing strongly until the eggs hatch, when song is largely curtailed as they feed the young. There is a short period of song again after the young fledge. The phonetics which to our ears best represent the song is "Sweet-sweet-sweet-summer sweet" high-pitched and rapidly delivered.

Nest sites are selected after the females arrive—a few days later than the males (Johnson 1950). In northeastern Illinois Gault (unpublished 1885) found most nests completed by 24 May. Most of the nest construction was by the female, using as material fine plant fibers, grasses and the inner bark of weeds, with a lining very often of material like cotton. They also used fur, feathers, and in the past, horse hair (Goeltz 1915, Finley 1917, Johnson 1950). The structure resembles the nest of the willow flycatcher, a species that nests in similar habitat (Grabert et al. 1974). Construction of a June nest in Iowa, possibly a second nesting, required at least 3 days (Schrantz 1943), and an early May nest (definitely a first nesting), which we observed in southern Illinois, was under construction at least 6 days. The yellow warbler is renowned for building multistoried nests in its efforts to bury cowbird eggs. Johnson (1950) studied a five-layered nest, and Rudolph (1916-1917) found a nest at Evanston on 14 June which contained four layers, each of which held both cowbird eggs and host eggs. The speed with which yellow warblers add layers to their nests is shown by the observations of Brooks (1928) in central Indiana. The nest was completed on 11 May, and a cowbird laid in it at 0700 on 13 May. In less than an hour the warblers were covering the cowbird egg with a new floor, and by night the new floor was installed.

The eggs of the yellow warbler are often greenish tinted and heavily marked with shades of brown, especially at the larger end. Egg laying lasts from about 28 April in the south and 18 May in the north to 21 June in the north, with peak egg production from 27 May to 6 June in northern Illinois (Fig. 36). Mainly using old oological records, we conclude that 4 eggs is the most common clutch size (Table 13). Johnson (1950) found clutches of no more than 4 eggs, but about 30 percent of pre-1900 nests had 5 eggs. The number of host eggs observed declines in parasitized nests, because the cowbird removes host eggs.

TABLE 13.—Clutch size and incidence of cowbird parasitism in yellow warbler nests in northern and central Illinois.

Period	5 Eggs		4 Eggs		3 Eggs		2 Eggs		1 or 0 Eggs <sup>a</sup>		Clutches With 2 or More Eggs	Average Clutch	Nests Parasitized	
	N	%	N	%	N	%	N	%	N	%			N	%
Before 1900	10	30.3	14	42.4	9	27.3			1		33	4.0		
Nests with cowbird eggs	1		0		0		0		1				2	5.9
Avg no. of cowbird eggs	1.0								1.0					
After 1900	8	23.5	14	41.2	6	17.6	6	17.6	4		34	3.7		
Nests with cowbird eggs	0		3		5		3		4				15	40.5
Avg no. of cowbird eggs			1.0		1.0		2.0		2.2					

<sup>a</sup>Excluded from average clutch calculation.

The incubation period at a nest we observed in northwestern Illinois was 12 days from the end of laying to the hatching of the last (fourth) egg. Gault (unpublished 1885) observed that the majority of nests in Lake County contained young by 7 June. A nest at Macomb contained nestlings for 11 days, and the nest already had young when discovered on 13 June (Finley 1917). Finley recorded feeding rates at the nest for 1 full day (22 June). The nest contained three young ready to fledge, one of which did fledge after the first hour. In the first hour (0500-0600) both adults fed and made 61 trips. After that the female did all of the feeding at the nest,

TABLE 14.—Plant species recorded as nest sites of yellow warblers in Illinois.

Species	Number	
	North & Central	South
Gooseberry	20	
Willow	10	1
Elm	8	
Raspberry	6	
Dogwood	5	
Apple	4	2
Hawthorn ( <i>Crataegus</i> )	3	1
Rose	5	
Locust	3	
Mulberry	3	
Grape	3	
Sumac	2	
Maple	3	1
Peach	2	
Cherry	2	
Pear	1	
Autumn Olive	1	
Osage Orange	1	
Box Elder	1	
Hackberry	1	
Hazel	1	1
Bull Thistle ( <i>Cirsium lanceolatum</i> )	1	
Elderberry		1
Black Oak		1
	86	8

the male presumably taking charge of the fledgling. Altogether, 579 feeding trips were made in 14-15 hours between 0500 and 1943 hours, when the last food was delivered. The female delivered food 30-48 times (mean, 37) each full hour of the day to the two nestlings. She also cleaned the nest 13 times during the day. The nature of the food was not stated and is apparently unknown. Wheelock (1905) referred to yellow warblers feeding young by regurgitation.

Excluding courtship, pairing, and postfledging care of the young, one nest cycle would take at least 30 days for a nest with four eggs, using only 3 days for nest-building (Schrantz 1943) and no days between nest completion and the onset of laying. Given the span of egg dates for the yellow warbler (Fig. 36), single broods would appear to be the rule for the species in Illinois. Late June and early July nests with eggs (Ford 1956) probably represent renestings after nest failure.

Data on nesting success for the yellow warbler in Illinois are meagre. In a small sample (9) of nests near the Mississippi shore in northwestern Illinois that we observed in 1968, only two fledged yellow warblers despite a relatively low incidence (about 20 percent) of cowbird parasitism. Nearly all of the nest failures appeared to represent mammalian predation, and we suspected raccoons. Johnson (1950) in the Rockford area recorded that 10 of 15 nests were successful despite heavy cowbird parasitism. He noted causes of failure to be human disturbance or vandalism and weather. The relatively high success rate in a population so heavily parasitized by cowbirds is surprising. Data on longevity and survival, as well as significant mortality factors, are lacking for all age groups and populations. Coale (1912) recorded the bizarre capture of a yellow warbler in the snare of a spider.

### Fall Migration

Because the yellow warbler's vast breeding range extends far north of Illinois (Fig. 35), we would expect to see numbers of yellow warblers in fall, but the numbers seen in fall are consistently small. Bennett's (1952) fall counts for the Lake Michigan shore showed great variation — from a total of 20 in

1946 to 160 in 1948 (5-year average, 59). He attributed the high count in 1948 to an exceptionally strong northwest cold front's coinciding with the migration. Yellow warblers appear to depart early (Wilson 1906), and our highest counts, as well as Bennett's, came in August (Fig. 36). "Last-seen" dates for the species in Illinois are often in August or early September (J.J. Schafer unpublished notes, B. T. Gault unpublished 1883-1917, Cooke 1888, 1904). Kills of yellow warblers at central Illinois television towers (a total of 44 picked up) have been detected mainly on 9-10 September (prevalent dates for yellow warbler migration, Raveling & Warner 1978). Two were found as late as 25 September and 1 October. Kills of this species appear not to be as large as for most common northern-ranging species (Fig. 36), possibly because of clear August weather or poor coverage of the towers by observers in that month. A "wave" of yellow warblers at Waukegan on 27 September was late for the species to appear in numbers (Balch 1970), but single birds have been seen occasionally in late September (Gault 1901a, Brown 1961, 1966, Kleen 1975a). Exceptionally late occurrences were 16 and 25 October in northern Illinois (Blake & Smith 1942), 12 October and 7 November in central Illinois (Kleen 1980a, 1980c), and 30 October in the St. Louis area (Wilhelm 1957).

The ratio of our spring to fall counts for the yellow warbler strongly favored spring by about 13 to 1 in the north (Dreuth's counts were about 1 to 1), 65 to 1 in central Illinois, and more than 350 to 1 in the south! The age ratio (6.5 immatures to 1.0 adults) in our small series (13) of fall specimens is nearly the reverse of that in a sample of 74 specimens (4.3 adults to 1.0 immature) killed in western Wisconsin (Raveling & Warner 1978).

## Food

The only data on the food of the yellow warbler in Illinois are those of Forbes (1878, 1881, 1883) on the stomach contents of (apparently) nine specimens. Five of these were collected in July at an orchard infested with cankerworms (Lepidoptera) in Tazewell County, where the birds had eaten cankerworms primarily (two-thirds of the food) but also species of beetles (23 percent, including *Aphodius*, *Psenocerus*, *Telephorus*), spiders (6 percent), Hymenoptera (2 percent), and Hemiptera (1 percent). Four specimens of yellow warblers (location and date?) referred to in Forbes (1878) also contained primarily Lepidoptera (two adults plus one caterpillar).

## Specimen Data

Our 13 fall specimens of yellow warblers from central Illinois television tower kills, though mainly immature females, showed the same sort of color variation outlined for adult specimens by Raveling & Warner (1978). Five had bright yellow-green backs and bright yellow underparts, four had duller greenish or grayish-green backs and pale drab underparts, and four were intermediate in color. All of the bright and intermediate birds (presumably *D. p. aestiva*) had relatively long bills (7.21 mm, average for females) and long

wings (61.4 mm for females), whereas the drab birds (presumably *D. p. amnicola*) had short bills (6.9 mm for females) and wings (57.9 mm for females). The latest specimens (25 September, 1 October) were also the shortest-billed birds of the series, probably representing far northern populations, i.e., *amnicola*. As in the Wisconsin sample, weights tended to be higher in the *aestiva* group. The percentage of *amnicola* types was about half as high in the Illinois sample as it was in the Wisconsin sample. Weights for fall specimens were: two adult males, 9.5 and 12.5 g, both with some fat; one immature male, 10.9 g, very fat; nine fat to very fat immature females, 8.6-11.9 g (mean, 9.77 g). Hancock (1888a) gave gross weights and brain weights for two male and five female yellow warblers killed in May. Gross weights for the males (plus a May specimen from our collection) ranged from 8.4 to 9.8 g (mean, 9.1 g). Gross weights for the May females ranged from 8.2 to 10.8 g (mean, 9.1g).

## MAGNOLIA WARBLER (*Dendroica magnolia*)

(Fig. 38 and 39)



Fig. 38.—Male magnolia warbler about life size in spring plumage. Photo taken in Champaign, Illinois, by Allen Smith.

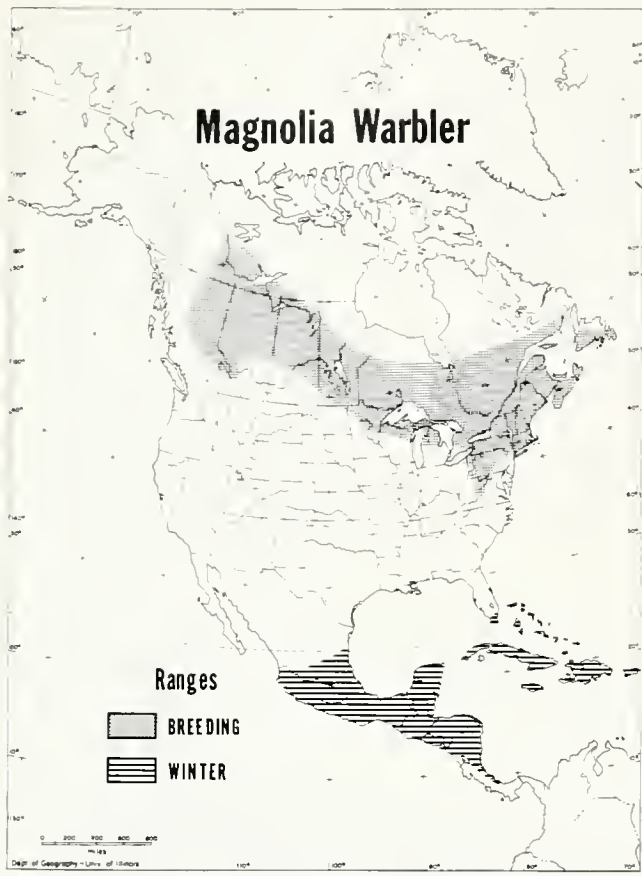


Fig. 39. — General distribution of the magnolia warbler.

### Spring Migration

The earliest records of magnolia warblers in Illinois are 10 April in the north (Fawks 1966b), 13 April in the central region (Bursewicz 1961), and 14 April in the south (George 1968). The average of "first-seen" records in 18 years at Urbana was 1 May (Smith 1921), and our high counts in the same area occurred 6–24 May (Fig. 40). During their many years of observation in northwestern and northeastern Illinois, respectively, J.J. Schafer and B.T. Gault most often found magnolia warblers between 10 and 25 May. At St. Louis, Widmann (1907) regularly found magnolias 3–5 May, with peak numbers in the second week of May. He noted that they tended to linger if May was cool. There are spring records as late as 10 and 16 June in the St. Louis area (Comfort 1942, Wilhelm 1957), 9 and 23 June for central Illinois (Smith 1930, Silloway unpublished 1922), and 30 June in the north (Mumford 1959b). The magnolia nests as close to Illinois as northern Wisconsin (Fig. 39).

At Peoria, Silloway (unpublished 1922) generally noted magnolia warblers foraging low in the canopy of bushes and small trees, especially oaks and elms. Our censuses showed highest densities in forest edge and shrub habitat, with some birds also in upland and bottomland forest (Table 15).

Silloway gave phonetics for the magnolia's song as: "Quick-to-see, we-see-'em" delivered in a hurried, nervous manner with emphasis on the last "see," somewhat suggestive of the chestnut-sided warbler's song. Farwell (1919) stated that the magnolia's song was quite sweet and musical—warbled something like the first "Whee-chee-tee" of the yellowthroat, but broken off, sounding unfinished.

TABLE 15. — Population densities of magnolia warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (26 April–1 June)						
Forest edge and shrub	Piatt (C)	1979–1981	7	164	30.9	12.1
Forest edge and shrub	Pope (S)	1979–1981	11	214	9.8	3.2
Mature upland forest	Piatt (C)	1979–1981	11	239	24.5	6.4
Mature upland forest	Pope (S)	1979–1981	11	221	1.9	0.5
Mature bottomland forest	Piatt (C)	1979–1980	7	144	9.2	2.8
Mature bottomland forest	Johnson (S)	1979–1981	11	231	9.5	1.6
Orchard	Central	1907		4		9.0
Fall (22 August–24 October)						
Forest edge and shrub	Piatt (C)	1979–1981	24	455	28.5	13.4
Forest edge and shrub	Pope (S)	1979–1981	13	242	11.3	2.8
Mature upland forest	Piatt (C)	1979–1981	23	446	10.2	2.8
Mature upland forest	Pope (S)	1979–1981	10	218	7.4	0.7
Mature bottomland forest	Piatt (C)	1979–1980	18	364	49.1	15.2
Mature bottomland forest	Johnson (S)	1979–1981	13	269	33.0	8.9
Pines	Pope (S)	1979–1980	6	106	4.8	0.8
Woods (unspecified)	Central	1906		24		1.7
Marsh	North	1909		7		5.5
Pasture	North	1909		193		0.2
Orchard	Central	1906		17		4.8
Orchard	South	1908		392	9.0	0.5

## Fall Migration

Magnolia warblers have been seen as early as 12 August in northern and central Illinois (Gault 1901*b*, Bohlen un-

published 1977) and 16 August in the south (George 1968). The species was common from about 28 August through September in northern Illinois and from 6 September to 6 October in central and southern Illinois. Magnolias were less

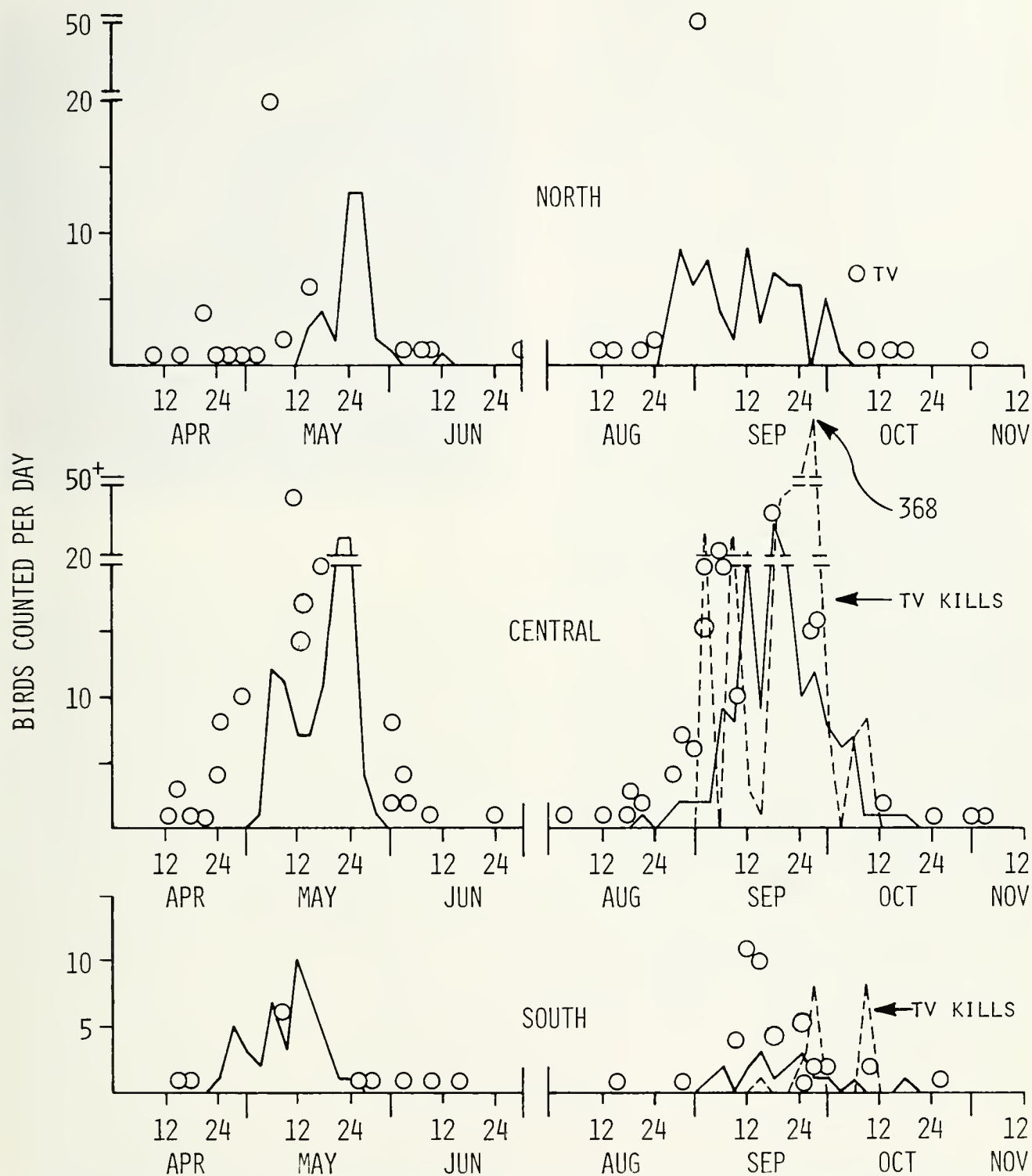


Fig. 40. — Migration seasons of the magnolia warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Dash lines show numbers killed at television towers during fall migration in Illinois.

numerous in the south, where daily counts were usually less than 5 per day versus more than 5 and up to 20 per day in the central and north (Fig. 40). There are a number of late October records for the magnolia in all regions of Illinois (Fig. 40), but records for 1-3 November (Brown 1974, C.T. Nearing unpublished 1960, F. Smith unpublished 1907) are unusual, as was (assuming it was fresh) a specimen found dead on 24 December (Sanders 1968).

Magnolia warblers were common victims at the central Illinois television towers (792 picked up), and the kills, except for the large kill of 27 September, coincide fairly well with the counts of live magnolias. In the south the tower kills were inexplicably late compared with the field counts (Fig. 40).

As in spring, fall densities of magnolia warblers were high in forest edge and shrub habitat, but even higher in bottomland forest (Table 15). Censuses for earlier times (1906-1909) produced densities not greatly different than ours (Table 15).

The ratios of our spring-to-fall counts were 1.0 to 1.5 in northern Illinois (the ratio for frequency of sightings at Chicago by William Dreuth was 1.0 to 1.7). The transects showed a ratio of 1.0 in spring to 3.5 in fall (central) and 1.0 to 2.8 (south), while in the random counts, ratios were 1.0 to 1.3 (central) and 2.7 to 1.0 in the south. Thirty specimens picked up at central Illinois television towers 9-10 September had 4 adults and 26 immatures (equivalent to 1.0 in spring to 7.5 in fall), whereas in late samples—297 specimens picked up 25 September-14 October—the ratio was nearly reversed: 202 adults and 95 immatures (equivalent to 1.0 to 1.5). Bennett's (1952) fall counts for the Chicago area were, on average, about three times higher than ours for northwestern Illinois.

## Specimen Data

Gross weights of magnolia warblers collected in May by Hancock (1888a) were, for two males, 6.9 and 8.8 g, and for one female, 7.9 g. Hancock also gave brain weights for the specimens. Our study (Graber & Graber 1965) of avian brain weights in fall specimens showed magnolias to have relatively heavy brains compared with those of other species, but whether the observation represents the youthfulness of the population, as hypothesized, has not been determined. The ranges of gross weights (with means and standard errors) of fall (mainly September) magnolias were, for 61 adult males, 7.8-10.3 g (mean = 8.83, SE = 0.08); for 31 immature males, 7.3-9.5 g (mean = 8.38, SE = 0.10); for 54 adult females, 7.2-10.8 g (mean = 8.45, SE = 0.10); and for 42 immature females, 7.2-9.8 g (mean = 8.37, SE = 0.08).

## CAPE MAY WARBLER (*Denroica tigrina*)

(Fig. 41 and 42)

### Spring Migration

Cape May warblers have been seen as early as 19 April in northern and central Illinois (Smith 1941a, Kleen 1977c).



Fig. 41.—Cape May warbler about two-thirds life size. Photo taken in Champaign, Illinois, by Allen Smith.

There are numerous records for the last week in April, but more are seen in May (Fig. 43). Most of the Cape May population is north of Illinois by the end of May, but there are a few records for June, as late as the 12th in the St. Louis area (Comfort 1942) and the 19th in central Illinois (B. Chato and H. Parker unpublished 1977). In most years even the high counts of Cape Mays are less than five per day (Fig. 43), but the species shows great variability from year to year (Farwell 1919, Ries & Werner 1946, Coursen 1947, Anderson & Bauer 1968). Cook (1884) referred to hundreds of Cape Mays per day having been seen in central Wisconsin, and Nelson (1876-1877) called the species a very common migrant in northeastern Illinois. These early observations suggest the possibility of a decline of the species, for we know of no recent count of more than 20 per day (Fig. 43). Fawks (1970b) referred to "many" being seen at Rock Island on 17 May, but that statement cannot be interpreted numerically. The early counts may merely represent the extreme in a highly variable population. In 21 years (1904-1925) Frank Smith and his students saw, on average, about 30 percent more Cape Mays per day than we did in east-central Illinois between 1957 and 1980. In most years they saw about the same number as we, but in 2 banner years (1909 and 1916) they counted two to three times as many, and most of the higher counts shown in Fig. 43 (central) represent their field work. Now the Cape May must be considered a relatively uncommon transient (Bohlen 1978).

Most warblers forage to some extent among tree blossoms

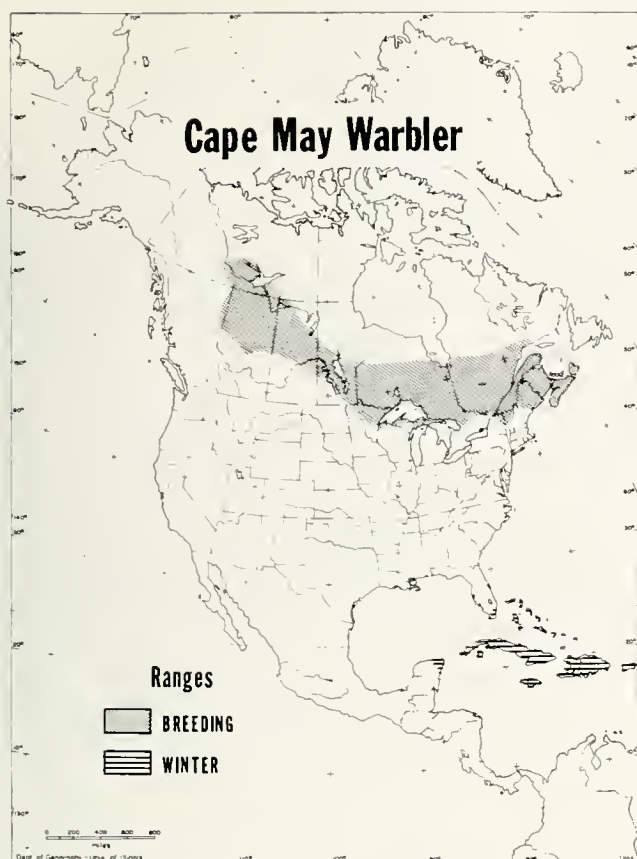


Fig. 42.—General distribution of the Cape May warbler plumage pattern.

as well as foliage, but the Cape May seems particularly oriented toward flowers (Ridgway 1889, Farwell 1919, Johnson 1942, Smith 1946). We often find them on blooming *Crataegus*. Whether the attraction is flower-loving insects or perhaps nectar is apparently unknown. Pueschel (1942) saw a Cape May feeding on a sliced orange, and in fall Marvel (1948) observed one regularly drinking sap from sapsucker drillings in a willow though it also foraged in the foliage in the usual manner of warblers. Farwell (1919) saw a Cape May running its bill up and down twigs, eating the eggs of "bark lice." Bohlen (1978) noted that Cape Mays favored conifers, especially spruce. The average densities we re-

corded for deciduous habitats, though low (Table 16), are slightly exaggerated by comparison with those of more common species because of the short seasonal occurrence (and thus lower number of hectares censused) of the Cape May in our transects. None came within our transects in the south.

Farwell (1919) described the Cape May's song as not remarkable, being a thin, rather sweet squeak repeated several times—one of the thinnest and least musical of warbler songs. Silloway (unpublished 1921) compared it to the song of the black-and-white warbler—a short series of thin, wiry notes ("Seep-seep-seep") with variation in the number of notes but not in the delivery.

### Fall Migration

Cape May warblers have been seen as early as 12 and 15 August in northern Illinois (Clark & Nice 1950, Blake & Smith 1941), 17 August in central Illinois (G. Wilford unpublished 1977), and 24 August in the St. Louis area (Widmann 1907, Wilhelm 1957). There are records of Cape Mays in northern and central Illinois for most dates from 18 August through September, for many dates almost through October, including six birds on 22 October at Decatur (Kleen 1974a). There are a few records for November (Ford 1956, Petersen 1968a, Kleen 1975a, 1976d, 1977a) and even for 18–19 December at Chicago (Peterjohn 1981). One stayed near St. Louis until 12 December (Petersen 1965b). The smaller number of records in the south (Fig. 43) may be partly a matter of fewer observers and more concealing habitat, but we believe that fewer Cape Mays actually reach southern Illinois in fall. In general, fewer are seen in fall than in spring (Fig. 43) except in northeastern Illinois, where Nelson (1876–1877) and Bennett (1952) saw many Cape Mays. Bennett's fall counts (seasonal totals) at Chicago were at least seven times more than ours in northwestern Illinois, where Fawks & Petersen (1961) recorded the species as rare in both spring and fall.

The ratio of our spring-to-fall counts of Cape Mays was even in northwestern Illinois, nine to one in central Illinois, and two birds to none in the south. In the central Illinois transects the ratio was about 1.5 to 1.0. At Chicago, Dreuth saw Cape Mays about twice as frequently in fall as in spring.

TABLE 16.—Population densities of Cape May warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (3-24 May)						
Mature upland forest	Piatt (C)	1979-1981	10	200	11.4	2.0
Forest edge and shrub	Piatt (C)	1979-1981	6	121	2.2	0.7
Forest edge and shrub	Pope (S)	1979-1981	7	135	2.3	0.6
Fall (2-22 September)						
Pasture	North	1909		172		0.2
Forest edge and shrub	Piatt (C)	1979-1981	11	207	5.2	0.9
Mature bottomland forest	Piatt (C)	1979-1980	7	144	4.0	0.6

O30

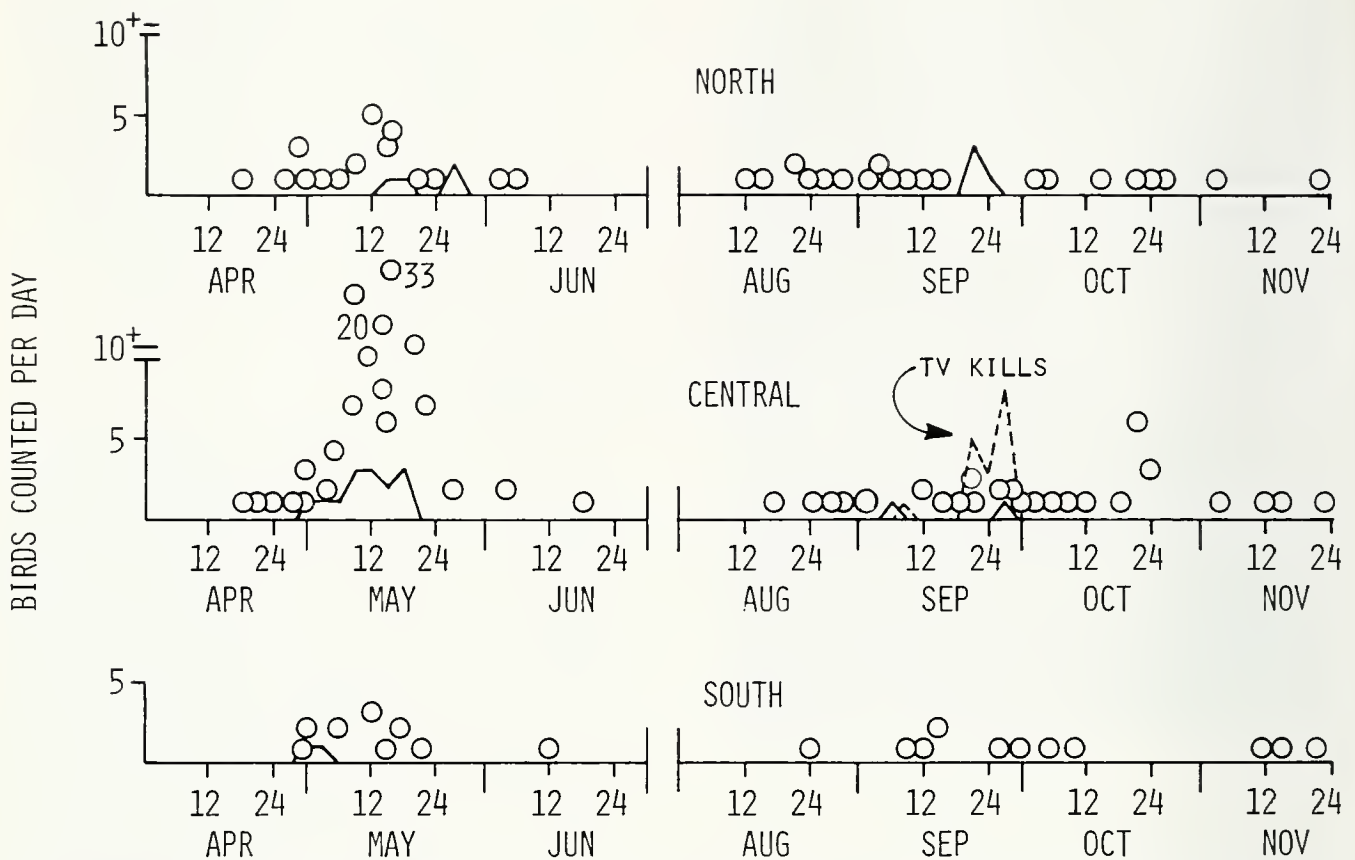


Fig. 43. Migration seasons of the Cape May warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

### Specimen Data

Only 17 Cape May warblers have been picked up at the central Illinois television towers (Fig. 43). An immature killed on 21 September was still obviously in molt. Cape Mays killed in September tended to be extremely fat; two adult males weighed 10.8 and 13.1 g, and an immature male, 11.5 g. One adult female weighed 11.5 g, and two immature females, 11.6 and 12.0 g.

## BLACK-THROATED BLUE WARBLER (*Dendroica caerulescens*)

(Fig. 44 and 45)

### Spring Migration

Early records of black-throated blue warblers in Illinois are 21-22 April in northern and central Illinois (Ford et al. 1934, T.E. Musselman unpublished 1910), and 18-19 April in the south (Cahn & Hyde 1929, Bent 1953). There are a

number of May records for northern and central Illinois, but few for the south (Fig. 46). This is a species which probably experienced a serious population decline in the past century, when southern Illinois had few observers. Most black-throated blue warblers have passed north of Illinois by the end of May, but there are two June records for northern Illinois (Ford et al. 1934, Bent 1953). Woodruff's (1907) reference to this species as a summer resident in Du Page County was not explained further, but it is not known to nest closer than central Wisconsin (Fig. 45).

In east-central Illinois, Frank Smith and his students encountered black-throated blues every year in May, and the distribution of their high counts is shown in Fig. 46. Their counts declined somewhat after 1912. Even then the species was not abundant. In 2 years (1906, 1922) only two were found, and their (Smith et al.) average May count during 21 years was only 11 black-throated blues, with 1 banner year (1910) in which 79 were counted. Now we feel fortunate to see even one in spring. Between 1967 and 1970 when we made the random counts, we saw only two in May, both in northern Illinois, and in 1979-1981 we detected only one in the (central) transect censuses in spring. The species is probably more common in northern Illinois than in the rest of

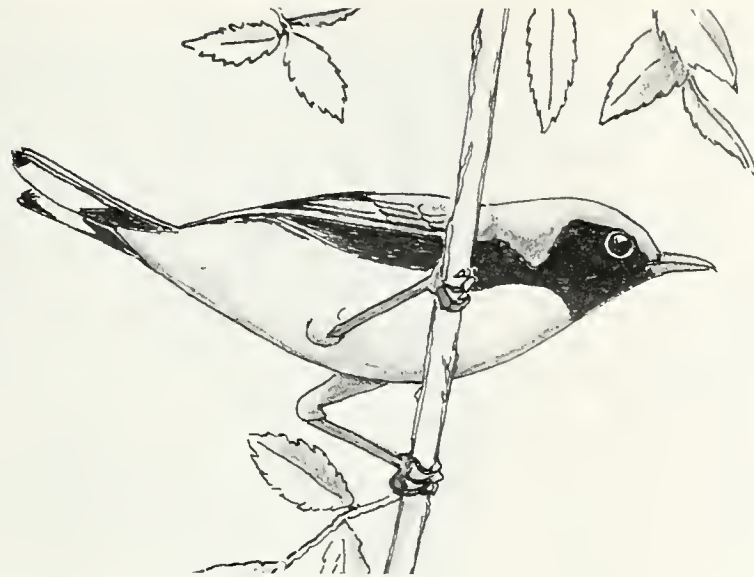


Fig. 44.—Adult male black-throated blue warbler.

the state in spring. Nehrling (1880) called the black-throated blue very numerous in mid-May in the northeast, and Coursen (1947) considered it fairly common. Because of the low spring population, we rarely hear the song—a slow, buz-

zy series of notes, which Nice (1930) phoneticized as, "Hur-hur-hur-hur-weeeeee."

### Fall Migration

The black-throated blue warbler, though uncommon, is more numerous in fall than in spring throughout the state (Fig. 46). It has been detected in northern Illinois as early as 23 August (Blake & Smith 1941) and in the St. Louis area on 30 August (Wilhelm 1957). The highest counts—less than 10 per day—have come between 31 August and 5 October (Fig. 46), and the latest records in all regions are between 22 and 26 October (Clark & Nice 1950, Anderson 1972, Fig. 46). Waves as large as six black-throated blue warblers have been reported in northeastern Illinois, 22–29 September (Baldwin 1941, Balch 1970) and 5 October (Fawks 1970a). Bennett's (1952) total fall counts at Chicago 1946–1950, ranged from 0 to 15 birds (mean, 9). Dreuth's counts at Chicago showed a nearly even ratio between spring and fall in frequency of sightings. Before 1920, B.T. Gault in northeastern Illinois made numerous observations of black-throated blue warblers, frequently seeing four to five per day. He often observed them feeding on elderberries and sometimes on grapes. Stomachs of specimens that he collected almost always contained fruit pulp as well as insect remains.

In their September censuses of 1906–1909, A.O. Gross and H. Ray recorded population densities for the black-throated blue of 6.8 birds per 40.5 ha in orchards, 0.7 in pastures of northern Illinois and 8.4 per 40.5 ha in woods in central Illinois. In fall 1979–1981 we detected the species within the transects only in upland forest in central Illinois, where the average density was 0.1 per 40.5 ha (range, 0–2.2) in 271 ha censused.

Relatively few black-throated blues are killed at television towers—a total of 27 have been picked up. A notable exception was the large kill involving six towers on the night of 26–27 September 1972, when 20 were killed (Seets & Bohlen 1977, Fig. 46).

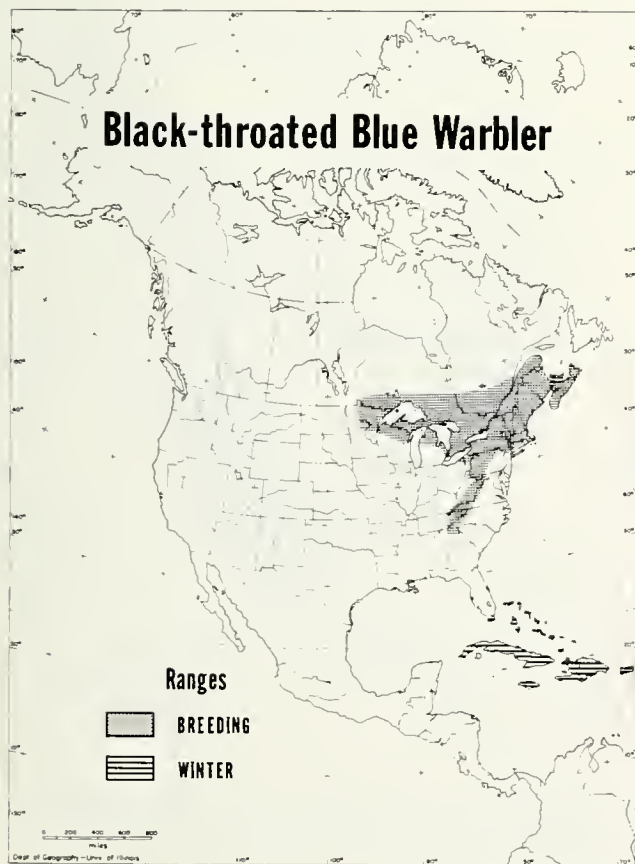


Fig. 45.—General distribution of the black-throated blue warbler.

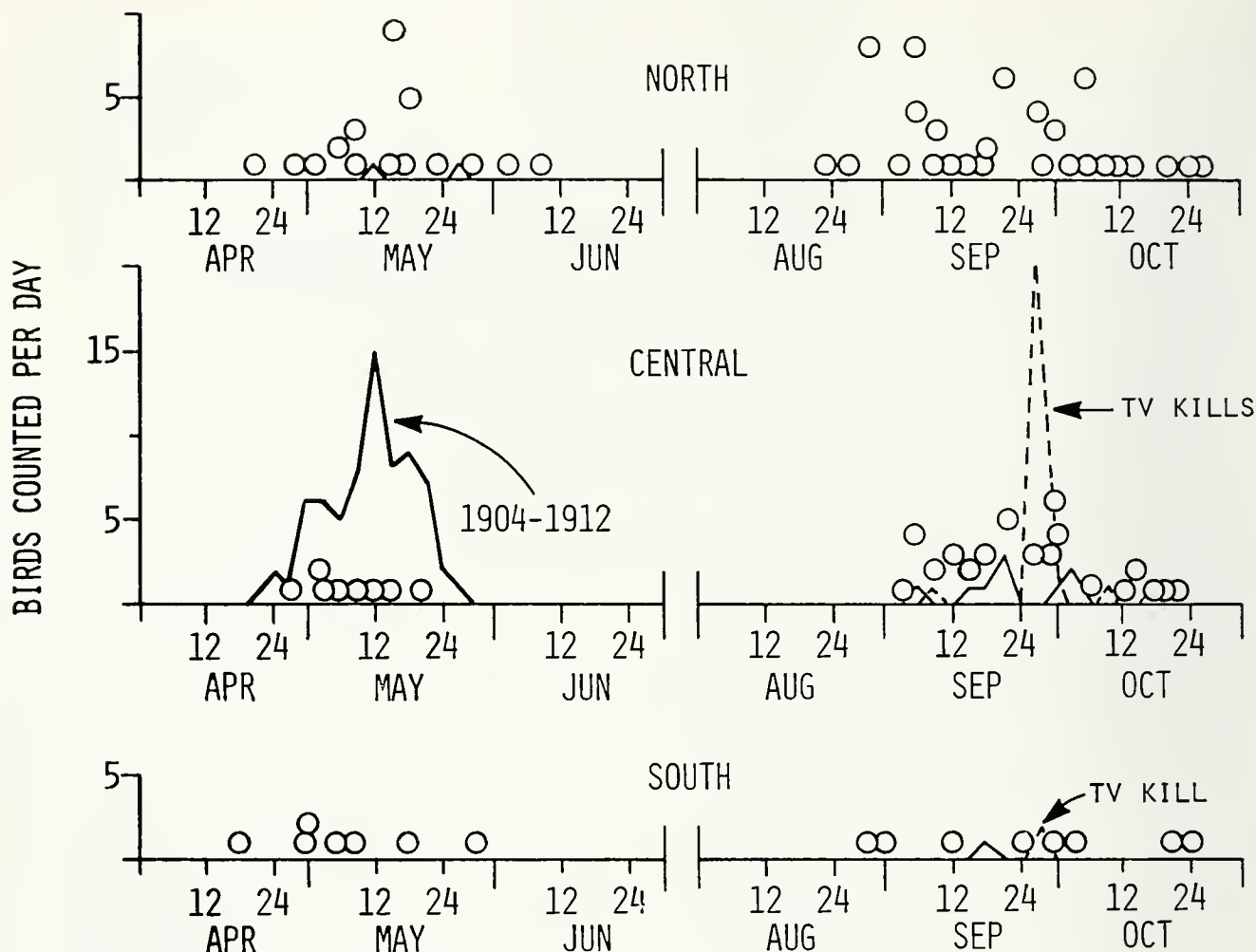


Fig. 46. — Migration seasons of the black-throated blue warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967–1970). Hollow circles represent counts made in other years or by other observers. The central region spring graph represents counts of Frank Smith and his students at Urbana. Dash lines show numbers killed at television towers during fall migration in Illinois.

### Specimen Data

Weights of black-throated blue warblers killed 9 September–1 October were: two adult males, 10.5 and 11.9 g (quite fat); three immature males, 9.0 (little fat), 10.1, and 12.8 g (very fat); one adult female, 10.1 g; and for two immature females, 9.5 and 9.6 g (quite fat).

## YELLOW-RUMPED WARBLER (*Dendroica coronata*)

(Fig. 47 and 48)

With rare exceptions, the yellow-rumped warblers of Illinois are myrtle warblers, and as allowed by the American Ornithologists' Union Committee on Nomenclature (Eisen-

mann 1973), myrtle is the name we have used virtually throughout this account.

### Spring Migration

Because of the variable winter population of myrtle warblers in Illinois, the beginning of the spring migration may be obscured. Our censuses showed fewer myrtles in February than in January (Table 18). We suspect that this decline represents mortality rather than migration, but it could be either or both. White's (1930) and Sanborn's (1921a) records of myrtles in the north on 16 and 20 March could refer to early migrations. B.T. Gault's earliest record at Glen Ellyn was 7 April, and in the St. Louis area Widmann (1907) noticed the first influxes of myrtles the second or third week of March but observed that the main migration of myrtles did not "set in" before 1 April. In some years a small wave of myrtles reaches to at least central Illinois in the



Fig. 47. — Myrtle warbler about life size  
Photo taken 30 April 1971 at Lodge Park,  
Piatt County, Illinois.

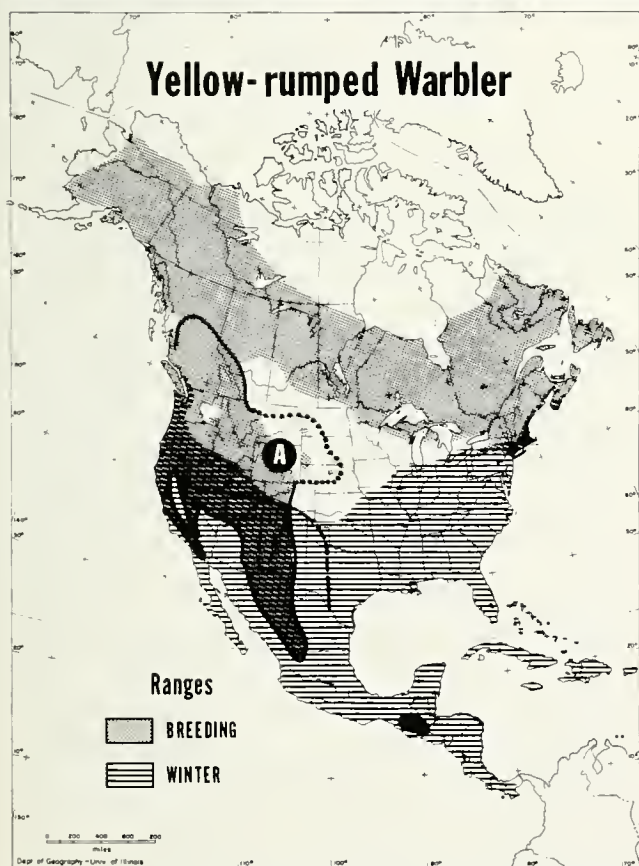


Fig. 48. — General distribution of the yellow-rumped warbler.  
Region A with outline is the range of the western form (Audubon's  
warbler).

last week of March (Fig. 49). The late March wave was noted by F. Smith et al. only in 2 of 21 years of observation.

Peak numbers of myrtles occurred between 9 April and 6 May in southern Illinois, 15 April and 12 May in central Illinois, and 18 April and 15 May in northern Illinois (Fig. 49). Records as late as 10 and 21 June in the St. Louis area (Widmann 1897a, Wilhelm 1957), 19 June in central Illinois (Kleen 1979c), and 21 June in the north (Ford et al. 1934) are exceptional.

Our highest spring counts for east-central Illinois and those of F. Smith and his students (1904–1925) are similar both as to numbers and dates (Fig. 49). The highest densities we recorded for myrtles in spring were in southern pine plantations (Table 17), where they fed on geometrid larvae principally in deciduous understory. In central Illinois, where there is only a small winter population, transient myrtles made heaviest use of bottomland forest.

The first myrtles seen in spring are virtually all in drab winter plumage. By the end of April some are in bright plumage, and some obviously in molt. After the 1st week in May many, probably females, are drab looking again. Vigorous singing and some fighting coincide with the appearance of the bright birds. The song, though rather soft, becomes conspicuous because of the large number of birds singing when the males are present in late April and May. Farwell (1919) described the song as sweet and varied; Silloway (unpublished 1921) gave us phonetics for the myrtle's song: "Ritter-ritter-ritter-ritter, swee-swee-swee," the first series of notes crescendo and the last diminuendo.

An adult male banded near Champaign on 16 April 1980 was recovered near Anchorage, Alaska, on 15 May 1981 (Banding report, Region 234).

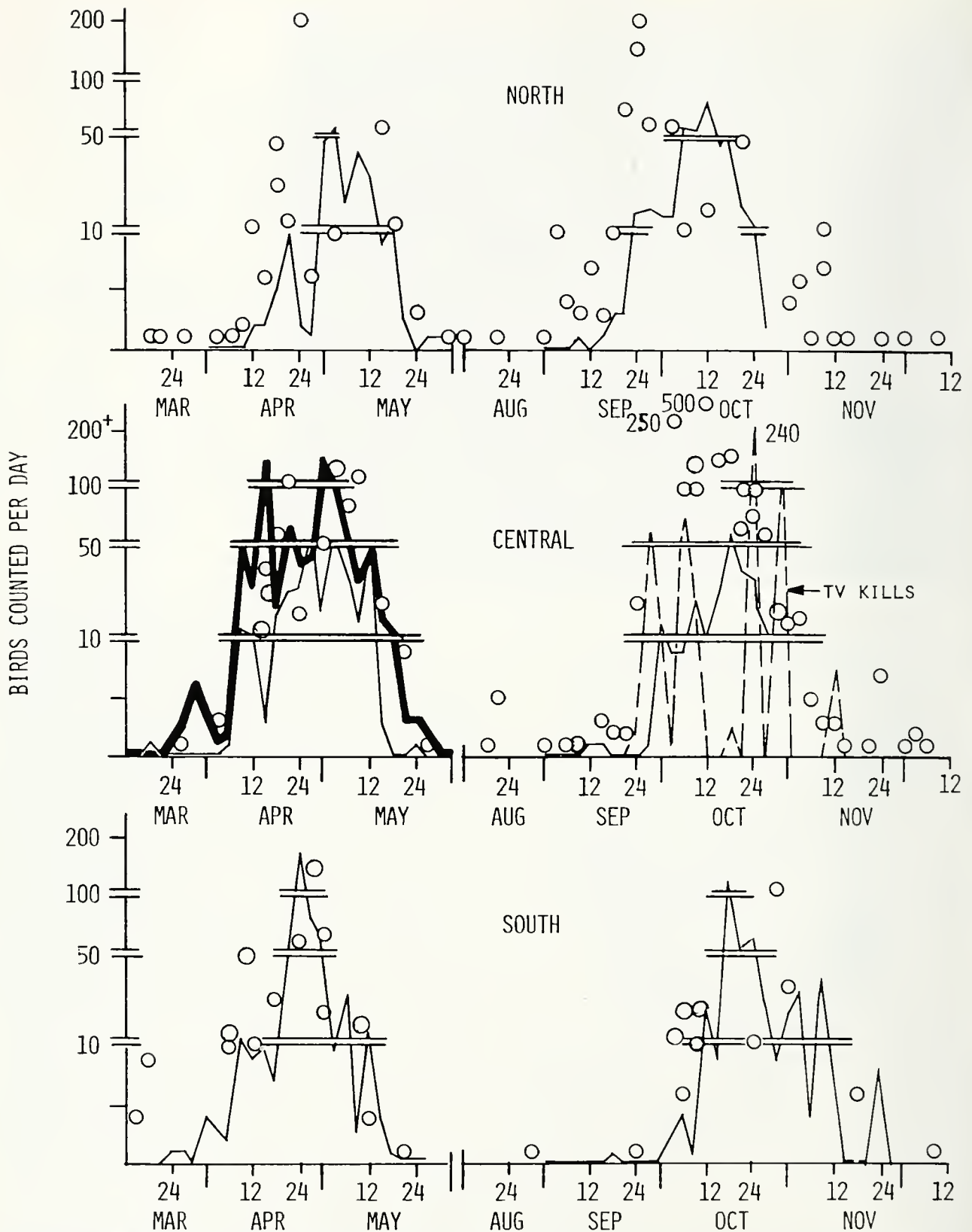


Fig. 49. - Migration seasons of the myrtle warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois. The heavy line (central spring) shows counts made by F. Smith and his students at Urbana.

TABLE 17.—Population densities of transient myrtle warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (23 March-15 May)						
Pasture	Central	1907		19	2.0	0.7
Corn stubble	Central	1907		81		0.5
Woods (unspecified)	Central	1907		19		20.8
Mature bottomland forest	Piatt (C)	1979-1980	8	155	223.9	46.0
Mature bottomland forest	Johnson (S)	1979-1981	17	351	26.1	7.4
Mature upland forest	Piatt (C)	1979-1981	10	204	92.5	36.0
Mature upland forest	Pope (S)	1979-1981	18	351	30.7	9.2
Forest edge and shrub	Piatt (C)	1979-1981	9	183	44.1	18.6
Forest edge and shrub	Pope (S)	1979-1981	16	318	15.6	4.8
Pines	Pope (S)	1979-1981	10	178	303.8	59.2
Fall (8 September-3 November)						
Orchard	Central	1906		12		51.6
Marsh	Central	1906		21		21.2
Fallow (weeds)	Central	1906		8		20.5
Fallow (weeds)	South	1906		8		24.6
Pastures	Central	1906		386		4.9
Corn fields	Central	1906		503		1.8
Small grain stubble	Central	1906		257		0.5
Woods (unspecified)	Central	1906		27		19.4
Woods (unspecified)	South	1906		10		69.2
Mature bottomland forest	Piatt (C)	1979-1980	15	301	342.4	79.7
Mature bottomland forest	Johnson (S)	1979-1981	10	204	198.8	40.7
Mature upland forest	Piatt (C)	1979-1981	18	345	41.6	8.9
Mature upland forest	Pope (S)	1979-1981	10	213	9.5	1.3
Forest edge and shrub	Piatt (C)	1979-1981	18	347	340.7	88.1
Forest edge and shrub	Pope (S)	1979-1981	12	226	43.1	7.7
Pines	Pope (S)	1979-1980	6	104	66.4	21.9

## Fall Migration

The earliest that myrtles have been reported in fall is 12 August in the north (Boulton & Beecher 1939, Kleen 1976d) and 13 August in the St. Louis area (Wilhelm 1957). The latter record is unusual also because seven birds were seen. Early records for central Illinois are 16 August (M. Easterday unpublished 1978) and five birds on 21 August (C.T. Nearing unpublished 1962). Even 2–3 September is early for the species (Smith & DuMont 1945a, Kleen 1977a), and most observers do not encounter myrtles, even in northern and central Illinois, until mid-September and in the south until late September (Fig. 49). Our earliest record of a myrtle casualty at television towers is 19 September. Peak numbers have been seen 21 September–21 October in northern Illinois, 3–27 October in central Illinois, and 12 October–9 November in the south (Fig. 49). The end of the migration in fall, like the beginning in spring, is obscured, especially in the south, by the winter population. The latest tower casualty occurred on 12 November in central Illinois, where a total of 593 myrtle warblers have been picked up at television towers. "Last seen" dates for myrtles in the north are 14, 23, and 26 November (Lewis 1923a, Blake 1941, Fawks 1967a). Bennett (1952) observed that influxes of myrtle warblers coincided with strong cold fronts and northwest winds. Reuss (1953) recorded layovers of 4 and 18 days in October for two myrtles at Blue Island. A possible indication of fall flight

direction is provided by data for a myrtle banded on 10 October 1976 near Rockford and recovered on 7 December 1977 near Baton Rouge, Louisiana. Another myrtle banded at Charleston on 9 October 1971 was recovered on 4 April 1972 near Augusta, Georgia. Much of the migration of myrtles is nocturnal, but we have also observed diurnal migration at low densities (four birds per hour) along the Ohio River, 4–7 October.

Principal habitats for the myrtle in fall were bottomland forest and forest edge and shrubs, but all woody habitats, and even fallow and cultivated areas, were used (Table 17). The ratio of our counts of myrtles between spring and fall was 1.0 to 1.5 in northwestern Illinois and 1.2 to 1.0 in central Illinois, but as the counts were discontinued by 1 November in both regions, the end of the migration may have been missed, and the ratio, therefore, may be incorrect. In southern Illinois, where the count was extended to 27 November, the spring-to-fall ratio was 1.0 to 2.1. In our census transects the ratio was 1.0 to 1.3 in central Illinois and 1.0 to 1.7 in the south. At Chicago the ratio of sighting frequency of myrtles by Dreuth was 1.0 (spring) to 1.6 (fall). Bennett (1952) at Chicago saw, on average, about one-third more myrtles than we did in the northwest. A fall sample of 299 myrtle warbler specimens from central Illinois television towers contained 129 adults (43 percent) and 170 immatures (57 percent), the equivalent of 1.0 bird in spring to 2.3 in

# Myrtle Warbler

## WINTER RECORDS

DEC. 15 - FEB. 1



Fig. 50. Winter records of the myrtle warbler in Illinois. Heavy black lines show the limits of the three regions referred to in the text.

fall. A small sample of specimens (43) killed in September showed a higher ratio of immatures (77 percent) than a sample (243) killed after 15 October (55 percent immatures); however, 39 myrtles killed in September and early October 1955 were all adults (Brewer & Ellis 1958).

## Winter Populations

Myrtle warblers probably occur in most Illinois counties in winter, but as yet records are lacking for many (Fig. 50). In addition to the plotted records, there is a 26 January record for Lawrence County (Kleen 1980d). Since 1968 myrtles have been detected on the Christmas counts every

year in all regions of the state, but earlier (1900-1940), myrtles were not listed on most Christmas counts. Surprisingly, Christmas counts indicate little difference in numbers of myrtles between northern and central Illinois (Fig. 51). Christmas counts for northern Illinois (1969-1979) were not correlated with counts of myrtles in either central or southern Illinois, but the central and southern counts were roughly correlated with one another ( $r = 0.705$ ,  $P = < 0.05$ ). Both the central ( $r = 0.905$ ,  $P = < 0.01$ ) and southern ( $r = 0.819$ ,  $P = < 0.05$ ) Christmas counts were correlated with our density figures for myrtle warblers in bottomland forests of southern Illinois. Annual variation in the Christmas counts of myrtles was great, ranging from 12 to 2,325 percent (mean, 250 percent) difference between consecutive years. Densities for bottomland forest in our censuses between 1974 and 1979 also showed great annual variation (average, 196 percent). Such variation may be related to supplies of poison ivy fruit, the staple for this species in fall and winter. Cooke (1883) and Cooke & Widmann (1883) observed that myrtles can withstand a temperature of  $-20^{\circ}\text{F}$ , given plenty of poison ivy fruit. The blizzard of January 1977 that killed all of the kinglets and wrens in Illinois did not eliminate the myrtle population, but caused them to move to upland forest areas where poison ivy fruit remained (Graber & Graber 1979). Despite the myrtle's hardiness, we have observed a decline in the population from early (before 10 January) to late winter (after 31 January) of about 40-45 percent even in mild winters (Table 18). Whether this change represents mortality, migration, or something else remains to be determined.

Populations of myrtle warblers are consistently highest in bottomland forest though pine areas also appear to support good numbers (Table 18). There appears to be an alternate-year pattern of high and low numbers of myrtles in bottomland forest, but not in upland. At Heron Pond (Johnson County), for example, the populations in January of the odd-numeral years—1975, 1977, 1979—had densities of 12.0-25.7 myrtles per 40.5 ha (mean, 19.4), whereas in even

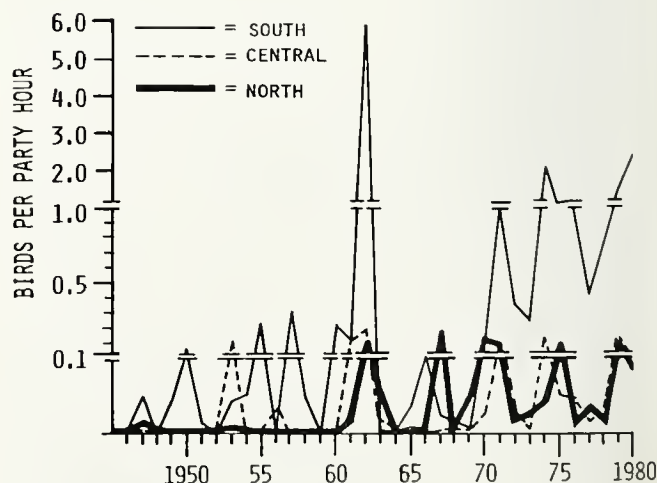


Fig. 51. Myrtle warblers seen per party hour on Audubon Christmas bird counts, 1945-1980.

TABLE 18.—Winter population densities of myrtle warblers in Illinois.

Season and Habitat	County or Region	January of Year(s)	Dates	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Winter (26 December- 17 February)						
Suburban woodlot	Lake (N)	1968- 1972		40	5.0 (Miller & Miller 1972)	1.0
Forest (unspecified)	South	1957- 1958		85		1.4
Mature bottomland forest	Piatt (C)	1978- 1980	To 10 January	91	3.6	2.2
Mature bottomland forest	Piatt (C)	1978- 1980	After 31 January	77	2.1	1.0
Mature bottomland forest	South	1974- 1977	Before blizzard	644	50.3	4.9
Mature bottomland forest	South	1977	After blizzard	186	2.7	0.6
Mature bottomland forest	South	1978- 1980	To 10 January	262	33.4	4.6
Mature bottomland forest	South	1978- 1980	After 31 January	194	13.2	2.5
Mature upland forest	South	1974- 1977	Before blizzard	342	14.8	1.7
Mature upland forest	South	1977	After blizzard	91	23.9	5.3
Mature upland forest	South	1978- 1980	To 10 January	236	5.6	1.7
Mature upland forest	South	1978- 1980	After 31 January	117	3.7	1.0
Shrub areas	South	1957- 1958		41		2.0
Forest edge and shrub	Pope (S)	1980	To 10 January	38	2.1	1.0
Forest edge and shrub	Pope (S)	1980	After 31 January	39		0
Pines	Pope (S)	1978- 1980	To 10 January	51	9.2	4.7
Pines	Pope (S)	1978- 1980	After 31 January	34	2.3	1.2
Urban residential	South	1976- 1977	Before blizzard	106	3.7	0.8
Urban residential	South	1977- 1978	After blizzard	167		0

years the densities were 0–6.2 (mean, 2.1). The Christmas counts do not show this pattern, but others of our bottomland census areas (Union County, Saline River) showed the same alternate-year pattern. This pattern may prove to be related to poison ivy or other fruit production, but the question needs study. One feature of both bottomland and upland forests that appeared to be correlated with numbers of myrtle warblers was the number of trees (at least 4 inches DBH) per acre. Myrtle densities increased as the number of trees increased above 160 per acre and declined as the number of trees declined ( $r = 0.671$ ,  $P = 0.01$ ). This relationship also may prove to be related to fruit production.

In the south at least, myrtle warblers regularly roost in evergreen stands, including conifers and holly—often 50 or more birds coming to the same roost (Ridgway 1889, Findley 1944, Harris 1947, 1948, Kleen 1980b). The birds are rarely seen at the roost during the day, but make their appearance about 1600–1700 hours (Harris 1947, 1948, Comfort 1951).

## Food

The food of the myrtle warbler changes greatly between spring and winter from a primary diet of insects to one of

fruit. As early as February, Ferry (1907a) observed myrtles pursuing small winged insects. In April and May we saw them feeding heavily on geometrid and other caterpillars. Forbes' (1878) undated records showed that the stomachs of five myrtle specimens contained four hymenoptera (one ichneumonid), three beetles (two scarabs), three hemipterans, two flies, one caterpillar, one spider, and one weed seed, a remarkable diversity in so small a sample.

In fall and winter there are numerous observations of myrtles eating poison ivy fruit (B.T. Gault unpublished 1894, etc., Lewis 1923b, Cooke 1883, Widmann 1907). We see them feeding on poison ivy virtually every time we visit suitable habitat. Widmann (1922) also reported myrtles feeding on red cedar fruit. In October we have also seen myrtles feeding intensively on tiny spiny hackberry gall insects (*Cecidomyia spiniformis*) as they emerged by the thousands. Wright (1926) observed a myrtle drinking sap at the drillings of a sapsucker. At feeders, myrtles have been observed eating suet and cheese (Roberts 1918–1919).

## Specimen Data

Examples of the western form of the yellow-rumped warbler (*Dendroica coronata auduboni*) have been reported

in or near Illinois in recent years, from the northeast in May and December (Balch 1971–1972, Kleen & Bush 1971, Miller 1980), in Central Illinois in December (Bohlen 1971), and in the St. Louis area in April and October (Mayfield 1949a, Anderson 1974, Kleen 1974a). Audubon's warblers cross extensively with myrtles where their breeding ranges overlap (Fig. 48), and with back crosses, produce plumages that span the range of variation from one parental type to the other. Many such hybrids cannot be identified in the field with any certainty. Because the range of *auduboni* is extensive and the populations large, it is not surprising that some have reached Illinois.

Judging from wing measurements given by Hubbard (1970), we conclude that all specimens of myrtles we have examined represent the nominate form (*D. c. coronata*). Wing lengths (chord) of 39 adult males killed on 24 October ranged from 69.7 to 77.0 mm (mean = 73.65, SE = 0.30), for 39 immature males the range was 65.8–76.4 mm (mean = 72.24, SE = 0.35), for 52 adult females the range was 65.6–74.9 mm (mean = 70.51, SE = 0.33), and for 61 immature females, 63.3–75.3 mm (mean = 69.06, SE = 0.30).

Gross weights of these specimens were, for adult males, 11.0–14.8 g (mean = 12.96, SE = 0.15); for immature males, 10.5–15.8 g (mean = 13.23, SE = 0.15); for adult females, 11.1–14.6 g (mean = 12.46, SE = 0.13); and for immature females, 11.2–14.6 g (mean = 12.67, SE = 0.11). Many of these specimens were very fat.

Small samples of specimens killed earlier in the fall (20 September–15 October) were, on average, shorter winged and lighter in weight, e.g., for eight adults males the average wing length was 72.58 mm (SE = 1.11) and weight was 12.04 g (SE = 0.31). Average weights of others in the earlier sample were, for 5 immature males, 12.52 g; 4 adult females, 11.80 g; and 14 immature females, 11.94 g (SE = 0.19). Larger samples are needed for the early part of the migration before it can be determined if the differences are significant.

## BLACK-THROATED GRAY WARBLER (*Dendroica nigrescens*)

It is surprising that there are at least four reports of this western species in Illinois—single birds seen on 24 April 1948 at Chicago (Ford 1956), 3 May 1975 at Springfield (Bohlen 1976), 6 September 1975 at Champaign (Kleen 1976d), and 9 October 1968 at Winnetka (Boyd 1969, Bohlen 1976).

## TOWNSEND'S WARBLER (*Dendroica townsendi*)

A bird of this western species was seen and carefully studied at Davenport, Iowa, on 7 May 1950 (Feeney 1950).

The first record for Illinois was a female seen in Chicago on 6 May 1980 (Kleen 1980e).

## BLACK-THROATED GREEN WARBLER (*Dendroica virens*)

(Fig. 52 and 53)

### Spring Migration

The earliest report of a black-throated green warbler in Illinois was 6 April in northern Illinois (Mumford 1959a) and 9 April in the south (Kleen & Bush 1972b). The species fairly regularly reaches southern Illinois by 13–15 April, central Illinois by 20 April, and northern Illinois by 1 May (Fig. 54). Peak numbers have been seen 27 April–9 May in the south, 2–24 May in central Illinois, and 6–15 May in the north. High counts in spring are usually less than 20–25 per day (Fig. 54). A report of 35 in Cook County on 6 May (Wade 1916) is the highest spring count we know. The counts of Smith and his students at Urbana (1904–1925) were very similar to ours (1956–1979).

Of the northern warblers, the black-throated green may be the most inclined to linger late in the spring—singing males are present well into June, which may account for the references to breeding in Illinois (Butler 1898, Davie 1898,

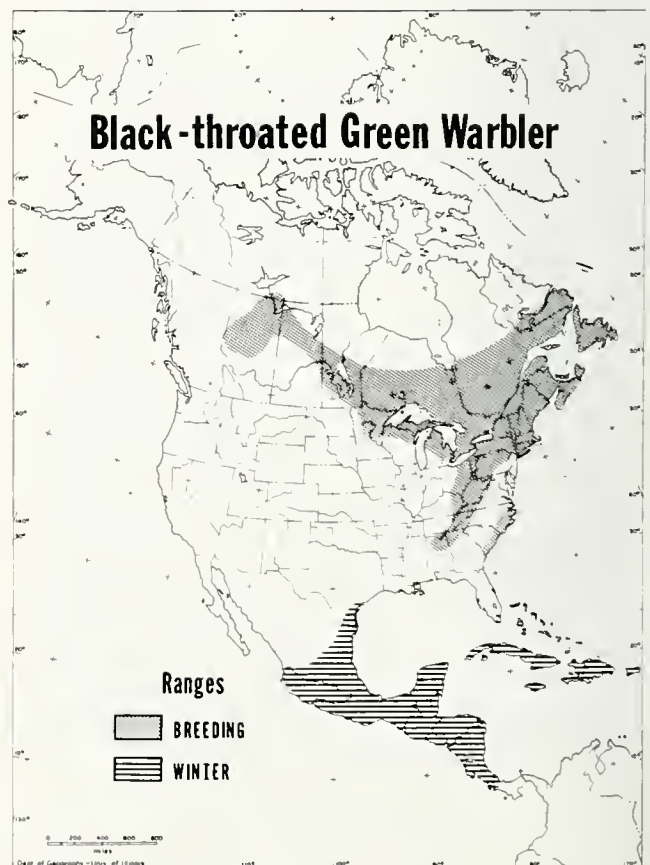


Fig. 52. General distribution of the black-throated green warbler.



Fig. 53.—Adult male black-throated green warbler plumage pattern.

Gault 1901b), all probably referring to Nelson (1876–1877). Now the closest breeding range known is northern Wisconsin or Michigan (Fig. 52). Though most of the population has passed Illinois by the end of May, the latest spring records are 21, 25, and 28 June in northern Illinois (Fawks 1969c, Kleen 1977d, 1980–1981) and 10 June in the St. Louis area (Wilhelm 1957). The males are persistent singers, and the

phonetics we feel best represent the song are: “Zee-zee-zoo-zee,” accented on the next to last syllable.

Ries & Werner (1946) reported that black-throated greens preferred hawthorns—presumably for foraging. The highest densities we recorded in both spring and fall were in forest edge and shrub (Table 19), but the species was well represented in all woody habitats.

TABLE 19.—Population densities of transient black-throated green warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (13 April–24 May)						
Mature bottomland forest	Piatt (C)	1979–1980	7	144	14.8	3.9
Mature bottomland forest	Johnson (S)	1979–1981	16	329	5.5	0.9
Mature upland forest	Piatt (C)	1979–1981	10	220	34.6	6.1
Mature upland forest	Pope (S)	1979–1981	17	345	5.7	0.6
Forest edge and shrub	Piatt (C)	1979–1981	8	161	23.5	5.3
Forest edge and shrub	Pope (S)	1979–1981	14	277	2.0	0.4
Pines	Pope (S)	1979–1981	9	162	2.4	0.5
Fall (2 September–15 October)						
Woods (unspecified)	Central	1906		44		9.2
Pastures	North	1909		172		1.2
Pastures	Central	1906		236		0.2
Corn	Central	1906		571		0.1
Mature bottomland forest	Piatt (C)	1979–1980	15	307	55.8	13.0
Mature bottomland forest	Johnson (S)	1979–1981	13	269	24.7	4.5
Mature upland forest	Piatt (C)	1979–1981	18	348	24.0	6.3
Mature upland forest	Pope (S)	1979–1981	11	240	13.3	7.6
Forest edge and shrub	Piatt (C)	1979–1981	20	378	78.1	17.9
Forest edge and shrub	Pope (S)	1979–1981	12	221	9.0	3.6
Pines	Pope (S)	1979–1981	6	106	15.6	3.8

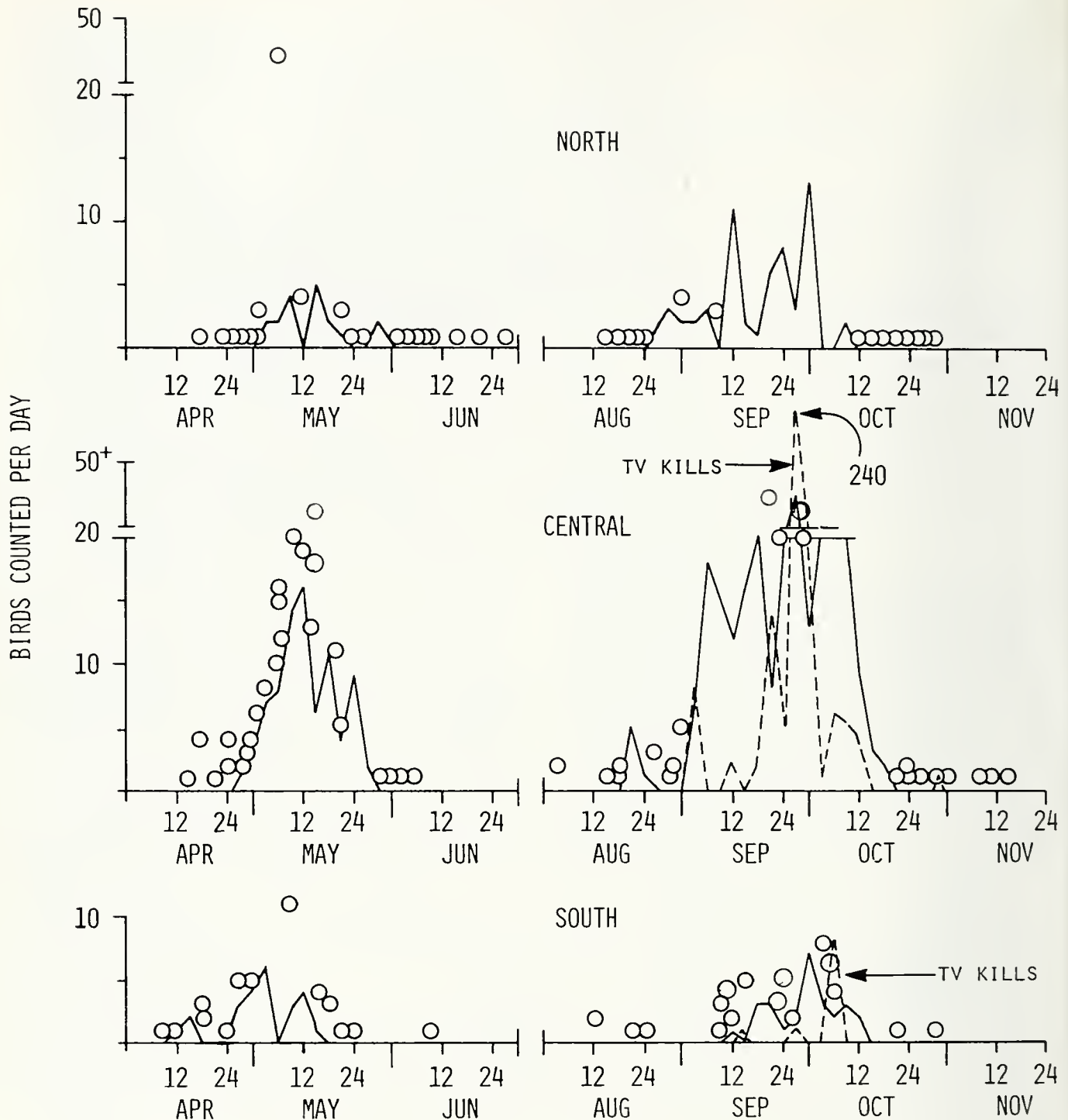


Fig. 54.—Migration seasons of the black-throated green warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967–1970). Hollow circles represent counts made in other years or by other observers. The dash lines show numbers killed at television towers during fall migration in Illinois.

### Fall Migration

Black-throated green warblers seen on 26 July at Springfield and on 27 July at the Indiana Dunes were pro-

bably extremely early migrants (Petersen 1964a, Kleen 1981a). Early records for the species are 15–17 August in northern and central Illinois (Brodkorb 1926a, H.D. Bohlen unpublished 1977, 1978) and 12 August in the St. Louis

area, an early record for the latitude (Wilhelm 1957). The next record for the south is 22 August (A.O. Gross unpublished 1908). Peak numbers of black-throated greens have been seen, 5 September–9 October in central Illinois, where more are seen than in either the northwest or south. Peak counts often exceed 20 birds per day in east-central Illinois but less than 10 in the south (Fig. 54).

Black-throated green warblers have been killed at television towers between 2 September and 31 October, coinciding fairly well with field counts (Fig. 54). Graber's (1968) statement that this species is less prevalent in the tower kills than other *Dendroica* seems refuted by a disastrous kill of 240 black-throated greens on 27 September 1972. The last black-throated greens are usually seen in the last half of October (Jones 1895, George 1968), and November records—one as late as the 28th—are exceptional (Ford 1956, Kleen 1974a, 1975a, Bohlen 1978).

The highest fall populations were in forest edge and shrub habitat, but as in spring, all woody habitats were used regularly (Table 19). The use of cultivated fields was negligible.

Flight direction is indicated as nearly due south for one specimen—a black-throated green warbler banded at Blue Island, 30 September 1962, and recovered on 3 November 1962 at Birmingham, Alabama (Bartel 1976).

The ratio of our spring-to-fall counts for the black-throated green were relatively high—1.0 to 3.2 in the north, 1.0 to 3.6 in the central Illinois, but only 1.0 to 1.4 in the south. The more precise transect censuses showed ratios of 1.0 to 6.1 (central) and 1.0 to 6.9 (south). The large number of black-throated greens in the southern region in fall is in contrast to the patterns of most warblers. Dreuth's records for Chicago showed a ratio of sighting frequency of 1.0 in spring to 1.8 in fall. Bennett's (1952) fall counts for Chicago were consistently two to three times higher than ours for the northwest.

A sample of specimens killed between 20 September and 12 October had 93 adults and 61 immatures, the equivalent of a spring-to-fall ratio of 1.0 to 1.7. The high fall ratios may have more to do with differing migration routes in spring and fall than with productivity.

## Specimen Data

Gross weight of 35 adult males killed 20 September–12 October were 8.3–10.9 g (mean = 9.41, SE = 0.11); of 29 immature males, 8.2–10.4 g (mean = 9.27, SE = 0.11); of 53 adult females, 7.5–11.2 g (mean = 9.00, SE = 0.08); and of 27 immature females, 8.2–10.5 g (mean = 8.90, SE = 0.12). Males (but not females) killed in October were, on average, about 1 g heavier (mean = 10.30, SE = 0.15) than those killed in September. Specimens of average weight were only moderately fat (2 on a scale of 0–5), and in contrast to most species of warblers, few black-throated greens were very fat.

## CERULEAN WARBLER (*Dendroica cerulea*)

(Fig. 55)

### Spring Migration

The earliest reports of cerulean warblers in or near Illinois were 26 March in the St. Louis area (Wilhelm 1957), 3 April in Pope County, and 18 April in both central and northern Illinois (H.D. Bohlen unpublished 1975, M. Campbell unpublished 1976, G. Wilford unpublished 1978, Levy 1964). Peak numbers have been seen 22 April–8 May in the south (9–31 per day) and 3–10 May in central Illinois (5–8 per day) (Fig. 56). The highest counts in northern Illinois have been three birds per day from 6 May through June.

Griscom (1942) mentioned the cerulean as an example of an overmigrant. Spring densities, on average, were about five times higher than breeding densities in central Illinois, and three times higher in the south (Table 20). As the breeding population north of central Illinois is not large, the high spring populations may represent overmigration. Night migration of ceruleans is indicated by two specimens found at Charleston and Olney television towers on 4 and 7 May (Eastern Illinois University Collections, L.B. Hunt unpublished).

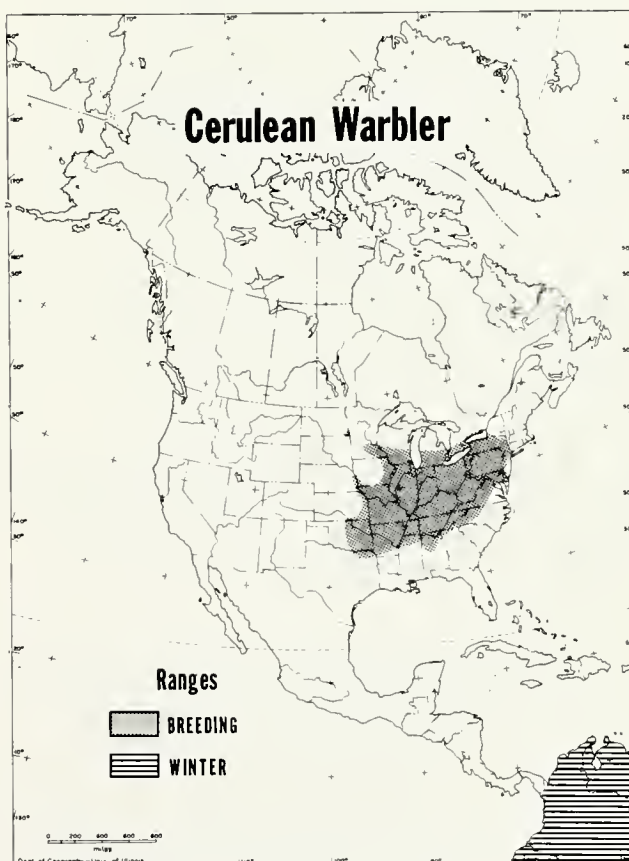


Fig. 55.—General distribution of the cerulean warbler.

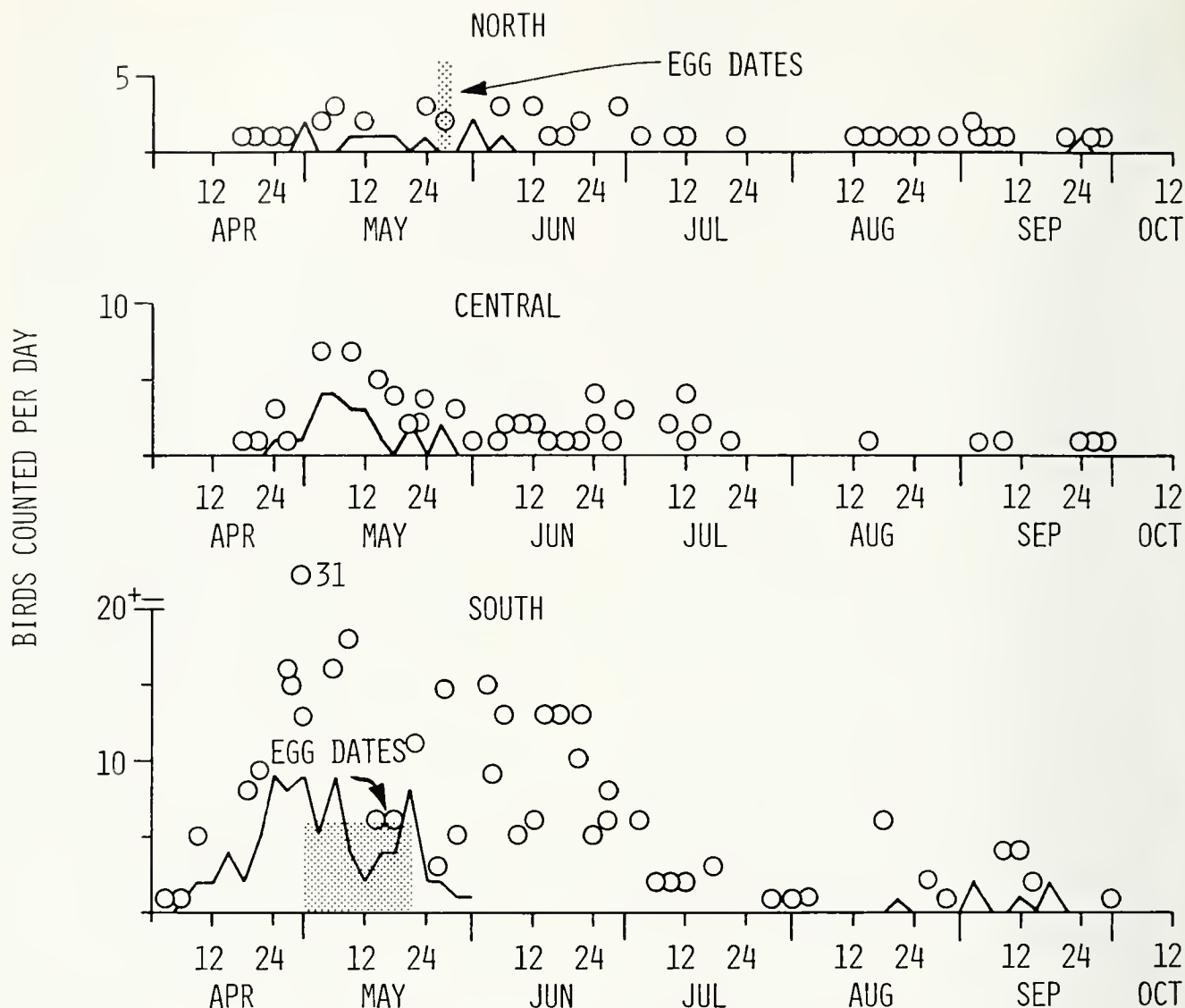


Fig. 56. — Egg-laying and migration seasons of the cerulean warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Shaded areas show the span of dates during which eggs have been found

The most used habitat in spring in southern Illinois was bottomland forest but in central Illinois was upland forest (Table 20). We have seen the species in shrub habitat in spring, but the densities must be low. None came within our transects in shrub or pine habitat.

### Distribution, Nesting Habitats and Populations

The cerulean warbler has been common in southern Illinois within historical times (Nelson 1877) but relatively rare in the north. Nelson (1876-1877) called it a rare summer resident in the northeast, where its status seems about the same today though with occasional years (e.g., 1889, 1938, 1958) of relative abundance (B.T. Gault unpublished 1889, Boulton & Pitelka 1938b, Nolan 1958). In the "high"

year, 1958, we recorded a density of one cerulean per 40.5 ha in forest in Jo Daviess County (Grabner & Grabner 1963). Near the Mississippi River the cerulean is apparently more common even north of Illinois (Kumlien & Hollister 1951, Brown 1975). We would expect this species to nest in every county in Illinois, but the record is woefully incomplete (Fig. 57). In addition to the records plotted, there are June records for ceruleans for unstated or unknown localities in Logan County (Du Bois 1918), in Winnebago County (Jones 1895), and near the Mississippi River in Scott County, Iowa (Hodges 1949).

Both Nelson (1877) and Ridgway (1889) called the cerulean the most abundant breeding warbler in the Wabash Valley, where the habitat was the "tall timbers of the creek and river bottoms." The highest densities we have found for ceruleans in such habitat, including the Wabash

# Cerulean Warbler

## BREEDING RECORDS

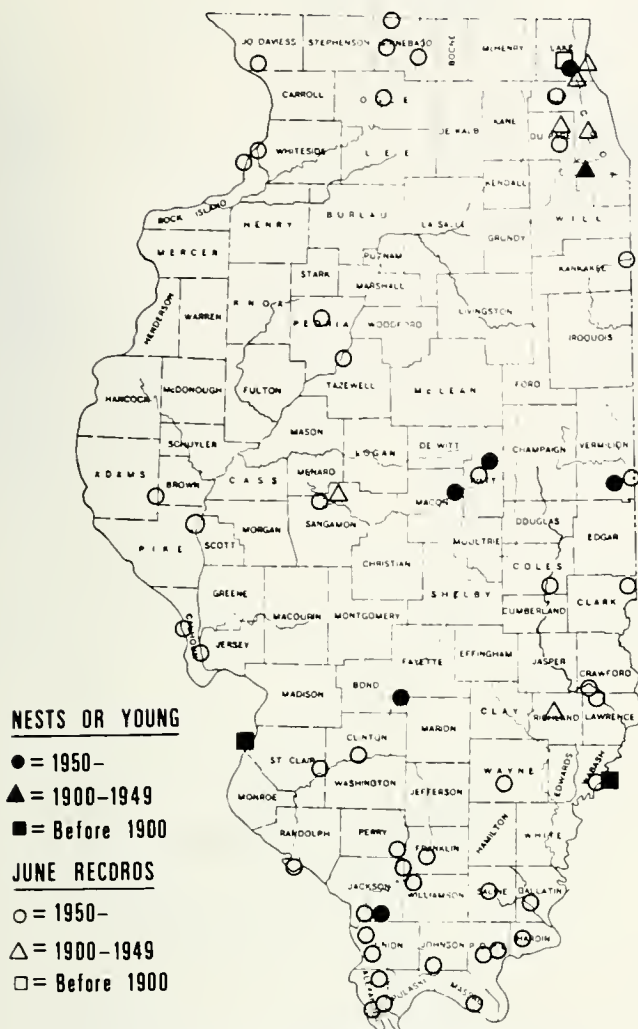


Fig. 57.—Breeding records of the cerulean warbler in Illinois.

Valley, was 9–10 birds per 40.5 ha (Table 20), the same as for the parula warbler, which Ridgway (1889) called “not uncommon” as a breeding bird. The prime habitat—bottomland forest—and thus the total cerulean (and parula) population, is declining. Ridgway (1887) listed the cerulean as a breeding species in Mt. Carmel. It is doubtful that any urban population of the species exists today. No feature of the vegetation that we measured in several upland and bottomland forest areas (Graber et al. 1977) correlated with cerulean numbers. Populations of ceruleans in upland forest in southern Illinois were about half as dense as those in bottomland (Table 20). The highest densities recorded in central Illinois were in virgin floodplain forest on the Sangamon River (Fawver 1947b, Snyder et al. 1948). The lower den-

sities that we recorded more recently in mature bottomland forest on the Sangamon may imply a population decline but could also represent differences in localities, years, or census methods. Between 1973 and 1979 in the south we found the annual variation of the cerulean population to range between 5 and 61 percent (mean, 36.5) in bottomland forest habitat, but it was higher in upland habitat: 13–144 percent (mean, 60.8). We found no ceruleans on our one study area (Grand Island, Mason County) of floodplain forest on the Illinois River.

## Nesting Cycle

Male ceruleans characteristically sing from the tops of large trees, and except for the song, the species would go largely undetected. Farwell (1919) described the song as four (sometimes only two) repeated notes, then four more a little higher in key—a quick chromatic run—ending with, “Burr-r-r,” a sweet whirring sound. Ferry (1907b) gave us phonetics for the song, “Whee-ta-te, zee-ee-e-e-e.” Ceruleans are persistent singers, and the song period lasts from at least the time of their spring arrival through June and, at a much reduced level, into August (Nolan 1956c, Swink 1976), with a brief resurgence to mid-September in the south. We have heard and seen ceruleans and parulas sing songs that were indistinguishable.

Despite the cerulean's abundance, few nests have been found in Illinois, probably because they are small and are characteristically placed high in large trees. Construction of a nest near Pomona was started on 25 April and completed in 4 days (George unpublished 1970). Smith (1893) found most of the cerulean nests that have been reported from, or near, Illinois. He referred to having found no less than 40 nests in one season in the St. Louis area. All but two of the nests were in sycamores, the two exceptions being in oaks. Sixteen nests in Jackson County were all in American elms (George unpublished 1970–1981). Nest heights usually ranged from 35 to 75 feet, according to Smith (1893). Two Illinois nests were lower; one at Mt. Carmel was 25 feet high (Allen 1879), and one in Macon County was 20 feet high in a white oak (R. Sandburg unpublished 1979). Nests were partially covered with lichens, in the fashion of wood pewee nests, and like pewee nests, were saddled on branches, one 12 feet out from the trunk. Smith gave dimensions of a typical nest in inches: inside diameter, 1.6; inside depth, 1.1; outside diameter, 2.6; and outside depth, 1.5.

The eggs apparently somewhat resemble those of the yellow warbler but with darker, red-brown spots (Allen 1879). Clutch sizes in 28 nests from the south (mainly data from Smith 1893) were: 5 eggs, six nests; 4 eggs, eighteen nests; and 3 eggs, four nests, the average being 4.1 eggs. A nest in Cook County had 3 eggs on 29 May (Ford et al. 1934). No mention was made of cowbird parasitism of the cerulean, and there are no data on nesting success or productivity. Eggs have been found in the south from 12 to 21 May (Fig. 56), but the egg season is undoubtedly longer. We have seen fledged young with half-grown tails on 19 June in the south, and Fawver (1947a) reported (apparently) newly fledged young in Piatt County on 15 July.

TABLE 20. — Population densities of cerulean warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (6 April-28 May)						
Mature bottomland forest	Piatt (C)	1979-1980	7	144	3.7	1.4
Mature bottomland forest	Johnson (S)	1979-1981	21	436	22.0	9.1
Mature upland forest	Piatt (C)	1979-1981	13	257	11.4	2.5
Mature upland forest	Pope (S)	1979-1981	21	433	3.9	0.7
Breeding (June)						
Virgin floodplain forest	Sangamon (C)	1948		31		8.0
					(Snyder et al. 1948)	
Virgin floodplain forest	Piatt (C)	1946		20		4.0
					(Fawver 1947 <i>b</i> )	
Forest (unspecified)	North	1957-1958		72		0.6
Forest (unspecified)	Central	1957-1958		87		0.5
Mature bottomland forest	Central	1978-1979	6	132	1.9	0.3
Forest (unspecified)	South	1957-1958		138		2.9
Mature bottomland forest	South	1973-1979	61	1,086	9.5	2.0
Mature upland forest	Central	1978-1979	3	64	1.9	0.6
Mature upland forest	South	1974-1979	30	580	4.7	1.0
Fall (31 July-19 September)						
Mature bottomland and upland forest	Piatt (C)	1979-1980	24	480		0
Mature bottomland forest	Johnson (S)	1979-1981	13	278	5.5	2.0
Mature upland forest	Pope (S)	1979-1981	13	262	1.8	0.2

## Fall Migration

After singing ends in June, few ceruleans are seen, and the fall counts are consistently low (Fig. 56). In the south we saw 14 ceruleans in spring to 1 in fall, and in the central and northern regions combined, 18 in spring to 1 in fall. The ratios signify the species' inconspicuousness in fall. We have never found a cerulean at television towers in fall. Most of the ceruleans in the fall transect censuses were in the primary breeding habitat — bottomland forest (Table 20).

The latest records of ceruleans in Illinois are 28 September in the north and central regions (Bent 1953, Fig. 56) and 30 September in the St. Louis area (Wilhelm 1957). The presence of this species in Alexander County on 6 November was very unusual (Findley 1949).

## Specimen Data

A male and a female cerulean warbler killed in early May weighed, respectively, 9.5 and 9.7 g (EIUC).

## BLACKBURNIAN WARBLER (*Dendroica fusca*)

(Fig. 58)

### Spring Migration

The earliest reports of the Blackburnian warbler in Illinois were 18 April in central Illinois (Kleen 1978a), 21 April in the north (Ford et al. 1934), and 24 April in the south (Fig. 59). High counts were made 5-18 May in the

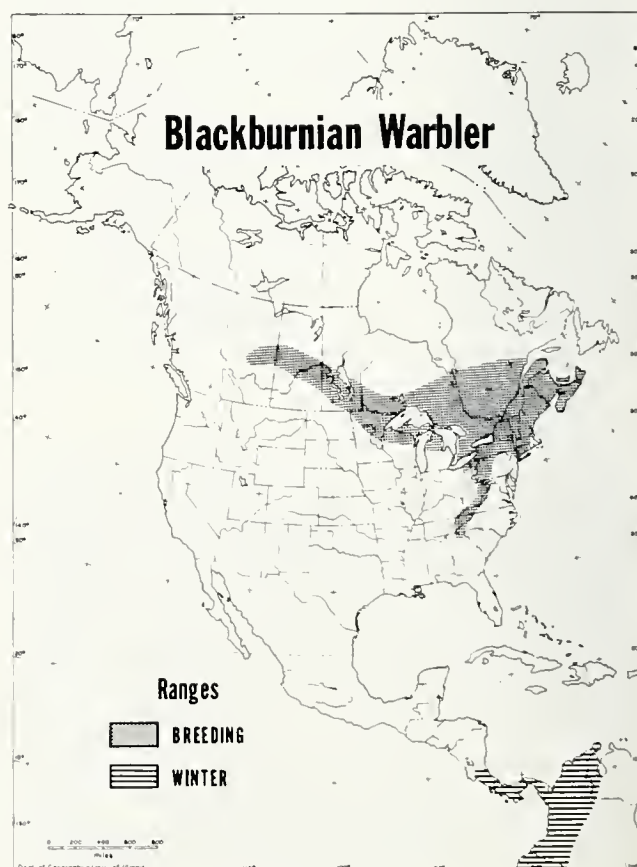


Fig. 58. — General distribution of the Blackburnian warbler.

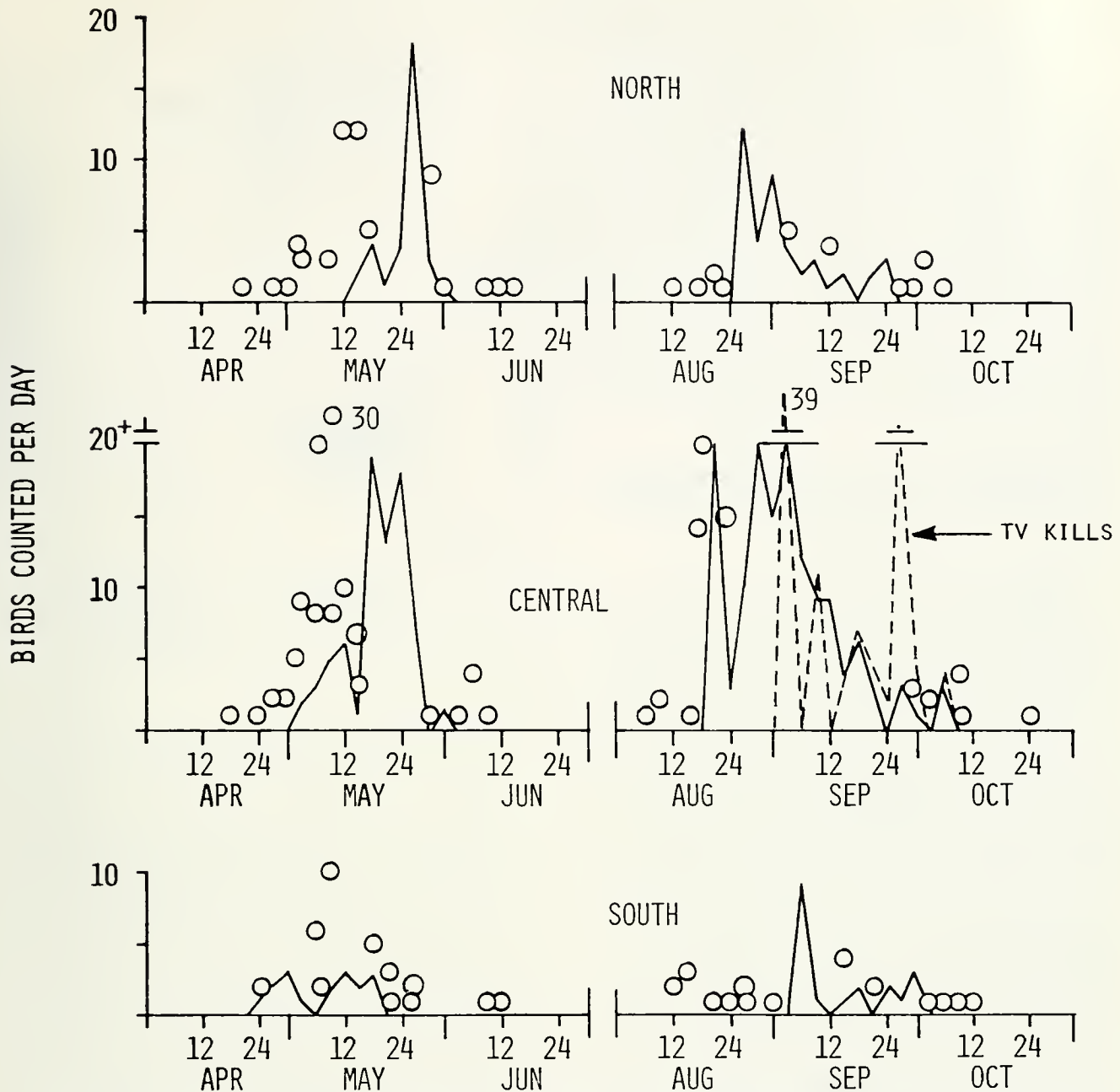


Fig. 59.—Migration seasons of the blackburnian warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

south (usually less than 10 per day, Fig. 59), 7-24 May in central Illinois (10-20 per day), and 12-26 May in the north (10-15 per day). The last blackburnians in spring have been seen 14 June in the north (Kleen 1977e), and 11 June in the south (Fig. 59). The spring counts of blackburnians by Frank Smith and his students (1904-1925) in east-central Illinois were similar to ours (1956-1979).

Blackburnians showed no consistent pattern of habitat use, occupying woody habitats in general (Table 21). They were absent from loblolly pine plantations in southern

Illinois, but most transient warblers were also absent from these plantations.

The males sing during their spring sojourn, but the song is not loud and does not increase their conspicuousness as much as it does in some species (e.g., cerulean, prothonotary). Farwell (1919) described the song as starting like a redstart's song, then ascending in key, and ending in an attenuated, very high-pitched squeak. Silloway's (unpublished 1923) phonetics for the song are "Swee-swee-swee-swee-zee-zee-e-e."

TABLE 21.—Population densities of Blackburnian warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (25 April-1 June)						
Mature bottomland forest	Piatt (C)	1979-1980	6	123	9.2	3.3
Mature bottomland forest	Johnson (S)	1979-1981	11	224	7.4	2.3
Mature upland forest	Piatt (C)	1979-1981	10	199	13.4	5.7
Mature upland forest	Pope (S)	1979-1981	11	226	7.5	0.7
Forest edge and shrub	Piatt (C)	1979-1981	7	142	7.2	1.4
Forest edge and shrub	Pope (S)	1979-1981	12	237	4.1	0.3
Fall (21 August-5 October)						
Woods (unspecified)	Central	1906-1909		21		1.9
Mature bottomland forest	Piatt (C)	1979-1980	11	224	40.4	6.8
Mature bottomland forest	Johnson (S)	1979-1981	11	235	7.2	1.4
Mature upland forest	Piatt (C)	1979-1981	15	292	8.0	2.2
Mature upland forest	Pope (S)	1979-1981	11	231	7.4	1.0
Forest edge and shrub	Piatt (C)	1979-1981	16	301	59.3	9.3
Forest edge and shrub	Pope (S)	1979-1981	11	211	2.0	0.2

## Fall Migration

A singing male Blackburnian warbler at Indiana Dunes on 20 July (Ford 1956) was possibly a very early transient. Other early fall records for the species in or near Illinois are 7 August in central Illinois (Kleen & Bush 1972c), 12 August in the north (Gault 1901d, Cooke 1904), and 13–15 August in the south (Brewster 1878b, Gower 1933). Peak numbers have been seen 19 August–11 September in central Illinois (9–20 per day) and 4–15 September in the south (less than 10 per day, Fig. 59). A report of 100 or more having been seen in the St. Louis area on 28 August is exceptional (Short 1938). The last Blackburnians of the season were reported 25 October in central Illinois (Petersen 1965a), 12 October in the St. Louis area (Jones 1935b), and 7 October in the north (Ford 1956). Much of the Blackburnian migration must occur in Illinois in late August, and it is strange that our earliest recoveries of specimens from television towers did not come until 1–2 September (Fig. 59). Whether this relates to weather factors, inadequate coverage of the towers in August, or something about the species' migration, remains to be determined. A total of 114 specimens have been picked up at the towers. Bennett (1952) noted that Blackburnians passed through the Chicago area quickly. His fall counts for Chicago were nearly identical to ours for northwestern Illinois.

As was the case with many species of northern warblers, our counts of Blackburnians were consistently higher in east-central than in west-central Illinois, both in spring (by a ratio of 5 in the east to 1 in the west) and fall (7 to 1). The differences may relate to habitat availability, forest being about nine times more available in the western counties than in the eastern counties censused. That fact would not account for differences between spring and fall, however. At Chicago, Dreuth saw Blackburnians with nearly equal frequency in spring and fall. Our counts showed a ratio between spring and fall of 1.0 to 1.5 in the north, 1.0 to 1.3 in central

Illinois, and 1.3 to 1.0 in the south. The spring-to-fall ratio in our transect censuses was 1.0 to 2.9 in central Illinois and 1.3 to 1.0 in the south. In a sample of 30 specimens from television tower kills (9–29 September), only 9 were immatures.

## Specimen Data

Gross weights of Blackburnian specimens killed in September were, for 5 adult males, 9.5–12.6 g (mean, 10.10); for 7 immature males, 9.1–14.1 g (mean, 10.90); for 15 adult females, 8.9–11.9 g (mean, 10.27); and for 2 immature females, 7.6 and 8.1 g. Specimens of average weight were moderately fat (2–3 on a scale of 0–5). Hancock (1888a) recorded the gross weight of an adult female killed in May as 8.7 g, and the brain weight for the same specimen as 0.356 g—notably lower than brain weights given by Graber & Graber (1962).

Two adult male specimens killed on 17 September were just finishing the molt of body plumage.

## YELLOW-THROATED WARBLER (*Dendroica dominica*)

(Fig. 60)

### Spring Migration

The earliest Illinois records of the yellow-throated warbler are 30 March in southern Illinois, 8 April in central Illinois (K. Spitze unpublished 1979), and 10 April in the north (Mumford 1959a). Peak numbers have been seen 18 April–8 May in the south (11–22 birds per day) and 19 April–12 May in central Illinois (4–8 per day). The records for the yellow-throated warbler in northern Illinois and adjacent Indiana and Wisconsin (usually not more than one per

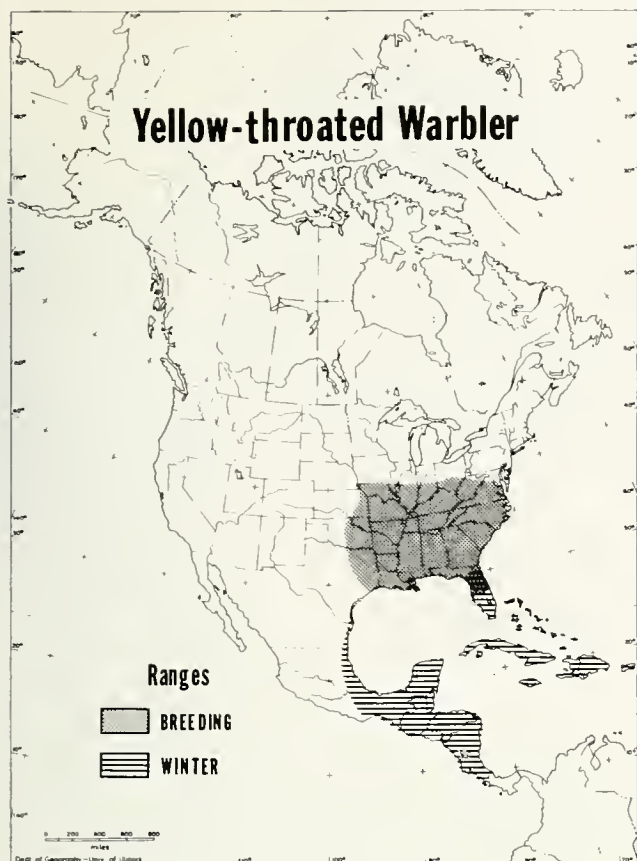


Fig. 60.—General distribution of the yellow-throated warbler.

day) fall between 10 April and 20 June (Fig. 62, Kleen 1975e, Kumlien & Hollister 1951). As the species is not known to breed north of Marshall County (Fig. 61, Princen 1979), most of these northern records may represent overmigration (Bohlen 1978–1979). A bird seen 20 June at Racine, Wisconsin, is the latest northern record (Ford 1956). In the south, spring population densities exceeded breeding populations by about 10 to 1 (Table 22). Also, yellow-throated warblers were found in habitats during spring that were not utilized in June (Table 22). Because this species (like the prothonotary) is often found over water and our census routes usually skirt bodies of water, our census method is biased toward the exclusion of yellow-throated warblers.

A reference to *Dendroica dominica* in central Illinois hedges (Wandell 1948) is almost certainly an erroneous reference to the common yellowthroat (*Geothlypis trichas*).

### Nesting Habitats and Populations

We do not know the sources for Bent's (1953) inclusion of Knoxville, Hennepin, and St. Charles in the breeding range of the yellow-throated warbler and have not included these localities in Fig. 61.

The yellow-throated warbler is another of the species that would be easily overlooked except for its persistent singing in spring. Ridgway (1878) noted that the song resembles

that of the indigo bunting in tone but is easily recognized by its "peculiar modulation," perhaps referring to the questioning note that nearly always ends the song.

Widmann (1907) considered cypress swamp to be the preferred habitat for the yellow-throated warbler, and it is our impression also that population densities are probably higher in cypress than in any other Illinois habitat. As yet, however, no populations have been measured in cypress, and the warbler occurs in riparian habitat well north of the natural range of cypress (Fig. 61). Several authors have mentioned the association of yellow-throated warblers with sycamores, especially large sycamores, as both song perches and nest trees (Ridgway 1889, Butler 1898, Comfort 1954a, Stine 1959). Among our bottomland forest study areas, those having the highest Importance (Y) of sycamore also had highest numbers of yellow-throated warblers, but the correlation between the two was not significant ( $r = 0.504$ ,  $P$

## Yellow-throated Warbler

### BREEDING RECORDS

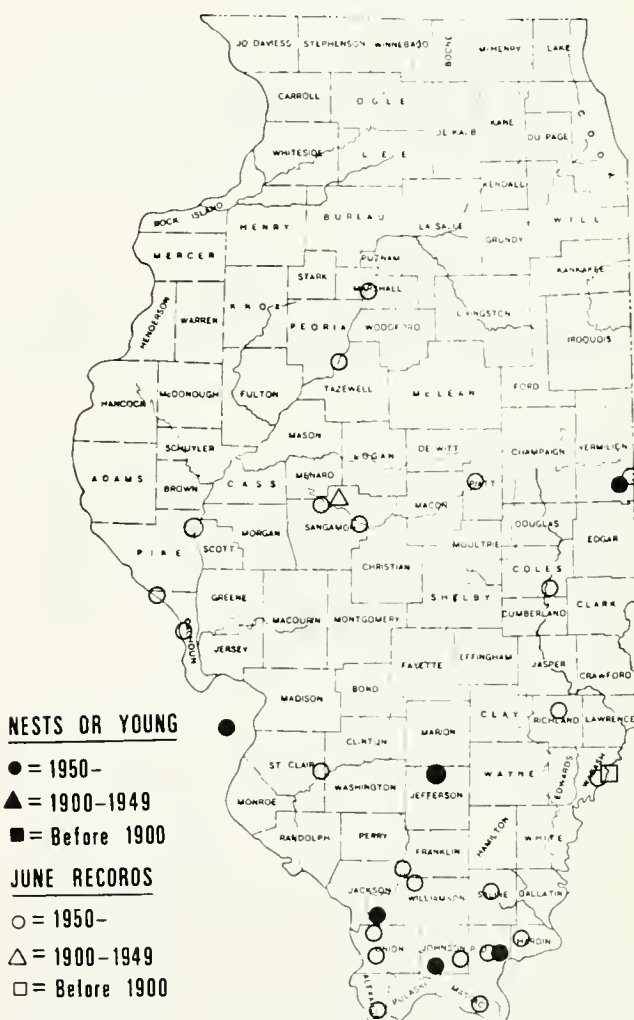


Fig. 61.—Breeding records of the yellow-throated warbler in Illinois.

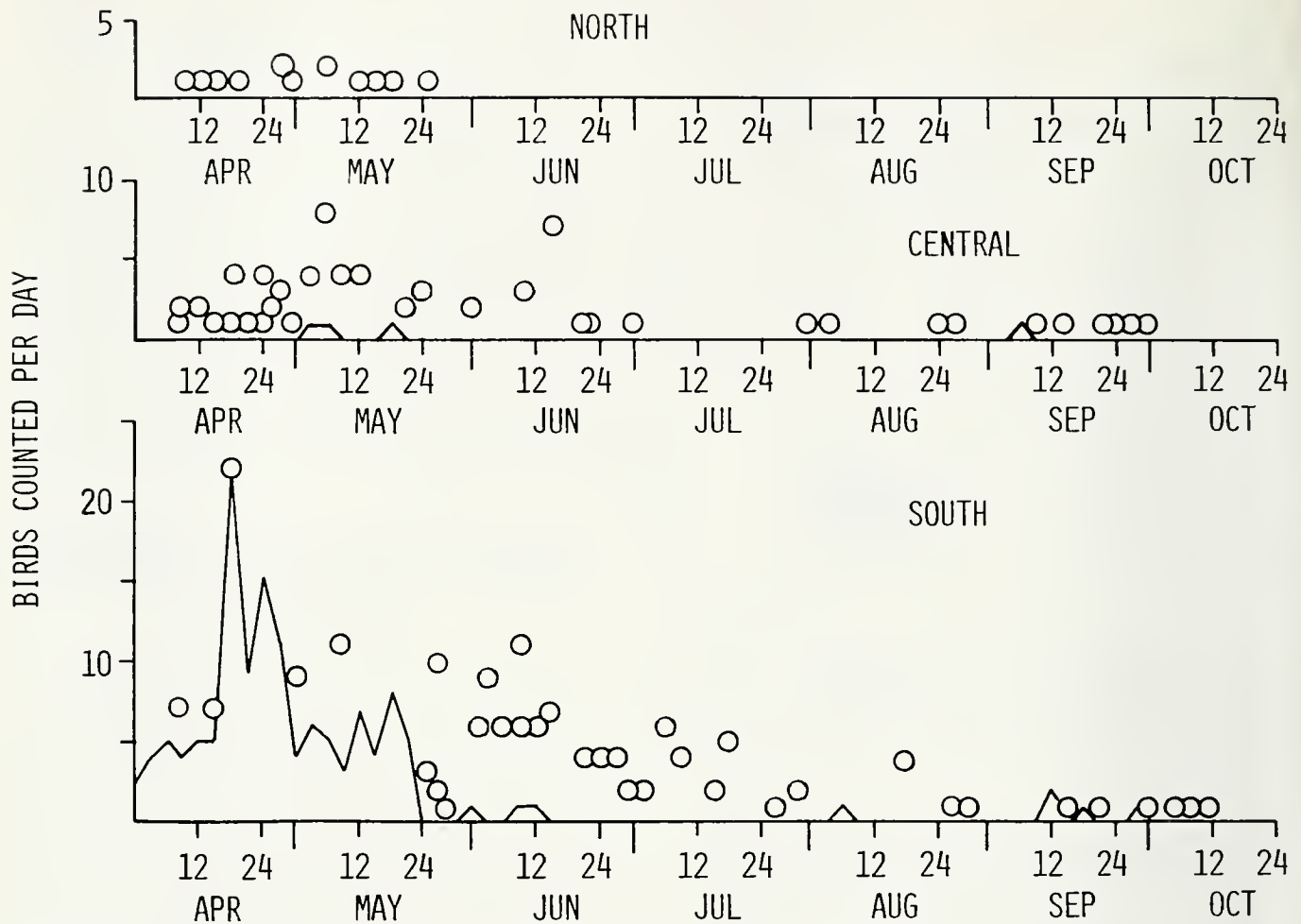


Fig. 62.—Migration seasons of the yellow-throated warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967–1970). Hollow circles represent counts made in other years or by other observers.

= < 0.10). We have observed this species foraging on elms, as did Nelson (1877). Yellow-throated warblers reside along even small streams well above large bottomland areas, and the low density figure for upland forest during the breeding season in southern Illinois (Table 22) represents birds seen near the floodplains of small upland streams. The highest recorded breeding density for the species in central Illinois was in virgin floodplain forest (Table 22).

Comfort (1954a) felt that the population of yellow-throated warblers was increasing in the St. Louis area, but the absence of actual population measurements makes it impossible to prove. Nelson (1876–1877) referred to the yellow-throated warbler as a rare summer visitant to northeastern Illinois.

The nesting cycle of the yellow-throated warbler in Illinois is virtually unknown. Few nests have been found, and because of their inaccessibility, none has had its contents examined. Thus, there are no data on clutch size, incubation period, nesting success, etc. A nest in Vermilion County was being built in a sycamore on 5 May (M. Campbell unpublished 1979). A nest near St. Louis (Comfort 1954a) and

two nests in Jackson County were also in sycamores. One in Johnson County was in a cypress. All the nests were high, 12–18 m. In southern Illinois yellow-throated warblers have been seen carrying nesting material between 14 April and 5 May. The material at different times was gossamer, frayed nylon rope fibers, and the inner bark of elm; the birds flew as far as 200 m from the nest to gather material. Young were being fed in one nest in Jackson County on 6 May.

### Fall Migration

As in the case of the cerulean, and to some extent other warblers, yellow-throated warblers become inconspicuous after June, when singing is greatly reduced, and the ratio of our spring-to-fall counts reflects this fact. In southern Illinois we saw 11 in spring to 1 in fall (5.3 to 1.0 in the census transects). In central Illinois the ratio was 3 to 1 (1 to 1 in the census transects). None have been recovered from Illinois television towers. Nelson (1877) had no trouble finding this species near Mt. Carmel, 30 August–2 September, when he collected 36 specimens that foraged regularly in a group of

TABLE 22. — Population densities of yellow-throated warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (6 April-29 May)						
Mature bottomland forest	Piatt (C)	1979-1980	8	165	1.9	0.2
Mature bottomland forest	Johnson (S)	1979-1981	21	436	21.1	4.1
Mature upland forest	Pope (S)	1979-1981	22	433	2.0	0.2
Forest edge and shrub	Pope (S)	1979-1981	17	337	4.0	0.2
Pines	Pope (S)	1979-1980	10	179		0.4
Breeding (June)						
Virgin floodplain forest	Sangamon (C)	1948		31		6.0 <sup>a</sup>
					(Snyder et al. 1948)	
Mature bottomland forest	Central	1978-1979	5	132	1.9	0.3
Mature bottomland forest	South	1973-1979	61	1,086	6.1	0.4
Mature upland forest	South	1974-1979	30	580	1.9	0.1
Fall (4 August-22 September)						
Mature bottomland forest	Piatt (C)	1979-1980	13	265	1.9	0.1
Mature bottomland forest	Johnson (S)	1979-1981	12	258	9.3	1.5

<sup>a</sup> Census based in part on coverage in April and May.

elms. All of our fall records are for birds in bottomland forest (Table 22). The latest record of a yellow-throated warbler in Illinois is 11 November in central Illinois (Kleen 1976d). This was possibly an accidental record of an eastern bird, as the specimen was very long billed (H.D. Bohlen unpublished 1976). A few yellow-throated warblers have been seen in Illinois after September, as late as 11 October in the St. Louis area (Cooke 1888).

In the series of specimens collected by Nelson (1877) at Mt. Carmel, some had nearly pure white superciliary lines, and others, bright yellow lores. Ridgway (1882) characterized the form *Dendroica dominica albilora*, the race expected in Illinois, as frequently having lores as yellow as they are in eastern birds, but always being smaller, especially the bill.

## CHESTNUT-SIDED WARBLER (*Dendroica pensylvanica*)

(Fig. 63 and 64)

### Spring Migration

The earliest reports of chestnut-sided warblers in Illinois were 14 April in central Illinois (R. Chapel unpublished 1977), 20 April in the St. Louis area (Wilhelm 1957), and 1 May in the north (Gault 1901c). Specimens killed at central and northern Illinois television towers, 16 and 21 May, indicate nocturnal migration on those dates. Peak numbers of chestnut-sides have been seen 2–18 May in the south, 9–27 May in central Illinois, and 14–28 May in the north (Fig. 65). Peak counts in all regions usually range from 15 to 40 birds

per day, but frontal storms sometimes concentrate migrants of this and other species and produce counts of 100 or more per day (Wasson 1957, Graber 1962b). Chestnut-sides are particularly common in some years in northern Illinois

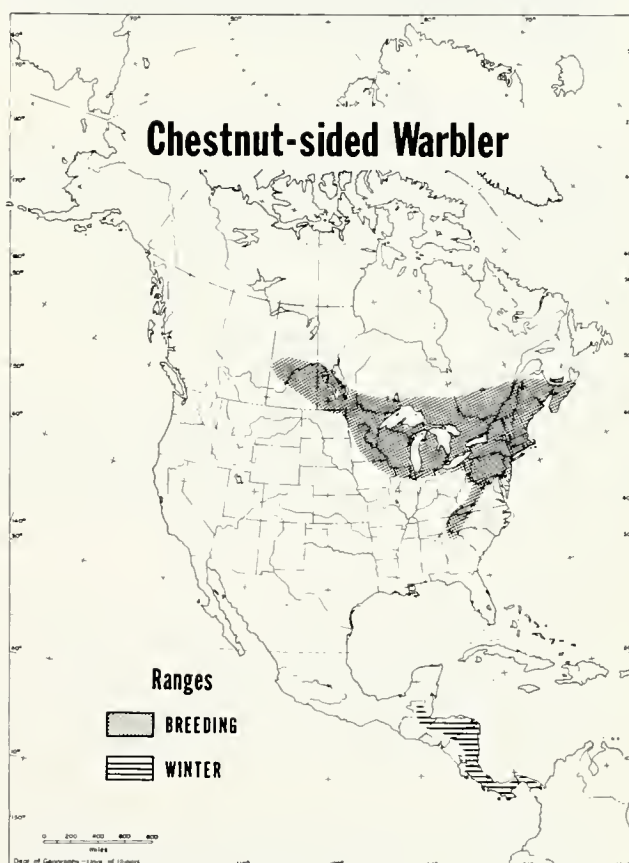


Fig. 63. — General distribution of the chestnut-sided warbler.



Fig. 64. (Left) Adult chestnut-sided warbler in spring plumage. Photo by Dr. William Beecher. (Right) Adult chestnut-sided warbler in fall plumage.

(Wilson 1904, Ferry 1908, Moyer 1933). The end of the spring migration may be obscured by a sparse breeding population, especially in the north (Fig. 65). June records may represent either migrants or local nesters. In the St. Louis area, where there are no recent nest records, chestnut-sides have been seen as late as 7 June (Comfort 1942). Coursen (1947) reported a chestnut-side that was probably a transient in Cook County on 19 June.

Our counts of chestnut-sided warblers in east-central Illinois did not differ consistently or significantly from those of F. Smith and his students (1904–1925). Populations were relatively uniform in woody habitats of central Illinois, but were low or lacking in pines and upland deciduous forest of the south in both spring and fall (Table 23).

### Breeding

Chestnut-sided warblers are fairly persistent singers even as migrants though our impression is that they sing less in southern Illinois than they do in the central and north. The song has been compared to that of the yellow warbler (Ridgway 1889, Farwell 1919). Silloway (unpublished 1922) gave phonetics for the song as, "Reeter-reeter-ree-see-you," rapidly delivered with the emphasis on "see." Though the song undoubtedly increases the species' conspicuousness in spring (versus fall), the effect is not as great as in the cases of the cerulean and yellow-throated warblers, as those species

tend to stay high in the trees, whereas the chestnut-side often forages within 10 feet of the ground.

Though the only recent summer or nesting records of the chestnut-side in or near Illinois are for the northern and central regions, the species bred as far south as St. Louis in the last century (Fig. 66, Gault 1892). Smith's reference (in Gault 1892) to having found six nests in a day at St. Louis implies a notable population. This southern part of the population is probably gone entirely but is possibly being overlooked, as there are few observers in southern Illinois. Ridgway's (1889) June record of a pair in Richland County possibly refers to transients. In addition to records shown in Fig. 66, there are June breeding records for unspecified localities in Lake County (Gault unpublished 1885, Kleen 1978–1979), Will County (Nolan 1956c), and Marshall County (Barnes 1890).

The nesting habitat is shrub and forest edge. Baird et al., (1874), Gault (1892), and Widmann (1907) referred to the habitat in the south as scrub oak and thickets of blackberry and hazel. The habitat was similarly described in the northern and central regions (Tuttle 1918, DuMont 1936). Barnes (1890) indicated that chestnut-sides preferred bottomland, but he worked mainly in bottomland areas, and other chestnut-side habitat descriptions are of upland areas (Tuttle 1918, Nolan 1958). In the north we have found chestnut-sides during the breeding season in both kinds of areas.

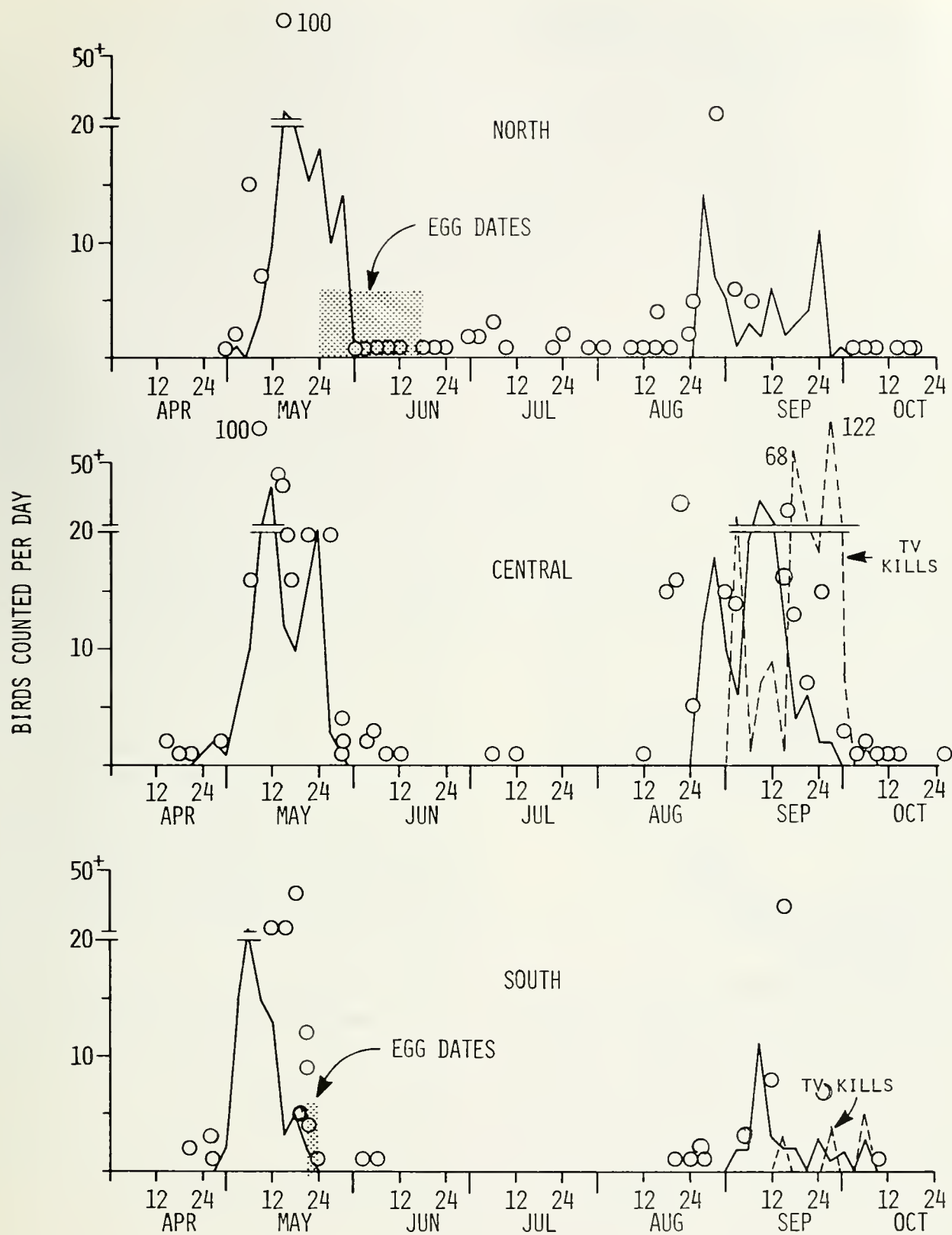


Fig. 65. Egg-laying and migration seasons of the chestnut-sided warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Shaded areas show the span of dates during which eggs have been found. Dash lines show numbers killed at television towers during fall migration in Illinois.

# Chestnut-sided Warbler

## BREEDING RECORDS

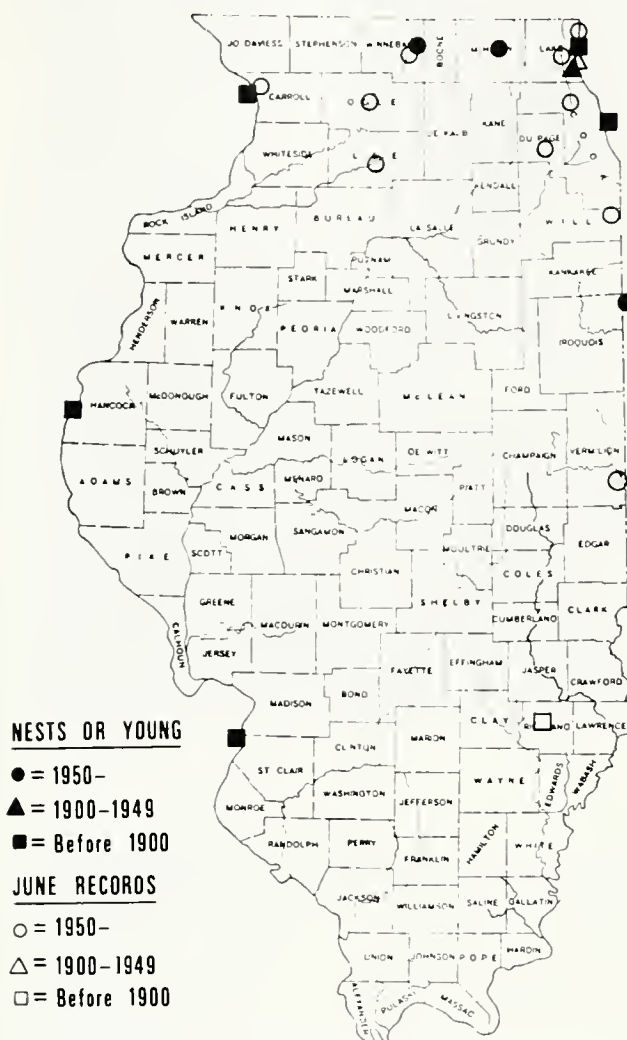


Fig. 66.— Breeding records of the chestnut-sided warbler in Illinois.

To our knowledge the only breeding population of chestnut-sided warblers ever measured in Illinois was in McHenry County, where Mrs. William Carroll (unpublished 1962) found two nests and possibly three pairs on 7 acres.

Nests are built in bushes along the edge of a thicket or young woods (Ridgway 1889). The only plants actually named as nest sites are "Indian current," presumably *Symphoricarpos orbiculatus* (DuMont 1936), and "hazel," possibly *Corylus americana* (Philo Smith unpublished 1891, ISM oological collection). Heights of six nests ranged from 1 to 3.5 feet (mean, 2.3), the three St. Louis nests being a foot higher than those in the north.

The three St. Louis nests each had 4 eggs and apparently no cowbird parasitism. In McHenry County one nest had 5 eggs, and four parasitized nests had, respectively, 4, 3, 1 and 0 host eggs (Thompson & Robinson 1963, Mrs. William Car-

roll unpublished 1962-1966). A nest in Winnebago County was also parasitized (L. Johnson unpublished 1958), making the incidence of parasitism very high—71 percent in a sample of seven nests. Data on nesting success and productivity are lacking, but for the above sample would be low.

Chestnut-sided warbler nests with eggs have been found in northern Illinois from 24 May to 18 June (Fig. 65). Ford et al. (1934) questioned the data on a nest allegedly of this species with two eggs on 13 May—early for the species. Egg laying in the St. Louis nests began about 20 May. The egg season may extend much later than 18 June. A nest at Willow Slough, (Newton County) Indiana, had eggs in mid-July (Kleen 1974c).

## Fall Migration

The earliest fall records of chestnut-sided warblers in areas where no breeding population is known are 12 August in central Illinois and 20 August in the St. Louis area (Wilhelm 1957). At Chicago a definite migration wave was observed 16-17 August (Nolan 1956a). Peak numbers have been seen 26 August-24 September in northern Illinois (10-25 seen per day), 20 August-13 September in the central region (16-37 per day), and 9-26 September in the south (7-36 per day). The last chestnut-sides of the season have been seen 17-19 October in the north (Boulton & Pitelka 1939, F.C. Gates unpublished 1905), 25 October in central Illinois (H.D. Bohlen unpublished 1977), and 9 October in the south (George 1968). Kills of chestnut-sided warblers at television towers have occurred between 2 September and 7 October (Fig. 65), the massive kills of 27-29 September being out of line with the field counts. A total of 419 specimens have been picked up at Illinois television towers.

The ratios of our spring-to-fall counts of chestnut-sided warblers were 2.5 to 1.0 in the north, 1.1 to 1.0 in central Illinois, and 4.0 to 1.0 in the south, but the ratios were reversed in favor of fall within our census transects—1.0 to 3.7 in central Illinois and 1.0 to 3.4 in the south. Annual variation is one possible explanation of the differences. At Chicago, Dreuth saw chestnut-sides with about equal frequency in spring and fall. In a sample of 75 specimens (mainly September) only 18 were immatures, the equivalent of a spring-to-fall ratio of 1.0 to 1.3. Bennett (1952) saw about 25 percent more chestnut-sided warblers at Chicago in fall than we saw in northwestern Illinois.

In the central region our counts of chestnut-sides were consistently higher on the east side of the state than on the west by a ratio of about 3 to 1 in both spring and fall.

In both central and southern Illinois, highest fall populations of chestnut-sides were in bottomland forest (Table 23). As in spring, they were absent from pine habitat, and the population was low in southern upland forest.

## Food

Forbes (1883) examined stomachs of two chestnut-sided warblers (undated) from Tazewell County and found the

TABLE 23.—Population densities of transient chestnut-sided warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (3-29 May)						
Pasture	Central	1907		182		0.7
Mature bottomland forest	Piatt (C)	1979-1980	7	144	13.8	4.2
Mature bottomland forest	Johnson (S)	1979-1981	8	171	14.5	4.0
Mature upland forest	Piatt (C)	1979-1981	11	220	65.2	9.2
Mature upland forest	Pope (S)	1979-1981	9	179	3.7	0.4
Forest edge and shrub	Piatt (C)	1979-1981	9	183	16.2	6.0
Forest edge and shrub	Pope (S)	1979-1981	8	155	8.0	3.9
Fall (12 August-5 October)						
Woods (unspecified)	North	1909		8		5.0
Residential habitat	North	1909		18		2.3
Pastures	North	1909		302		1.1
Woods (unspecified)	Central	1906-1909		21		3.8
Pastures	Central	1906-1909		289		0.1
Mature bottomland forest	Piatt (C)	1979-1980	14	285	102.1	18.8
Mature bottomland forest	Johnson (S)	1979-1981	14	297	68.3	13.5
Mature upland forest	Piatt (C)	1979-1981	18	350	61.9	7.1
Mature upland forest	Pope (S)	1979-1981	13	274	7.4	1.0
Forest edge and shrub	Piatt (C)	1979-1981	20	377	49.0	14.0
Forest edge and shrub	Pope (S)	1979-1981	13	245	7.9	1.5

dominant food to be caterpillars (77 percent of the total) plus 11 percent beetles (scarabs and *Psenocerus supernotatus*) and 5 percent plant lice. B.T. Gault (unpublished 1894) recorded chestnut-sided warblers (at least two) eating green larvae on 17 August in Du Page County.

### Specimen Data

The range of gross weights of chestnut-sided warblers killed between 9 September and 16 October were, for 11 adult males, 8.9-11.5 g (mean = 9.83, SE = 0.26); for 3 immature males, 9.3-11.5 g (mean = 10.50); for 24 adult females, 8.4-11.2 g (mean = 9.49, SE = 0.13); and for 10 immature females, 8.8-10.4 g (mean = 9.35, SE = 0.15). A female killed on 16 May weighed 8.8 g and was very fat. In general, fall specimens of average weight were moderately fat.

## BAY-BREASTED WARBLER (*Dendroica castanea*)

(Fig. 67 and 68)

### Spring Migration

The earliest reports of bay-breasted warblers in Illinois were 22 and 25 April in the north (Walter & Walter 1904, Ford et al. 1934) and 28 April in the south (George 1968). A report of the species in central Illinois on 15 April is early for this typically late migrant (Thorn 1973). Peak numbers have been seen 12-18 May in the south (10-11 birds seen per day) and 14-27 May in the central region (22-28 per day) and

north, where our peak counts were only 5-8 per day (Fig. 69). A large concentration—100 or more—was reported on 14 May in the Chicago area (Wasson 1957). The migration

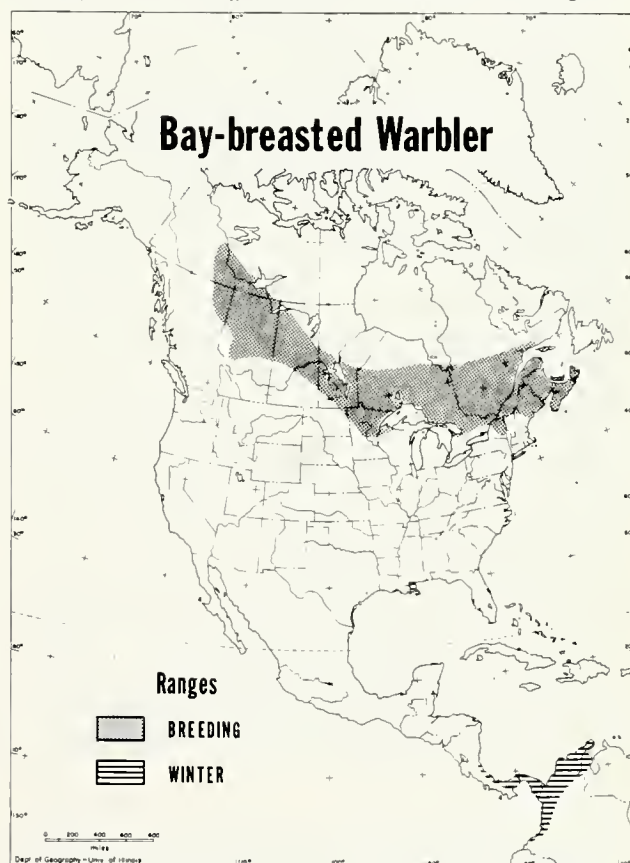


Fig. 67.—General distribution of the bay-breasted warbler.



Fig. 68. — Bay-breasted warbler about life size. Photo taken 24 September at Urbana, Illinois.

of bay-breasts probably regularly extends into June, as indicated by a count of 22, including 14 males, on 5 June at Urbana (F. Smith unpublished 1907) and late records of 18–19 and 30 June in central and northern Illinois (Kleen 1977*d*, 1980–1981, Ford 1956) and 10 June in the St. Louis area (Wilhelm 1957). The counts of F. Smith and his students in east-central Illinois (1904–1925) were similar to ours (1956–1980).

The spring migration of the bay-breast appears to be quick, the habitats being occupied relatively briefly (Table 24). Bay-breasts in central Illinois favored upland forest (oak-hickory) habitat over bottomland and shrub. The species was absent in spring from our pine census area in southern Illinois, but a wave of bay-breasts at Decatur on 19 May foraged intensively on urban plantings of Norway spruce and Scotch pine, hovering at the branch tips in the fashion of parids (Kleen 1976*b*).

Though male bay-breasts sing frequently as they pass through in spring and occasionally even in fall (Widmann 1907), the song is faint and does not greatly increase the bird's conspicuousness. Farwell (1919) referred to the song as monotonous saw-filing—the poorest and weakest of the warbler songs. Silloway (unpublished 1921–1923) compared the song to that of the black-and-white warbler and gave phonetics as: "Weesie-weesie-weesie."

### Fall Migration

The earliest fall reports of bay-breasted warblers were 1 August in the north (Coursen 1947, Kleen & Bush 1972*c*), 7

August in central Illinois, and 26 August in the south (Fig. 69). Peak numbers have been seen 31 August–24 September in the north (18–31 birds per day) and 8–29 September in central Illinois (30–43 per day). The highest fall count in the south (33) came on 14 September, but most of the peak counts there were much lower (7–11 birds per day) and later—to 14 October (Fig. 69). The last bay-breasts of the season were seen 2 and 8 November in northern Illinois (Ford 1956, Kleen 1976*d*), 23 November in central Illinois (Kleen 1977*a*), and 20 October in the south (Bent 1953). The migration is more protracted in fall than spring and brings more birds through the state.

The ratios of our spring-to-fall counts were 1.0 to 9.9 to the north, 1.0 to 1.3 in central Illinois, and 1.2 to 1.0 in the south. Within our census transects the ratios were 1.0 to 4.7 in central Illinois, and 1.0 to 17.0 in the south. At Chicago, William Dreuth saw bay-breasts with a frequency ratio of 1.0 in spring to 1.9 in fall. Bennett's (1952) fall counts of bay-breasts at Chicago were, on average, nearly the same as ours in northwestern Illinois. In a sample of 214 bay-breast specimens killed at television towers between 2 September and 15 October, only 70 were immatures, the equivalent of a ratio of 1.0 in spring to 1.5 in fall. The range of dates of kills of bay-breasts closely coincided with the times when they were seen in the field (Fig. 69).

A bay-breast banded at Blue Island on 23 September 1938 was retrapped there on 25 September 1938—a layover time of at least 3 days (Bartel 1976). Flight direction is in-

○ 100+

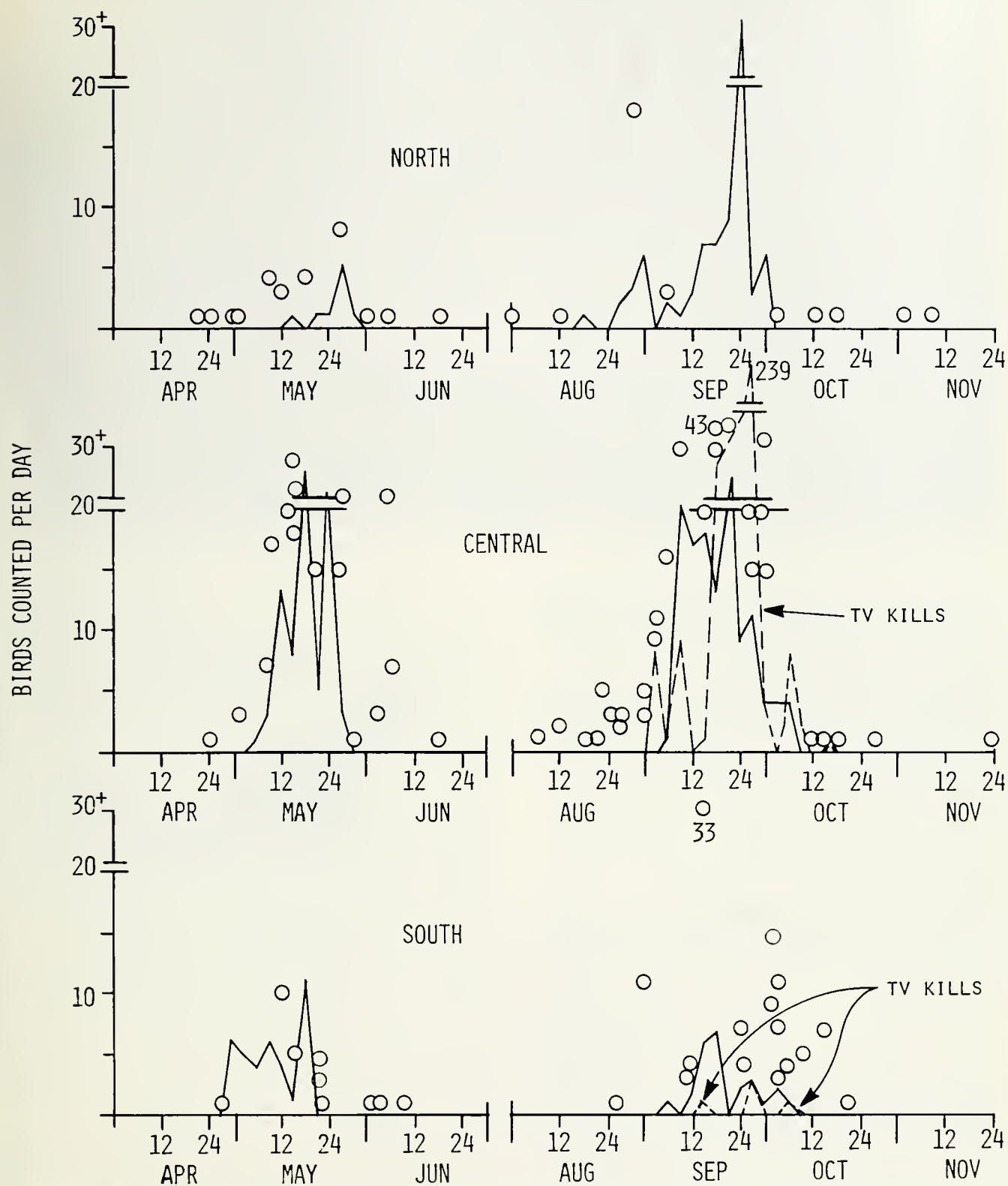


Fig. 69. — Migration seasons of the bay-breasted warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Dash lines show numbers killed at television towers during fall migration in Illinois.

TABLE 24. — Population densities of bay-breasted warblers in Illinois, 1979-1981.

Season and Habitat	County or Region	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
				Maximum	Mean
Spring (8-23 May)					
Mature bottomland forest	Piatt (C)	5	102	23.9	10.7
Mature bottomland forest	Johnson (S)	3	63	6.2	2.6
Mature upland forest	Piatt (C)	5	139	44.8	21.8
Mature upland forest	Pope (S)	4	86	9.3	2.8
Forest edge and shrub	Piatt (C)	4	121	16.2	9.7
Forest edge and shrub	Pope (S)	4	77	2.0	0.5
Fall (7 August-11 October)					
Mature bottomland forest	Piatt (C)	18	366	52.0	14.0
Mature bottomland forest	Johnson (S)	16	333	62.9	11.7
Mature upland forest	Piatt (C)	22	428	115.8	17.6
Mature upland forest	Pope (S)	14	296	25.8	7.8
Forest edge and shrub	Piatt (C)	22	409	126.5	27.2
Forest edge and shrub	Pope (S)	15	283	14.2	2.8
Pines	Pope (S)	7	124	12.0	4.9

licated by the recovery of bay-breasted warbler (sex and age?) banded 22 September 1975 in northeastern Illinois and recovered 10 days later almost due south in western Tennessee (Periodic Banding Report for Region 234, 1976). Another bay-breast (immature, sex?) banded in extreme southern Illinois 2 October 1973 was recovered 19 May 1974 near Detroit, Michigan, (Annual Banding Report for Region 234, 1975) northeast of the banding site, presumably after having travelled southeast to its winter range in northern South America (Fig. 67).

In fall bay-breasted warblers occupied all the woody habitats censused but were least numerous in shrub and pine habitats in the south (Table 24). As they were most numerous in shrub habitat in central Illinois, the attraction was apparently the place, not necessarily the habitat.

### Specimen Data

Stoddard (1921) reported a female bay-breasted warbler collected on 21 May that was nearly as bright as a spring male.

The ranges of gross weights of bay-breasted warblers killed 9 September-15 October were, for 47 adult males, 11.4-14.9 g (mean = 12.75, SE = 0.12); for 29 immature males, 11.0-13.9 g (mean = 13.01, SE = 0.21); for 42 adult females, 10.7-14.7 g (mean = 12.31, SE = 0.13); and for 27 immature females, 9.8-13.8 g (mean = 11.96, SE = 0.17). One adult male killed in May weighed 13.2 g and was very fat. Most of the fall specimens were only moderately fat (2 on a scale of 0-5). Adult bay-breasts had relatively low brain weights, but whether this indicates old age of the population as hypothesized (Graber & Graber 1965) remains to be proved.

### BLACKPOLL WARBLER (*Dendroica striata*)

(Fig. 70 and 71)

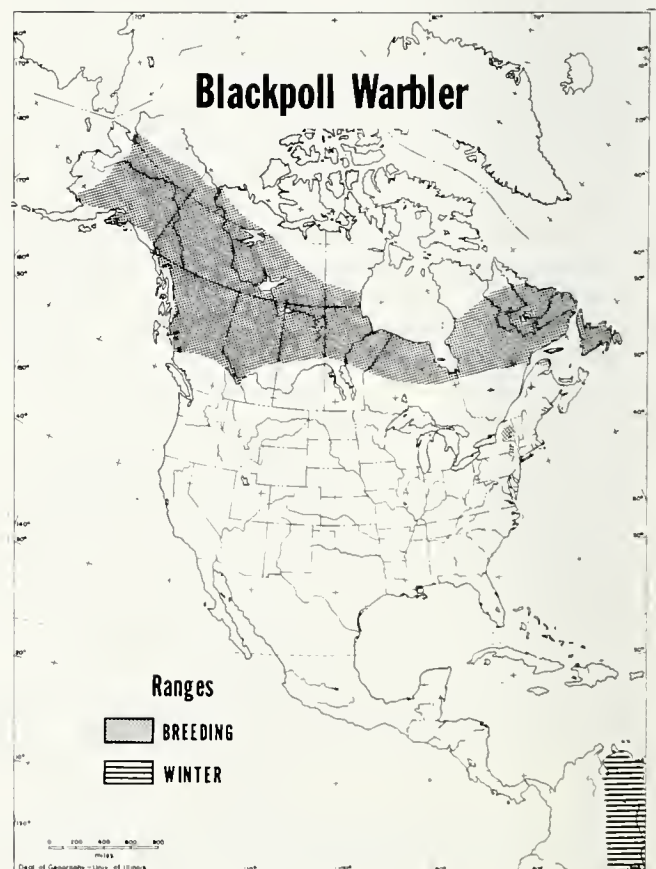


Fig. 70. — General distribution of the blackpoll warbler.



Fig. 71.—Blackpoll warbler. Photo taken 24 September at Urbana, Illinois. The light colored feet are yellow in contrast to the dark feet of the bay-breasted warbler.

### Spring Migration

The earliest reports of blackpoll warblers in Illinois were 21 April in central Illinois (R. Chapel unpublished 1979), 23 April in the south, and 25 April in the north (Brodkorb 1928a). The blackpoll was one of 20 species found earlier at Danville than at St. Louis nearly 100 miles farther south (Cooke 1888). Peak numbers have been seen 28 April–13 May in the south (19–42 per day), 7–24 May in the central region (17–57 per day), and 19–28 May in the north (Fig. 72). High counts for northwestern Illinois (8–12 per day) were well below those for the northeast (24 and 55, Raymond 1916, Graber 1962b). In central Illinois also, our counts were consistently higher on the eastern than on the western side of the state. This was the pattern for many species of warblers.

Blackpolls killed at television towers in central and northern Illinois 9–21 May indicate nocturnal migration in that period (L.B. Hunt unpublished 1970–1974, Eastern Illinois University collections, L. Johnson unpublished 1959). Widmann (1907) noted that male blackpolls had usually passed St. Louis by 15 May, and we observed that the sex ratio was about even in central Illinois on 22 May. The blackpoll is a late migrant, and June records are to be expected every year, the latest reports being 6 June in the St. Louis area (Widmann 1907), 24–25 June—a singing male—at Peoria (P.M. Silloway unpublished 1922), and 13 June—also a singing male—in the north. Male blackpolls are persistent singers, but the song is weak and does not greatly increase the species' conspicuousness though Butler's (1898) comment that males greatly outnumber females in spring

may be related to the effect of song. The observation needs verification. Gault (1901c) described the song as quaint pebble-like clicking notes. Ferry (1908) gave phonetics for the song as "It-tit-tit-tit-it-it"—seven short, high-pitched, sharply accented syllables, wiry and insectlike. Silloway (unpublished 1921) called the song a series of chippylike notes uttered seven or eight times in a monotonous manner. We have found the number of notes to be highly variable, sometimes running 20 or more but always rather faint.

Silloway often noted the blackpoll in oaks and sometimes in elms and willows. In the south, forest edge and bottomland forest were primary habitats (Table 25). In central Illinois densities of blackpolls were high in all woody habitats, but highest in upland forest, where oaks predominate. This pattern of high populations in southern bottomlands and central uplands was true of several species of warblers and implies a possible relationship with oaks, which dominate upland as well as bottomland forests in the south but are much less prominent in bottomlands of central and northern Illinois.

### Fall Migration

The earliest fall reports of blackpolls were 18 August in the north (Boulton & Pitelka 1937b, Clark & Nice 1950), 22 August in central Illinois, and 28 August in the south—two birds in the St. Louis area (Wilhelm 1957). The numbers seen in fall were much below those seen in spring (Fig. 72, Table 25), with high counts recorded 2–15 September in the north (six to seven per day) and 16 September–3 October in central Illinois (five to six per day). Few blackpolls (usually

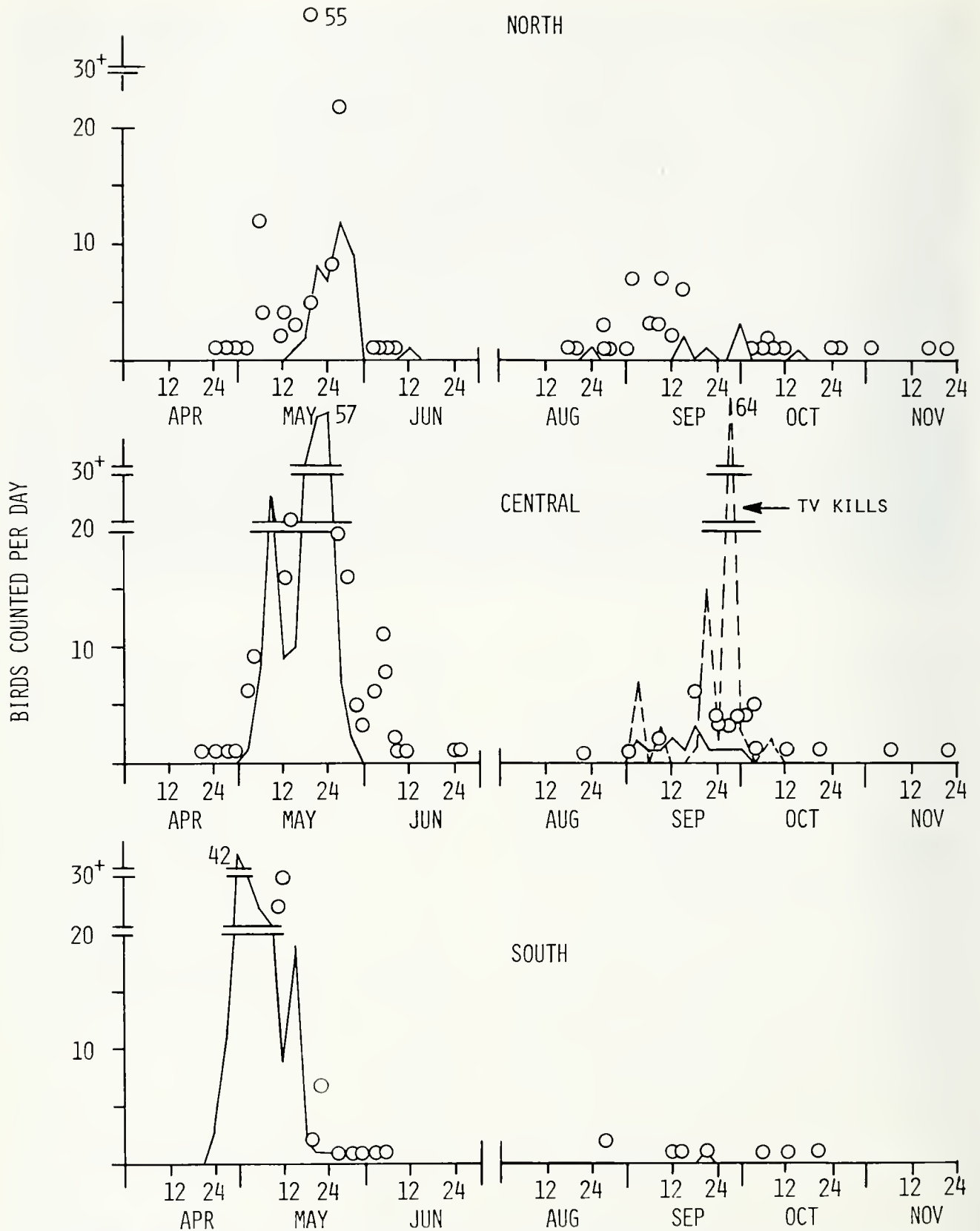


Fig. 72. - Migration seasons of the blackpoll warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

TABLE 25.—Population densities of blackpoll warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (27 April-23 May)						
Mature bottomland forest	Piatt (C)	1979-1980	6	123	27.6	8.5
Mature bottomland forest	Johnson (S)	1979-1981	10	203	24.3	6.2
Mature upland forest	Piatt (C)	1979-1981	7	139	42.0	14.3
Mature upland forest	Pope (S)	1979-1981	10	204	18.1	3.6
Forest edge and shrub	Piatt (C)	1979-1981	6	121	11.1	3.7
Forest edge and shrub	Pope (S)	1979-1981	9	175	46.1	7.4
Fall (22 August-20 September)						
Residential habitat	North	1909		17		2.4
Mature bottomland forest	Piatt (C)	1979-1980	8	165	3.9	1.0
Mature bottomland forest	Johnson (S)	1979-1981	6	129	1.8	0.3
Mature upland forest	Piatt (C)	1979-1981	11	215	8.0	1.6
Mature upland forest	Pope (S)	1979-1981	5	110		0
Forest edge and shrub	Piatt (C)	1979-1981	12	227	4.1	1.0
Forest edge and shrub	Pope (S)	1979-1981	3	60		0

only one per day) have been seen in southern Illinois in fall. Most blackpolls have passed Illinois by mid-October, and the last seen in southern Illinois was 20 October (Bent 1953). There are a few November records (Ford 1956, Clark & Nice 1950, Williams 1975) as late as the 22nd in both northern and central Illinois (Nolan 1957, Kleen 1977a).

Most of the blackpoll's fall migration probably passes north of Illinois (Nisbet 1970). Kills of blackpolls at television towers, 2 September–10 October, coincide fairly well with the field counts, and except for the disastrous kill of 27 September 1972, have generally been low. This situation is reflected in the ratio of our spring-to-fall counts: 13.6 to 1.0 in the north, 20.5 to 1.0 in the central region, and 200.3 to 1.0 in the south. The ratio in our census transects was 4.5 to 1.0 in central Illinois and 81.0 to 1.0 in the south. At Chicago both Dreuth's and Bennett's (1952) fall counts of blackpolls were surprisingly high. The ratio of sighting frequency observed by Dreuth was 1.0 blackpoll in spring to 2.2 in the fall. Bennett's fall counts (1946–1950) averaged 112 times ours in northwestern Illinois. The annual variation in his counts ranged from 6 to 279 percent, and the average was 90 percent per year, well below the difference between his counts and ours. The data imply an unexpected concentration of blackpolls in the Chicago area. In a sample of 30 specimens killed 9 September–14 October, 18 were immatures. This would be equivalent to a spring-to-fall ratio of 1.0 to 2.5 if the migration routes were the same spring and fall, which they are not. In the south, the fall population densities of blackpolls were consistently low in all habitats, and were absent from upland habitats, including pines (Table 25).

## Food

Forbes (1883) examined stomachs of four blackpolls from Tazewell County (date?) and found that about 67 percent of the food was cankerworms (Lepidoptera) and most of

the rest beetles, especially *Psenocerus*—a small borer—plus traces of Hemiptera.

## Specimen Data

The range of gross weights of eight male blackpolls killed in May was 11.5–16.2 g (mean = 13.09, SE = 0.52). The ranges of gross weights of blackpolls killed 9 September–14 October were, for three adult males, 12.3–14.7 g (mean = 13.23); for eight immature males, 11.4–15.0 g (mean = 12.51, SE = 0.59); for six adult females, 10.8–12.7 g (mean = 11.82, SE = 0.31); and for seven immature females, 11.4–16.3 g (mean = 13.33, SE = 0.72). The low weight for adult females may only reflect the small sample size. About half of the immatures were extremely fat. One unsexed immature weighed 22.0 g and was carrying a fat load comparable to, or above, that found in fall bobolinks—renowned for their heavy fat loads (Gifford & Odum 1965).

## PINE WARBLER (*Dendroica pinus*)

(Fig. 73)

### Spring Migration

There are widely scattered winter records of pine warblers in Illinois, and possibly a regular winter population exists in the south (Kleen 1976b, e); thus the onset of spring migration may be obscured. A pine warbler seen 29 March at Springfield was probably a transient (H.D. Bohlen unpublished 1979), and the record likely represents about the beginning of migration in central Illinois. March records in the south (Courtney 1917, Hobbs 1932, Kleen & Bush 1972a)—as many as five on 10 March (Kleen & Bush 1973b)—may represent transients, breeding birds, or winter

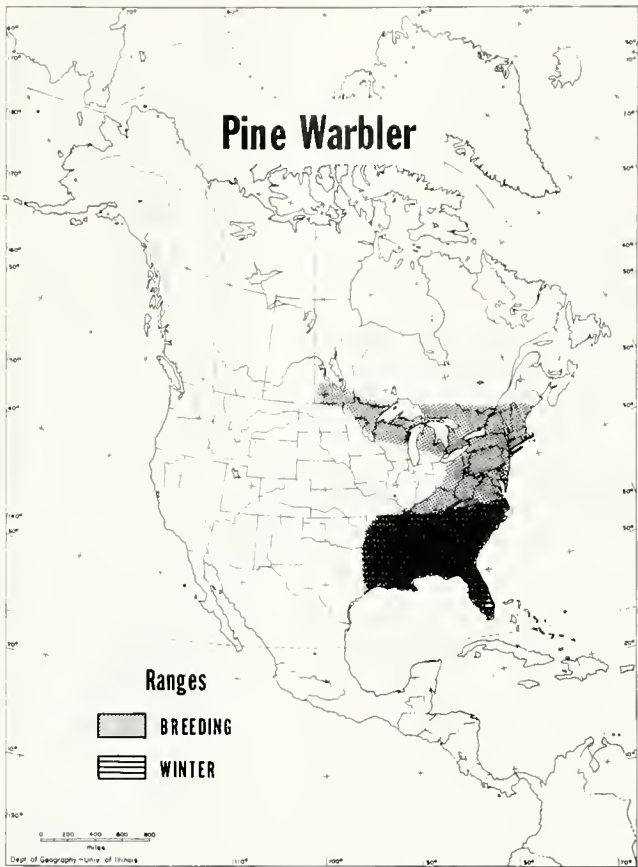


Fig. 73.—General distribution of the pine warbler.

birds. At Pomona the local breeding males arrived by 12 March (George unpublished 1976). The number of records of pine warblers greatly increases in April throughout the state (Fig. 74). Highest numbers have been seen 14 April–6 May in the south (6–9 birds per day), 24 April–11 May in the central region (5–10 birds per day), and 1–21 May in the north (2–3 birds per day). Cooke & Widmann's (1883) reference to a flock of 50–60 pine warblers at St. Louis on 3 May greatly exceeds any other count in or near Illinois. A later paper by Widmann (1907) made no mention of this large flock. The high counts of Smith et al. at Urbana (1904–1925) were consistently above our more recent counts

by a factor of at least three times, and most of the high counts shown in Fig. 74 (central region) are their records. These records, if accurate, imply a decline of the pine warbler population that breeds north of Illinois.

Pine warblers nest in southern Illinois but not, apparently, farther north in the state (Fig. 75); thus, the end of the spring migration is indicated by records on 29 May in central Illinois (DuMont & Smith 1946c) and 3 June in the north (B. Gault unpublished 1917, Ford et al. 1934).

We detected pine warblers within the census transects only in the south, where most birds were in pine habitat. Transients apparently used pine habitat, as the peak spring density was about three times the breeding population, and numbers outside of pine habitat were very low (Table 26). Average densities even in pine habitat were only slightly higher in spring than in June, indicating a generally small transient population.

Breeding

Pine warblers have adapted as breeding birds to the extensive pine plantations of southern Illinois, and they also occur in the natural stands of shortleaf pine (*Pinus echinata*) in Union County and adjacent Missouri to the northwest (Fig. 75). We have not searched for the warbler in native pines in Jackson and Randolph counties. Nelson (1876–1877) reported pine warblers apparently nesting in a northwestern Indiana "pinery," and Sanborn (1922a) referred to a breeding population at Beach. However, recent breeding records are lacking for north and central Illinois, notwithstanding extensive pine plantations in some areas (e.g., Mason, Henderson, and Ogle counties), even though the species breeds well north of Illinois (Fig. 73). We do not know the source of Bent's (1953) reference to breeding pine warblers at Riverside. Ridgway (1889) believed that pine warblers nested in bottomland forest near Mt. Carmel and stated that they were not uncommon there, but there are no recent breeding records for deciduous habitats. We have never encountered the species during the breeding season in our censusing of Illinois deciduous forests. The species of pines used by pine warblers in southern Illinois include at least the native *P. echinata* plus the introduced loblolly (*P. taeda*) and white pines (*P. strobus*), but the species of pine is

TABLE 26.—Population densities of pine warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (5 April-6 May)						
Mature upland forest	Pope (S)	1979-1981	16	310	1.9	0.1
Pine plantation (40 years old)	Pope (S)	1979-1980	10	178	7.2	2.5
Breeding (June)						
Pine plantation (40 years old)	Pope (S)	1979-1980	2	36	2.3	2.2

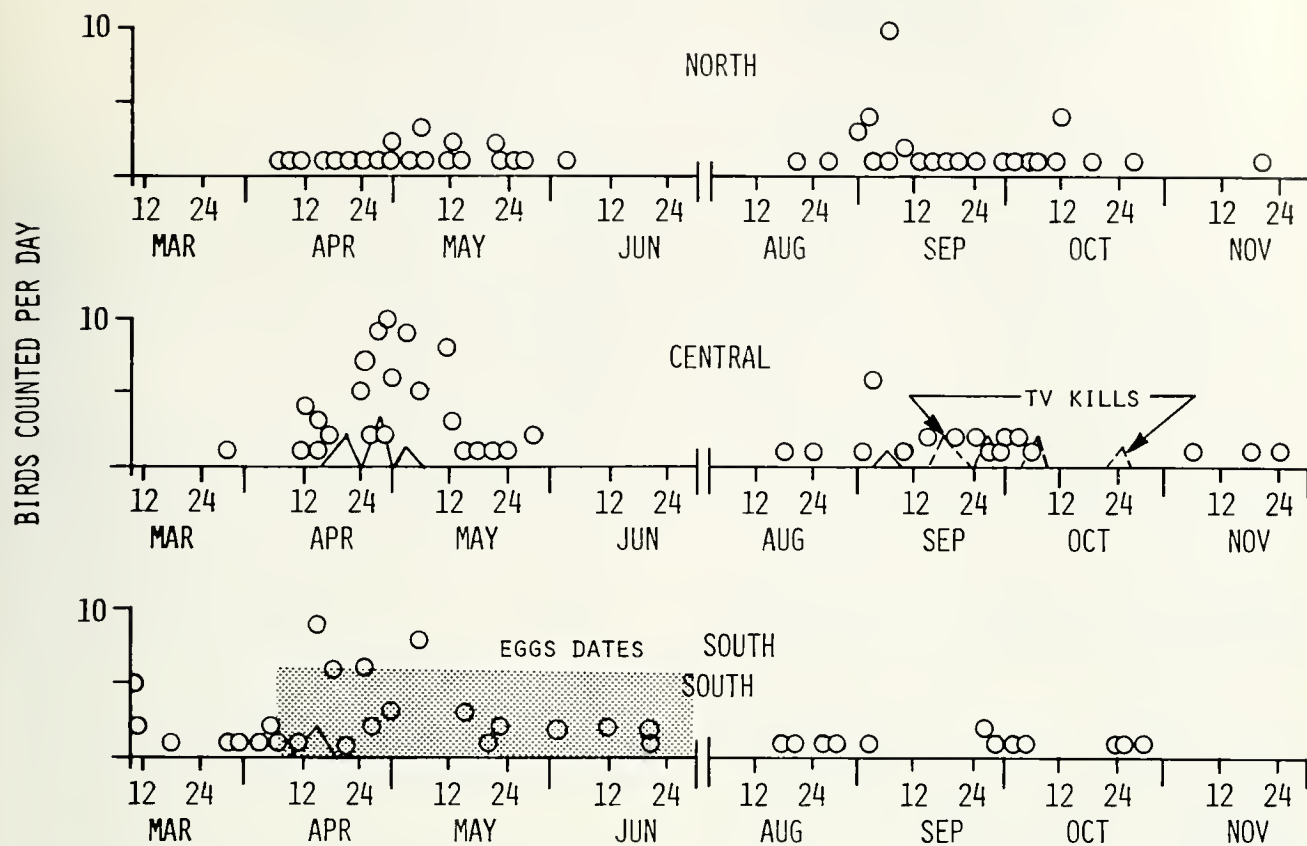


Fig. 74. — Migration seasons of the pine warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967–1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

probably less important than the age of the stand. We have not found them in stands much under 40 years old. A pine plantation near Pomona had a breeding population in only 3 years between 1968 and 1981 (George unpublished 1982).

Pine warblers—possibly winter residents—have been heard singing in southern Illinois as early as 26 February (Kleen 1976e), and they are still singing in June. Ridgway (1889) compared the song to that of the chipping sparrow and worm-eating warbler. A rather sweet, level trill, it is also suggestive of the junco's song.

We have records of only two nests of the pine warbler in Illinois, and the breeding biology is much in need of study. Most of the “nesting” records plotted in Fig. 75 refer to the finding of recently fledged young in juvenile plumage and still in the care of adults. The records include broods of at least one to three fledglings seen between 20 June and 5 August—quite late by comparison with the two actual nest records. A nest near Pomona was 6 m high in a plantation of shortleaf pine, and a nest in Pope County was 7.5 m high in a loblolly pine. The Pomona nest was found on 27 March. On 9 April it contained four eggs, and on 16 April, young, which probably fledged on 24 April. The Pope County nest was

nearly complete on 14 April, and the female was incubating on 25 April.

### Fall Migration

Reports of pine warblers in central Illinois on 17 August (J. Polk unpublished 1977) and in the north on 20 August (Coursen 1947) indicate the start of fall migration. Relatively few pine warblers are seen in fall, and few are killed on television towers (a total of eight has been picked up, Fig. 74). Usually not more than one or two are seen per day, and high counts of 10 at Chicago on 7 September (F.C. Gates unpublished 1908) and six at Urbana on 4 September (F. Smith unpublished) are unusual. Bennett's (1952) fall counts between 1946 and 1950 averaged only about two to three pine warblers per season, and we saw only one in northwestern Illinois in 1968. Dreuth saw pine warblers with a frequency of three in spring to one in fall at Chicago, and in central Illinois we saw eight in spring to one in fall. The fall migration of pine warblers seems even more protracted than those of most warblers, with records in northern and central Illinois extending from 17 August through 25 November (M.

# Pine Warbler

## BREEDING RECORDS

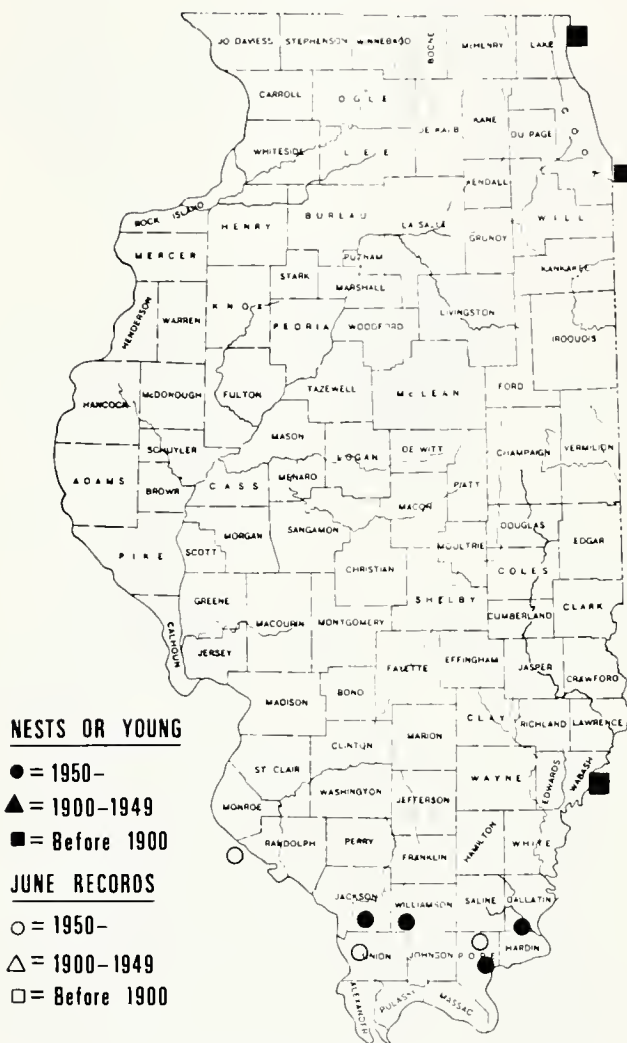


Fig. 75.—Breeding and June records of the pine warbler in Illinois.

Swan unpublished 1971, Kleen 1980a). One pine warbler stayed at Springfield 6–25 November (H.D. Bohlen unpublished 1975). At St. Louis, Widmann (1907) most often noted pine warblers 3–5 October.

Most winter records of pine warblers are for southern Illinois (Cooke 1885 and 1888, Bush 1955, Thom 1968, Lawhon 1967, Homoya 1975, Kleen 1975b), but there is at least one late December record for northern Illinois (Balch et al. 1972). Whether pine warblers remain every winter, even in the south, remains to be determined, but the extreme southern tip of the state may well be a regular part of the winter range (Fig. 73).

### Specimen Data

An immature male killed 27 September weighed 13.3 g, and an immature female killed on the same date weighed 13.4 g. The female was very fat.

## KIRTLAND'S WARBLER (*Dendroica kirtlandii*)

Mayfield (1960) suspected that Illinois was west of the normal migration route of Kirtland's warbler, and he pointed out that most of the Illinois records were old, representing a period in the history of the species when the population was possibly larger. The unquestionable records—those based on collected specimens—are old (Table 27) and support the hypothesis that the total population of Kirtland's was greater at the turn of the century, and hence the Illinois records when there were relatively few observers to detect the birds.

The Illinois records may also imply that Kirtland's warbler, like many eastern migrants, has an elliptical migration that takes birds downwind, southeast in fall, and brings them back farther west in spring because of the influence of prevailing easterly winds at lower latitudes, where they begin the northward flights. Such a pattern might bring at least a few Kirtland's to Illinois fairly regularly in spring but never in fall. Note that all of the unquestionable records, and virtually all the rest, are spring records, 28 April–3 June (Table 27). There are explanations for this fact other than the possible elliptical migration route: (1) increased conspicuousness in spring due to song (note that most of the sexed birds seen have been males) and (2) probably more birdwatching is done in spring than fall although this custom may be changing.

In Table 27 we have listed all the unrefuted Illinois (and border) reports known to us, except Petersen (1964a), because the original observers were known to us to be very inexperienced. Records of nine, (Petersen 1964a) and six (Ford 1956) Kirtland's warblers per day in Illinois are very unlikely. A fall report for the St. Louis area (Comfort 1950) was not for a border locality, and there was some apparent uncertainty about the date (see also Wilhelm 1957, Anderson & Bauer 1968).

Observers of Kirtland's warbler in this region were variously impressed with (1) the bird's tail-wagging behavior, (2) its tameness and slow (for a warbler) movement, (3) that it was in low, edge vegetation or on the ground, and (4) its frequent loud singing (Widmann 1885, Gault 1894, Blackwelder 1899, Moyer 1908). Moyer (1908) described the song as loud and clear, phrased "We-chee, we-chee, we-chee-chee-ree-eee," or "We-see, we-see, see-see-rrrr," the first notes always soft, then the volume increasing.

A recent count of Kirtland's warblers on their Michigan breeding ground indicates a total male population of only 242 birds (Tessen 1980). When we consider that the average spring population of a common species of warbler, such as the Tennessee, is about a million birds in just the southern half of Illinois and that our peak counts of that species are about 100 birds per day, we get a glimpse of how remote is the chance of seeing a Kirtland's. The problem is only intensified by the fact that Kirtland's, if they arrive, arrive at or near the peak of the migration of many other species, and are perhaps lost in the crowd.

TABLE 27. - Records of Kirtland's warblers in or near Illinois.

Date	Locality, County, and Region	Specimen(s) Observed	Reference
8 May 1885	St. Louis, MO (S)	Male	Widmann 1885 <sup>a</sup>
7 May 1894	Glen Ellyn, Du Page (N)	Male	Gault 1894 <sup>a</sup>
25 May 1894	Winnebago (N)		Jones 1895 <sup>a</sup>
22 May 1899	Morgan Park, Cook (N)	Male	Blackwelder 1899 <sup>a</sup>
3 May 1908	Bird Haven, Richland (S)	Male	Ridgway 1914
16 May 1908	La Grange, Cook (N)	Male	Moyer 1908
19 May 1910	Glen Ellyn, Du Page (N)		B.T. Gault unpublished 1910
3 June 1910	Glen Ellyn, Du Page (N)	Female	B.T. Gault unpublished 1910
28 April 1932	Blue Island, Cook (N)		Bartel & Reuss 1932, Bartel 1933
18 May 1934	Jackson Park, Cook (N)		Ford 1956
20 May 1945	St. Louis, MO (S)		Wilhelm 1957
12 May 1947	La Grange, Cook (N)	6 birds!	Ford 1956
4 May 1952	St. Louis, MO area (S)		Comfort 1952
10 May 1979	Chicago, Cook (N)		Kleen 1979b
26 September 1978	Chicago, Cook (N)		Kleen 1979b

<sup>a</sup> Collected specimens.

## PRAIRIE WARBLER (*Dendroica discolor*)

(Fig. 76 and 77)

The prairie warbler provides a rare and welcome exception to the rule that species in our general region have had little ecological study. Thanks to Nolan's (1978) 13+ years of study of the prairie warbler in southern Indiana, it is one of

the best studied species in North America, and his findings on the biology will undoubtedly apply to Illinois populations.

### Spring Migration

The earliest reports of prairie warblers in Illinois are 5 April in the south, 20 April in the central region (M. Campbell unpublished 1977), and 22 April in the north (Fawks



Fig. 76. - Female prairie warbler at its nest. Photo taken 5 June in Pope County, Illinois.

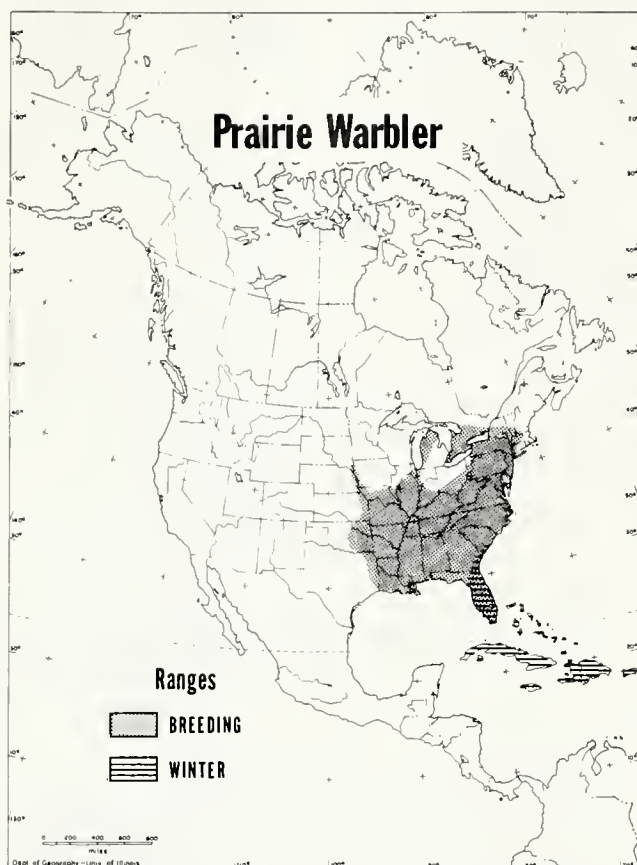


Fig. 77. — General distribution of the prairie warbler.

1973b) (Fig. 78). Peak numbers have been seen 19 April–26 May in the south (12–18 birds per day) though high counts there are about the same through June (Fig. 78), 26 April–13 May in the central region (2–4 per day), and 7–23 May in the north (2–4 per day). The highest counts in central and northern Illinois were made in the early 1900's, and those of Smith et al. at Urbana were higher and also came earlier in

the season than later counts (Fig. 78). These early-season peaks are a frequent pattern of the Smith counts and may only reflect the larger populations coming through the state then—i.e., more birds = expanded migration season. The end of the spring migration is obscured by the breeding population, which is now very thin north of the southern tip of Illinois.

Most of the spring population of prairies was in shrub habitat, but strangely, spring densities were lower than those of the June population (Table 28). Our censuses show slight use of upland forest habitat by prairie warblers in spring.

## Breeding

The precise limits of the area where prairie warblers are common in Illinois have never been worked out, but the clustered records in the south shown in Fig. 79 may indicate most of the area. Ridgway (1881) considered the prairie warbler uncommon in Wabash and Richland counties, where it has continued to be uncommon (Stine 1959). The species has also been rare or uncommon as a breeding bird to the north, where only two areas were reported to have had noteworthy numbers—the Fairbury area long ago (Mundt 1883) and the Indiana Dunes even in recent times (Mayfield 1948, Nolan 1978). Nelson (1876–1877) and Eifrig (1919) considered it very rare in northeastern Illinois. Musselman (1921) stated that the prairie warbler was especially uncommon in western Illinois. It is a common breeder near St. Louis (Hurter 1884, Wilhelm 1957), but areas in Jefferson and Fayette counties, Illinois, that looked suitable for prairie warblers in the 1960's had none. Nolan (1978) listed 26 Illinois counties believed to have breeding prairie warblers. A June record for McLean County was not plotted in Fig. 79 because the locality was not stated (Kleen 1979–1980).

The prairie warbler is one of the few strict specialists of upland, old-field shrub habitat. In the south we have never encountered it in bottomland shrub areas, where yellow warblers and willow flycatchers are most common. In the

TABLE 28. — Population densities of prairie warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (11 April–26 May)						
Mature upland forest	Pope (S)	1979–1981	16	328	2.0	0.1
Forest edge and shrub	Pope (S)	1979–1981	17	337	16.1	8.5
Breeding (June)						
Shrub areas	South	1957–1958		52	7.5	5.4
Forest edge and shrub (25-year-old field)	Pope (S)	1979–1981	3	62	22.0	11.8
Fall (1 August–9 September)						
Mature upland forest	Pope (S)	1979–1981	9	174	5.5	0.7
Forest edge and shrub	Pope (S)	1979–1981	10	198	7.8	2.8

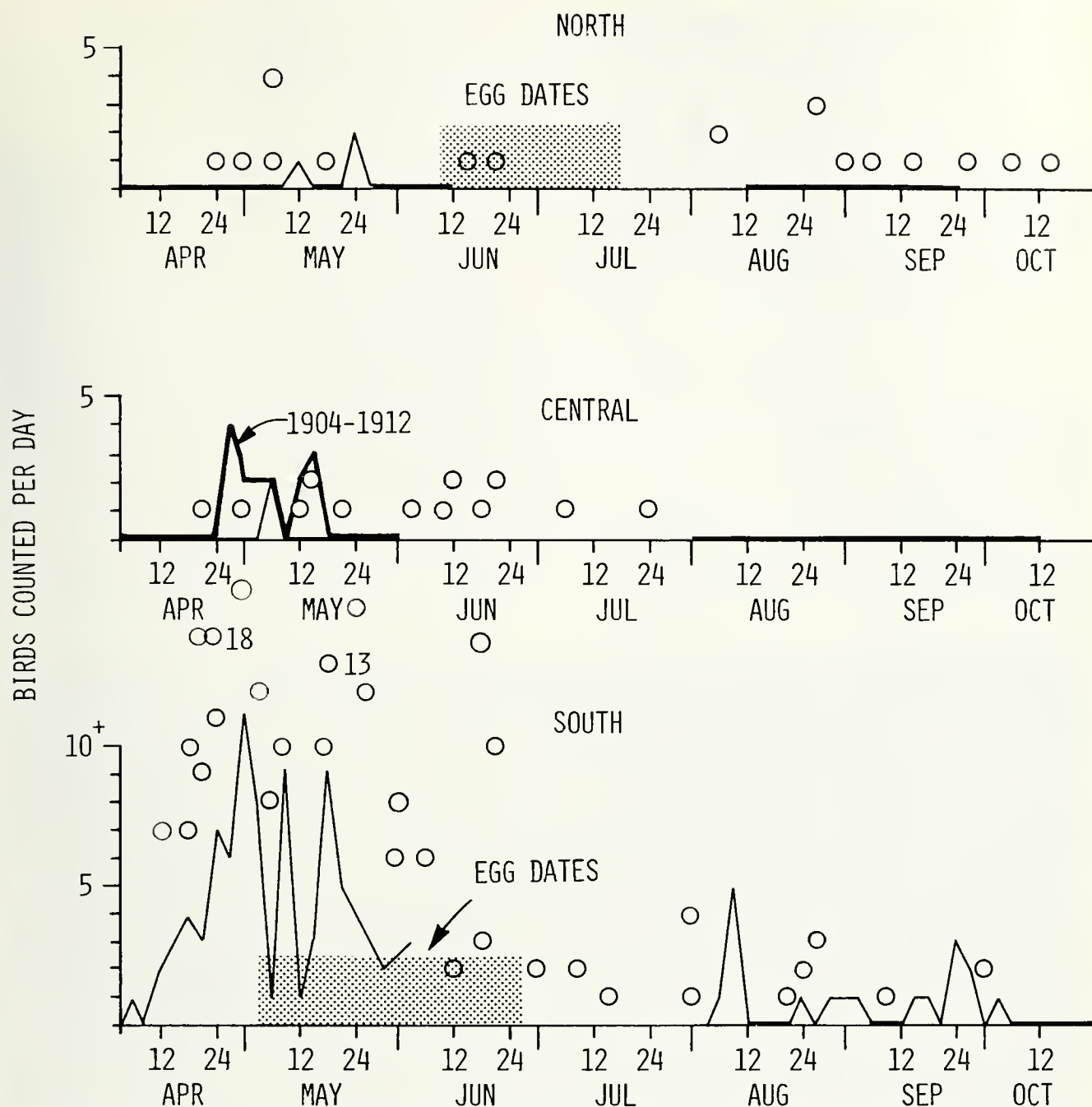


Fig. 78. — Egg-laying and migration seasons of the prairie warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The heavy line (central spring) represents counts of Smith et al. at Urbana. Shaded areas show the span of dates during which eggs have been found.

upland shrub areas of central and northern Illinois, where yellow warblers and willow flycatchers also nest, prairie warblers are absent or scarce, yet the prairie warbler's breeding range extends well north of Illinois (Fig. 77). In southern Illinois prairie warblers occur on very poor soils (over-farmed) in the 19th and early 20th centuries, which probably contribute to the durability of the habitat. The area we censused (Table 28) has been used by prairie

warblers for about 20 years without having the succession set back, and we estimate that it could possibly last another 10 years before losing its open grass-shrub-island characteristics as prairie warbler habitat. On better soils re-forestation would have progressed faster. Brewer, (1958b) found prairie warblers in the 18-to 20-year-old vegetation following strip mining, also probably on poor soils. The area we censused included forest edge as well as shrub areas, i.e., other than

# Prairie Warbler

## BREEDING RECORDS

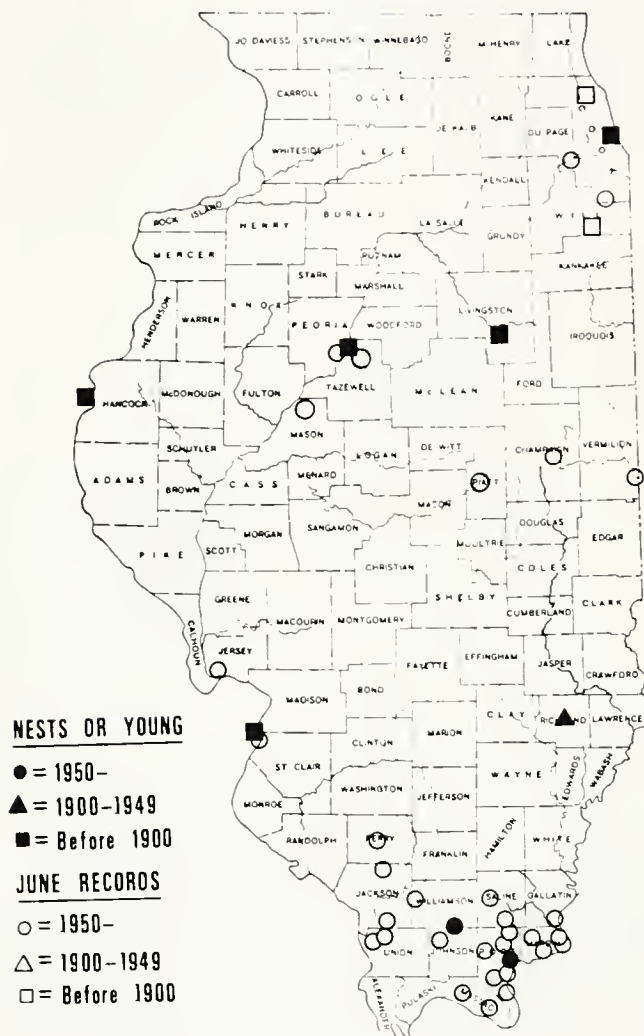


Fig. 79.—Breeding records of the prairie warbler in Illinois.

only optimum prairie warbler habitat, and our densities were generally lower than those reported for several areas by Nolan (1978). Our census area was also much larger than most of the areas censused by others. We often find prairie warblers at the edges of pine plantations or in openings within pine plantations—even 40-year-old stands. However, no population in such habitat has been measured, and our impression is that densities in such areas would be much below those in old-field shrub habitat.

The common song is a vibrant ascending trill, the pattern somewhat suggestive of the song of the field sparrow, which shares the shrub habitat. Egg laying at one nest in Pope County began on 3 May, which would put the onset of nest building about 27 April, according to Nolan's data on the time requirements (6-7 days) for nest building. Most

nests that we found, however, were built in May or June. There are no data on nest sites except in the extreme south, where 15 of 22 nests were in winged elms—trees generally 2-3 m tall—2 were in persimmons, 2 in sassafras, 2 in bramble (*Rubus*)—about 1 m high—and 1 in a 2-m buckeye (*Aesculus glabra*). All but the buckeye are dominant species of the habitat. At least four of the nest trees were draped with Japanese honeysuckle or grape. The nests ranged in height from 0.5 to 3.0 m, and average (1.5 m) was the same as for a much larger sample of nests in Indiana, where however, the dominant nest tree was American elm instead of winged elm. The nests were built primarily of grass and unidentified weed fiber (at least one with grape fiber) fastened together with gossamer, and two contained one or two feathers (of flicker and towhee) in the structure.

The prairie warbler egg laying season in Pope County lasted at least from 3 May to 11 June. In Indiana, Nolan found clutches being started in most years as late as July, usually early to mid-July but once as late as the 23rd. Egg dates (not egg-laying dates) have been recorded as late as 18 July in the north (Ford 1956) though, for possibly the same record, Sanborn (1921c) gave 18 June.

Four May-June nests in Pope County that were not known to have been molested by cowbirds or predators during laying each had 4-egg clutches, and one nest had 5 eggs. Nolan found that incubation was performed by the female only, the period varying from 10.5 to 14.5 days (average, 12). Nestling life lasted about 10 days, and usually both adults fed the young.

A sample of 10 nests in Pope County (1967-1973) had a success rate of less than 10 percent, producing only two young. In a large sample of nests in Indiana, Nolan found success rate to be, on average, about 20 percent, with success best in the better concealed nests. The nests in our sample were found more or less by accident and were likely the nests easiest to find. Of the 10 Pope County nests with fairly complete histories, 9 failed during egg laying or incubation. Two of these each received one cowbird egg, and a third had one of the host eggs pecked, possibly by a cowbird. Judging from the appearance of the nests, we assumed that one was probably destroyed by a mammalian predator and at least three were victims of snake predation.

## Fall

We have seen prairie warblers in southern Illinois that appeared to be in fresh plumage on 28 August, and one on 31 August was still obviously in the molt, but largely through.

Relatively few prairie warblers are seen in the fall, and there are apparently no fall records for the central region (Fig. 78). From the available records it is not possible to determine the onset of fall migration. We have never recovered a prairie warbler from the television towers. In northern Illinois most of the fall records have come in September (Sanborn 1921d). The last records of the season have been 4-14 October in northern Illinois (Bent 1953, Fawks 1970a, F.C. Gates unpublished 1904) and 1 October and 23 November in the south (Mumford 1960a). Our high

counts after August have been two to three prairie warblers per day in the south (Fig. 78). Within our southern census transects we saw 4.4 prairie warblers in spring to 1.0 in fall. Most of the fall birds were seen in shrub habitat, but as in spring, a few were seen in nearby upland forest (Table 28).

## PALM WARBLER (*Dendroica palmarum*)

(Fig. 80 and 81)

### Spring Migration

Except for a few winter records, the earliest reports of palm warblers in or near Illinois were 29 March and 5 April in the St. Louis area (Cooke 1905b, Wilhelm 1957), 3 April in the central region (Hollinger 1916), and 8 April in the north (Eifrig 1922). Peak numbers have been seen 21 April–16 May in the south (17–45 per day), 21 April–13 May in the central region (30–“100’s” per day) and 30 April–11 May (20–100 per day) in the north (Fig. 82). Abbott (1942) observed the peak at Chicago in late April 1934. The high counts of Smith et al. at Urbana (especially 1904–1912) were fairly consistently higher than our more recent counts (Fig. 82). Ridgway (1889) considered the palm to be one of the most abundant spring warblers, and in some years they ap-

pear in very high concentrations (Johnson 1936, Mumford, 1960c). The last palm warblers of spring have been seen 1 June in northern Illinois (Bent 1953), 31 May (a count of seven) in the central region (F. Smith unpublished 1907), and 30 May in the St. Louis area (Wilhelm 1957).

Palm warblers show a broad tolerance in their use of habitats, occurring even in cultivated fields at significant densities (Table 29). They are usually in low vegetation but are often on the ground, where they walk in a graceful gliding manner, the body tilting, and the tail oscillating at each step (Ridgway 1889). The song, a sprightly trill, is soft but becomes conspicuous when large numbers of males arrive together.

### Fall Migration

The earliest fall reports of palm warblers were 4–7 August in northern Illinois (A.O. Gross and F.C. Gates unpublished 1907), 17 August in the central region (Kleen 1978b), and 7 September in the south (A.O. Gross unpublished 1909). Highest numbers have been seen 9 September–9 October in northeastern Illinois (55–150 per day) (Bennett 1952, Kleen 1975a) and 27 September–13 October in the central region (25–57—the latter a tower kill—per day). In the south usually only one to two palm warblers have been seen per day (Fig. 82). Scattered winter



Fig. 80. — Palm warbler. Photo taken 8 May at Lodge Park, Piatt County, Illinois.

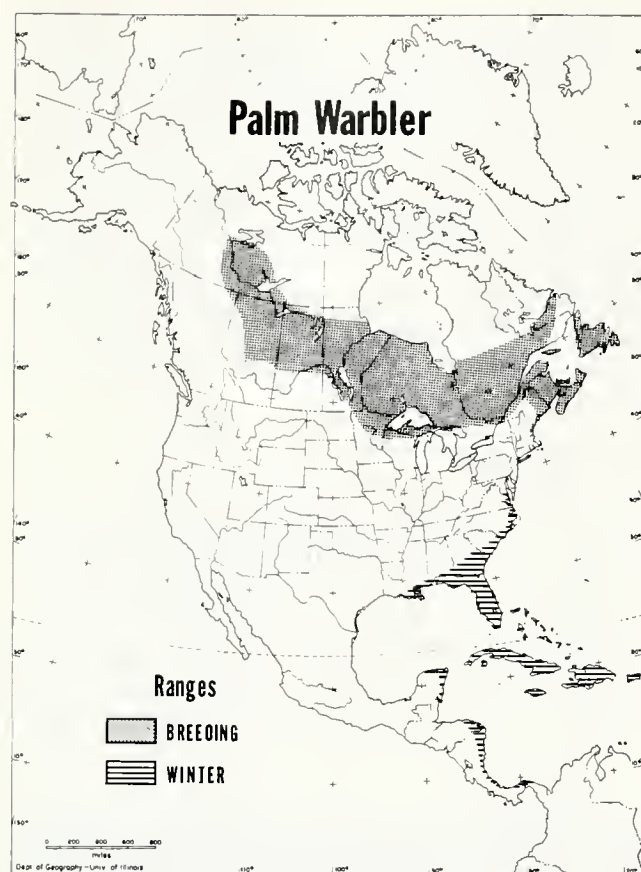


Fig. 81.—General distribution of the palm warbler.

records make it difficult to label the end of the fall migration. It is largely over by 20 October (Fig. 82), but there are a number of November records for northern (Blake 1941,

Coursen 1947, Ford 1956, Fawks 1967a) and central Illinois (unpublished records of H.D. Bohlen, M. Campbell, R. Chapel, C. and M. Hallowell, and C.T. Nearing, 1961–1977, and Kleen 1974a). A palm warbler at St. Louis 5–9 December was possibly a transient (Kleen 1975b). Much of the palm's fall migration must pass north of Illinois, with landings of any size in the state largely confined to the northeastern corner, where Bennett (1952) found that palms arrived especially with strong northwest cold fronts. On average, Bennett saw about 50 palm warblers at Chicago to our 1 in northwestern Illinois. Wilson (1906) and Schafer (unpublished 1914–1923) also found the palm relatively rare or even absent in northwestern Illinois in fall. Annual variation in Bennett's counts ranged from about 40 to 235 percent (average, 98). The kills of palms at television towers show them to be present in fair numbers in east-central Illinois in some years, but in most years the kills of this species are small, a total of 161 having been picked up. Kills of both palm and blackpoll warblers tend to be fewer at the Springfield tower than at towers farther east in the state (Graber 1968). Both species are also seen more commonly on the eastern side of the state in fall than they are on the western side.

The ratio of our spring-to-fall counts was about 10 to 1 in northern Illinois and 100–150 to 1 in the south and central regions, both regions having fall counts of only 1–3 birds for the entire season. The ratio in our transect censuses was 14.1 palms in spring to 1.0 in fall in central Illinois. We did not detect the species in our fall transects in the south. In a sample of 35 palm specimens killed 20–30 September, 27 were immatures.

### Winter Records

Cooke (1885) stated that palm warblers sometimes wintered in southern Illinois, and though specific records are

TABLE 29.—Population densities of palm warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (20 April-20 May)						
Pasture	Central	1906-1907		131		0.3
Small grain	Central	1906-1907		167		3.9
Small grain stubble	Central	1906-1907		46		4.4
Mature bottomland forest	Piatt (C)	1979-1980	4	81	50.6	15.5
Mature bottomland forest	Johnson (S)	1979-1981	11	226	2.3	0.9
Mature upland forest	Piatt (C)	1979-1981	7	142	3.9	1.4
Mature upland forest	Pope (S)	1979-1981	10	204	7.7	0.8
Forest edge and shrub	Piatt (C)	1979-1981	6	125	21.1	5.5
Forest edge and shrub	Pope (S)	1979-1981	11	218	34.3	9.1
Pines	Pope (S)	1979-1980	6	105	8.9	2.3
Fall (4 September-8 October)						
Pasture	North	1909		172		1.6
Corn	Central	1906		432		0.3
Forest edge and shrub	Piatt (C)	1979-1981	16	309	2.0	0.3
Forest edge and shrub	Pope (S)	1979-1981	11	224		0
Mature upland forest	Piatt (C)	1979-1981	14	270		0.3

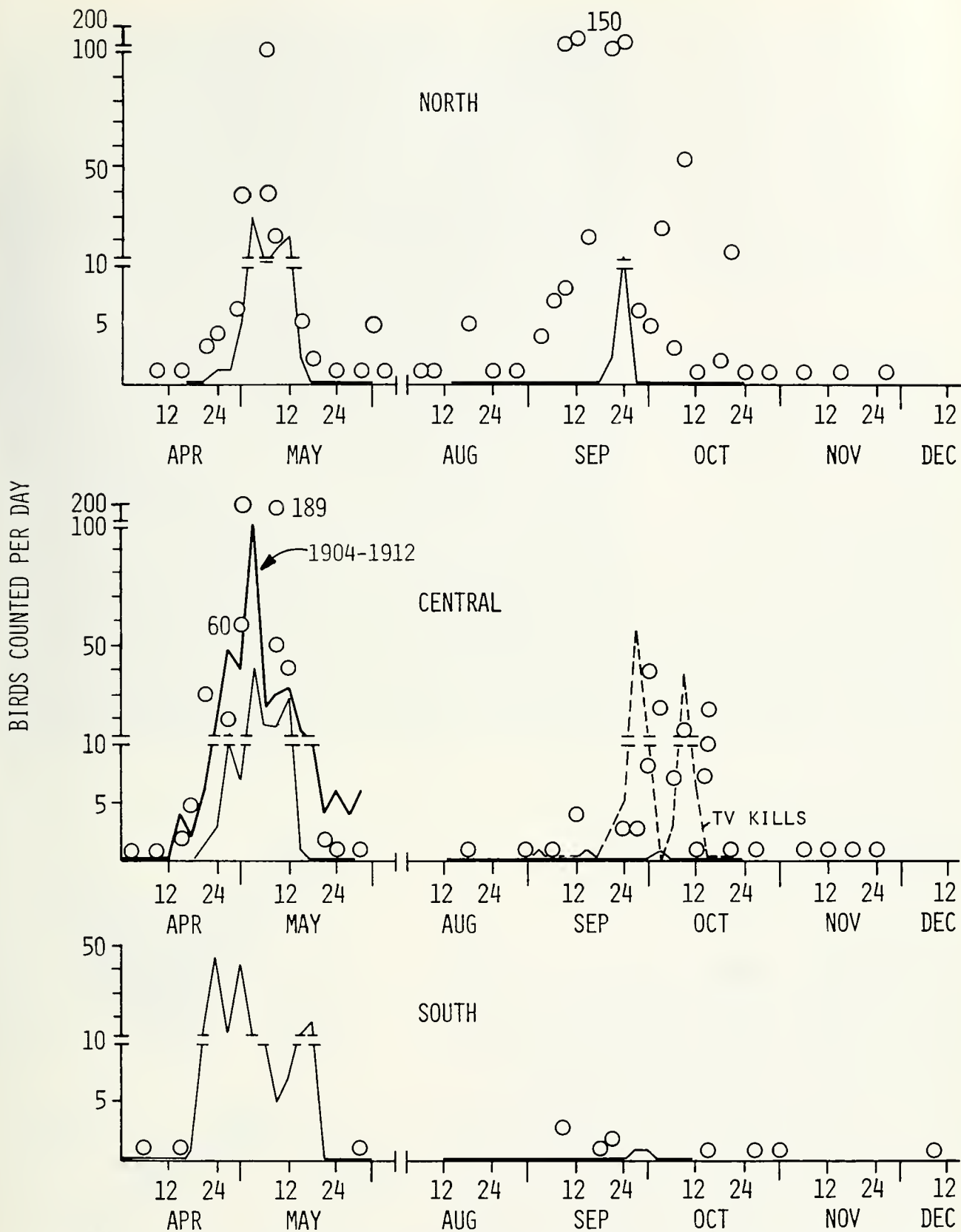


Fig. 82.—Migration seasons of the palm warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The heavy (central spring) represents counts of Smith et al. at Urbana. The dash line shows numbers killed at television towers during fall migration in central Illinois.

lacking there, they are to be expected in view of several late December–January records of palms in Champaign (Kendeigh 1953), Coles and Peoria (Kleen 1975*d*), Macon (Nolan 1956*b*), and Vermilion counties (Kleen 1980*b*) in central Illinois and Cook (Brown & Sanders 1968, Sanders 1975, 1976, 1980) and Du Page counties (Bartel 1949) in the north. It is not clear that these are more than accidental records, although three palms apparently survived at Chicago from at least 15 December to 10 January and one through at least 14 January (Kleen 1980*b*). At Decatur one palm warbler perished during severe weather in January (Nolan 1956*b*). What the food was for these, or any other palm warblers in Illinois, has not been determined.

## Specimen Data

There is great color variation in the palm warbler, some Illinois specimens (especially in spring) being very bright yellow (Ridgway 1876), but despite references to the occurrence of the eastern form ("yellow palm," *D.p. hypochrysea*), there is no evidence that Illinois specimens are other than the western form (*D.p. palmarum*), as stated by Ridgway (1876).

The range of gross weights of five adult male palm warblers killed in May was 9.6–12.8 g (mean, 11.50), all quite to very fat.

The range of weights of palm warblers killed 20–30 September was, for 2 adult males, 10.1–10.8 g (mean = 10.45); for 8 immature males, 10.4–12.4 g (mean = 11.57, SE = 0.25); for 3 adult females, 9.9–11.7 g (mean = 10.97); and for 12 immature females, 9.5–12.0 g (mean = 10.64, SE = 0.20). The fall specimens were also quite to very fat (3 or 4 on a scale of 0–5, 5 being extremely fat).

## OVENBIRD (*Seiurus aurocapillus*)

(Fig. 83 and 84)

### Spring Migration

The earliest reports of ovenbirds in Illinois were 3–4 April in the north (Bartel 1935, Fawks 1969*b*), 5 April in the St. Louis area (Wilhelm 1957), and 14 April in the central region (R. Chapel and the Hallowells unpublished 1977). Highest numbers have been seen 28 April–18 May in the south (4–6 per day), 29 April–24 May in the central region (15–100+ per day), and 3–31 May in the north (7–30 per day) (Fig. 85). A count of 300 at Urbana on 8 May reflects the concentration of migrants by weather (Graber 1962*b*). The high counts of Smith et al. (especially 1904–1916) were consistently above our more recent counts (Fig. 85). The end of the ovenbird's spring migration is obscured by the breeding population. Dreuth's latest spring record of an ovenbird at Lincoln Park, where the species was not known to nest, was 2 June (Clark & Nice 1950).

As was true of many warblers, spring populations of ovenbirds were highest in bottomland forest in the south and upland forest in the central region (Table 30). The ovenbird population is large, and it is not surprising that they were found in all habitats censused; note, however, that spring densities in pines were nearly the same as June densities (Table 31), whereas in all other habitats spring densities were higher than breeding densities. Transients apparently did not avoid the upland forest in central Illinois, which had the highest breeding population of any area we censused (Table 30).

### Breeding

We would expect ovenbirds to nest in every county in Illinois, but, if so, the record is obviously incomplete (Fig. 86). In addition to records plotted in Fig. 86, there are breeding records for unspecified localities in Randolph (Kleen 1980–1981), Peoria and Tazewell (W. Loucks unpublished 1892), Logan (Du Bois 1918), Du Page (Ford et al. 1934), and Lake counties (Sanborn & Goelitz 1915, R. Russell unpublished 1961). The breeding populations are apparently somewhat spotty in the state. Though generally common as a breeder in northern Illinois (Nelson 1876–1877, Wilson 1906, Ries & Werner 1946), the ovenbird was unknown to Eaton (1878) as a nesting bird in the Peotone area (Will County). Barnes' (1890, 1912) extensive studies of the nesting birds of Marshall County produced no

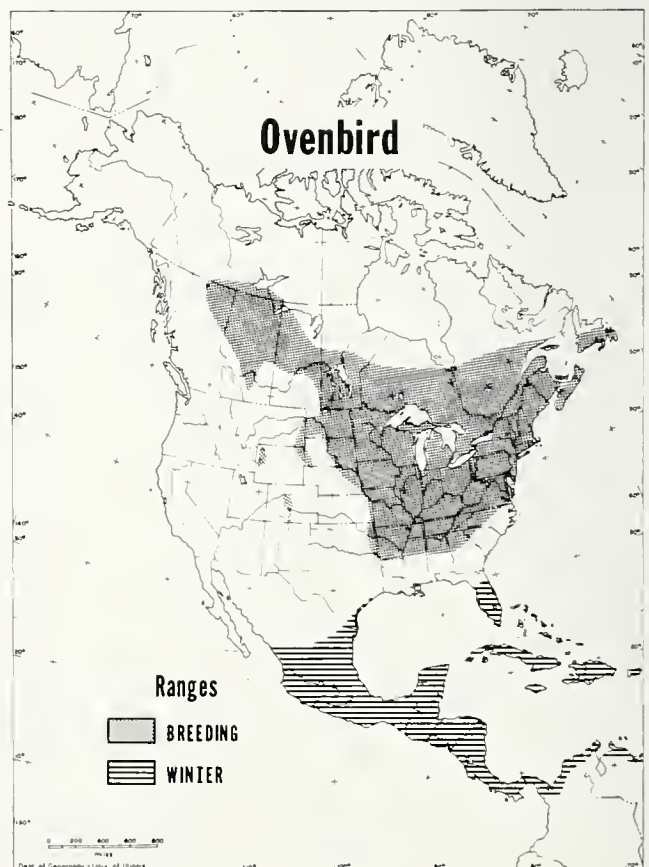


Fig. 83. – General distribution of the ovenbird.



Fig. 84. — Ovenbird. Photo taken 15 May at Urbana, Illinois.

TABLE 30. — Population densities of ovenbirds in Illinois, spring and fall.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (24 April-31 May)						
Mature bottomland forest	Piatt (C)	1979-1980	6	123	4.6	1.6
Mature bottomland forest	Johnson (S)	1979-1981	13	268	14.5	3.6
Mature upland forest	Piatt (C)	1979-1981	12	239	114.1	16.6
Mature upland forest	Pope (S)	1979-1981	14	286	3.8	1.4
Forest edge and shrub	Piatt (C)	1979-1981	9	183	14.1	4.6
Forest edge and shrub	Pope (S)	1979-1981	13	258	2.5	0.6
Pines	Pope (S)	1979-1980	6	110	4.8	1.8
Fall (12 August-10 October)						
Woods (unspecified)	North	1909		8		5.0
Woods (unspecified)	Central	1906-1909		21		3.8
Orchard	South	1908		459		0.4
Mature bottomland forest	Piatt (C)	1979-1980	15	305	29.4	12.5
Mature bottomland forest	Johnson (S)	1979-1981	19	398	21.5	3.6
Mature upland forest	Piatt (C)	1979-1981	20	388	72.5	11.6
Mature upland forest	Pope (S)	1979-1981	17	348	7.4	0.6
Forest edge and shrub	Piatt (C)	1979-1981	21	396	37.5	8.6
Forest edge and shrub	Pope (S)	1979-1981	18	346	4.6	0.7
Pines	Pope (S)	1979-1980	9	160	12.0	1.5

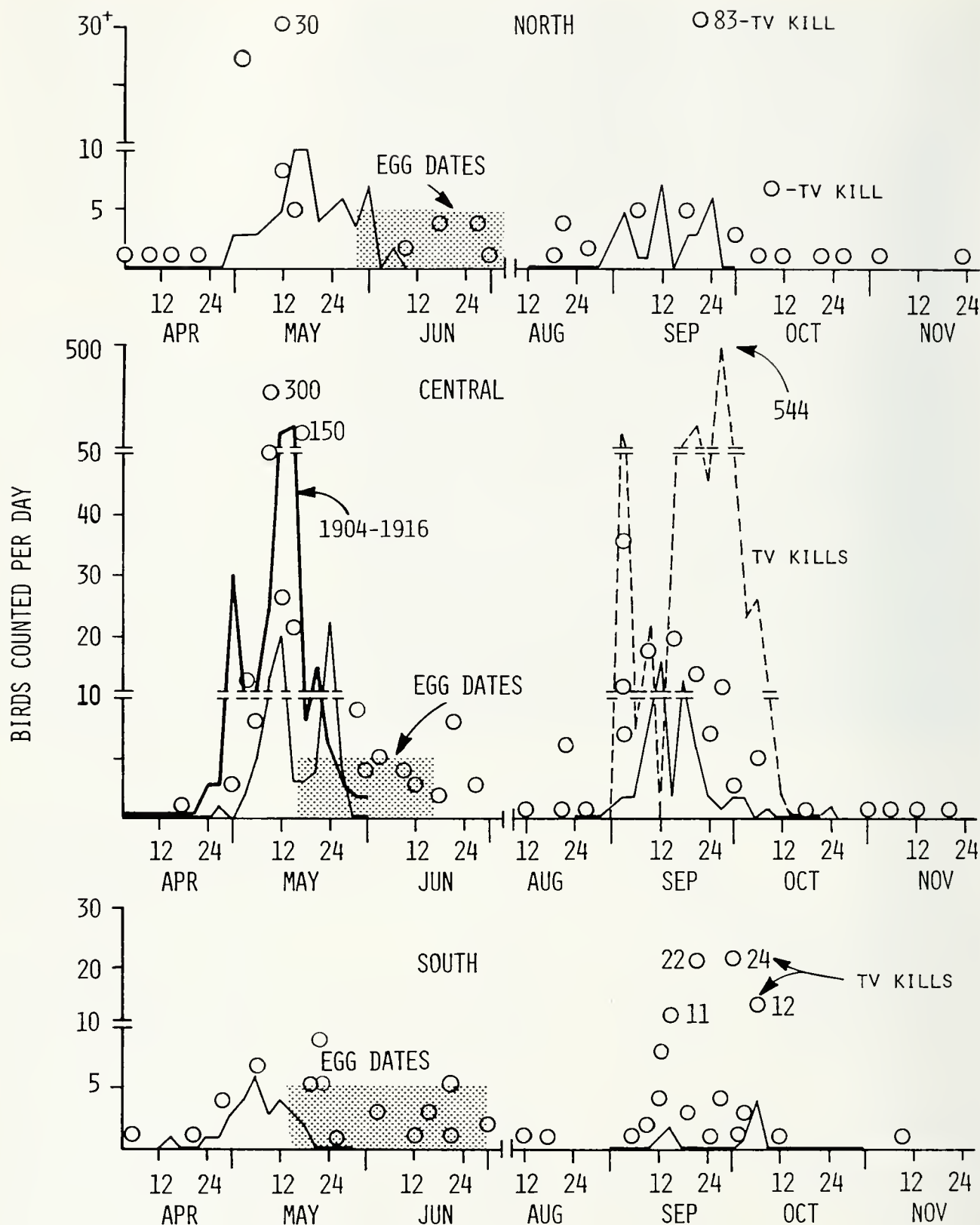


Fig. 85. — Egg-laying and migration seasons of the ovenbird in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Shaded areas show the span of dates during which eggs have been found. The dash line shows numbers killed at television towers during fall migration in central Illinois. The heavy line shows spring counts made in central Illinois by F. Smith and his students.

# Ovenbird

## BREEDING RECORDS

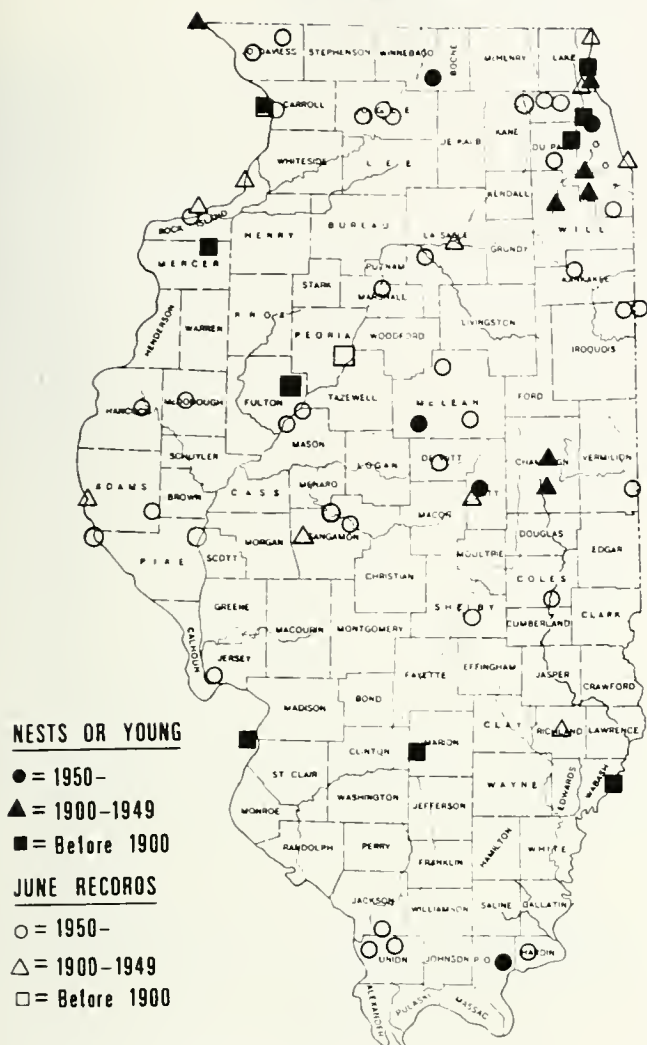


Fig. 86. — Breeding records of the ovenbird in Illinois.

ovenbird nest records, and Loucks (1891) at Peoria considered the ovenbird a rare nester. For most of the southern half of Illinois there are no historical data on the breeding population of ovenbirds. Ridgway (1887, 1889)—probably referring to Wabash County—said that the ovenbird was to be found in any woodland “not too wet” and furthermore that it was a common breeding bird in the outskirts of Mt. Carmel. Widmann (1907) found that the ovenbird was becoming rare as a breeding bird in some areas where it had been common around St. Louis; he attributed the decline to the increased use of woodlands as hog pastures. During the censuses of 1907-1909, and 1957-1958 no ovenbirds were found in the southern Illinois transects (Graber & Graber 1963), but in more recent years, the ovenbird has been detected at low, and possibly increasing, densities (Table 31, Kleen 1977-1978). Though ovenbirds were likely

present in the south throughout the century (George 1969), the numbers between about 1900 and 1970 (at least in some years) were apparently well below those seen by Ridgway. Forest acreage reached its historical low in Illinois around 1920 (Graber et al. 1977), and its quality as habitat may have been similarly low in that period.

Ridgway's (1889) statement about forest “not too wet” and the available census data (Table 31) indicate that prime habitat for the ovenbird is mesic upland or second level forest. Floodplain forests usually lack ovenbirds, but some lowland forests have notable populations (Calef 1953b), probably on the second level ridges above the floodplain. The danger of the floodplain to a ground-nesting species such as the ovenbird is indicated by Calef's (1953a) observation that two of five ovenbird nests were lost to flooding on his study area in May 1950. Sanborn & Goelitz (1915) described ovenbird habitat in Lake County as deep, damp woods. Swink (1976) referred to the habitat as rich woods, especially with sugar maple—a species that thrives in the moist zone above the floodplain. Ovenbirds apparently summer in the sand soil forests of Mason County (Bjorklund & Deters 1972). The highest breeding density of ovenbirds in southern Illinois was in the edge of a pine plantation. Population levels in relation to soil types have not been studied in this or most other species. The degree of forest maturity required for ovenbirds is unknown (Robertson & Snyder 1948).

In the lowland habitat studied by Calef (1953a) 13 ovenbird territories ranged from about 1.3 to 5.5 acres (means, 2.5 in 1950, 4.1 in 1951); i.e., the territories were larger in 1951 when the population was lower.

Illinois has contributed little to the knowledge of the ovenbird's nesting cycle, but there is a fine study by Hann (1937) for nearby southern Michigan. John Burroughs' phonetics for the ovenbird's song, “Teacher-teacher-teacher-teacher-teacher,”—loud and emphatic, the accent on the first syllable with each successive word louder—is very apt (Ridgway 1889). Hann described a more complex, softer flight song of the ovenbird, which is more rarely heard. Freeman (1950b) described a lengthy courtship display involving footwork like the claw-sharpening action of a cat by the displaying bird as it moved along a branch, its tail tilted up, its wings drooped and slightly outspread. Like the water-thrushes, the ovenbird spends much time on the ground and walks with its body tilting up and down (Ridgway 1889).

Gault (unpublished 1885, 1916) observed mating of ovenbirds 11-24 May in northeastern Illinois. Nest building in Michigan began about 9-15 May, and required about 5 days for first nests (Hann 1937). The domed, oven-shaped nest with the entrance on the side is built on the ground by the female and is usually composed of grass, slender weed stems, and dry leaves.

Egg laying began as early as 14-16 May in Michigan, and it would likely be that early in northern Illinois though the available records do not show it (Fig. 85). Egg dates from about 15 May to 30 June in southern Illinois and as late as 9 July in the north (Ford 1956) probably do not include the entire egg season. Hann (1937) determined the incubation period to average 12 days. Incubation was by the female only and began on the day before the last egg was laid. A sample

TABLE 31.—Breeding population densities of ovenbirds in Illinois.

Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
					Maximum	Mean	
Woods (unspecified)	Rock Island (N)	1917–1923	7 years	22	5.9	1.6	J.J. Schafer unpublished 1917–1923
Woods (unspecified)	North	1957–1958		72	12.6	7.9	Graber & Graber 1963
Woods (unspecified)	Central	1957–1958		87	2.1	1.9	Graber & Graber 1963
Woods (unspecified)	South	1907–1909		24		0	Graber & Graber 1963
Woods (unspecified)	South	1957–1958		138		0	Graber & Graber 1963
Oak-maple forest	Champaign (C)	1927–1976	45 years	22	3.6	0.1	Kendeigh 1944, 1948, Kendeigh & Edgington 1977, Johnston 1947
Oak-hickory- maple forest	McLean (C)	1976–1979	4 years	13		6.2	Birkenholz 1977–1980
Second-growth upland forest	Sangamon (C)	1941–1948	4 years	46 +	4.3	0.9	Robertson & Snyder 1948
Wet oak forest	Newton, IN (C)	1974, 197- 8	2 years	11	7.3	3.7	Hopkins 1974a, 1978
Mature bottomland forest	McLean (C)	1950–1951	2 years	25	27.0	22.2	Calef 1953b
Mature bottomland forest	Central	1978–1980	7	154	1.8	0.3	This paper
Mature bottomland forest	South	1973–1980	62	1,108		0	This paper
Mature upland forest	Piatt (C)	1978–1980	3	63	5.8	3.8	This paper
Mature upland forest	South	1974–1980	30	602	1.6	0.1	This paper
Pines	Pope (S)	1979–1980	2	36	4.4	2.2	This paper

of 13 Illinois (and border) nests of the ovenbird had these clutches: 6 eggs, one; 5 eggs, five; 4 eggs, six; and 3 eggs, one (mean 4.5). The data are from old oological records for nests of unknown histories; there are no recent data. Hann found ovenbird clutches for 27 southern Michigan nests believed not to have been molested by cowbirds to average 4.7 eggs, most nests receiving 5 eggs.

Nestling life lasted 8 days on average, but in some instances was as short as 6–7 days. Both parents fed the young, and parental care continued by at least one of the adults—often the male—until the young were at least a month old. The nestlings were fed geometrid larvae and small earthworms at first and later a greater variety of invertebrates. Adults brought food 16 times on the first day and 67 times on the eighth day to a nest with two young ovenbirds (Hann 1937).

Illinois data on rates of cowbird parasitism and nesting success are lacking. Hann found that about 52 percent of ovenbird nests that received eggs were parasitized. Ovenbirds were able to rear as many as four of their own young and as many as two cowbirds together, in which case the number of feeding trips increased to 160 per day on the eighth day. Hann found that cowbirds were the principal source of egg loss by ovenbirds. Illinois nests are also known to have been parasitized (Friedmann 1963). A nest in Champaign County had seven cowbird eggs (Hess 1902), and one in Mercer County, two cowbird eggs and three host eggs (Wilson 1912). A nest in Pope County had two ovenbird eggs and three cowbird eggs. Data are much needed on all phases of the nesting cycle in Illinois, especially on nesting success and pro-

ductivity. Dr. Hann estimated that about 24 percent of the eggs laid produced independent young, with a production of 1.4–1.8 young per female. At least one female attempted to rear two broods.

In southern Michigan Hann (1937) noted that adult ovenbirds disappeared from their nesting areas as early as 5 July and through mid-August, coincidental with the coming of the independence of the young. Whether this disappearance was the beginning of migration, merely a change in habitat usage, or something else is not known.

Hann (1948) also provided data on the survival of ovenbirds in his banded Michigan population. Mortality between the first and second year of banding was about 45 percent. The average minimum life span of adults was about 2.4 years for females and 2.8 years for males. One adult (of 38) survived at least 6 years, and one at least 7 years.

### Fall Migration

In central Illinois we have seen ovenbirds that appeared to be in fresh plumage on 29 August. Holcombe (1938) trapping at Zion caught what he believed to be the first migrant ovenbirds of the season on 26 August, i.e., new birds in the area. Judging from television tower kills, we believe that large migrations of ovenbirds are in progress by at least 2 September (Fig. 85). Probably more ovenbirds have been killed at the central Illinois television towers (1,791 picked up) than any other species. The kills indicate the peak of the fall migration of ovenbirds to be 2 September–7 October, when 100 or more ovenbirds have been killed per night. In the same period, however, our field counts in the central

region were fewer than 20 ovenbirds per day. Many ovenbirds apparently passed unseen in fall. High counts in the northwest in September were only five to seven ovenbirds per day, and in the south only two to eight per day (Fig. 85). Heavy migration in the north is indicated by a tower kill at Orion of 83 ovenbirds on 20 September and the banding of 84 ovenbirds at Blue Island between 21 and 23 September (Boulton & Pitelka 1938c). Most of the ovenbird population has passed Illinois by 10 October, but there are several records even for November (Fawks 1966d, 1969a, Petersen 1969, Kleen 1976a, 1977a, 1979a, 1979d).

As was typical of most warblers, the numbers of ovenbirds counted by Bennett (1952) at Chicago far exceeded (two to one) our counts in northwestern Illinois. Annual variation in his counts of ovenbirds (37–79 percent) averaged 52 percent per year, i.e., somewhat lower than for most warblers. We saw about three times more ovenbirds in spring than in fall in northwestern Illinois. In northeastern Illinois Dreuth saw ovenbirds with about equal frequency in spring and fall, and Holcombe (1929, 1930) and Bartel (1950, 1953) banded ovenbirds in about equal numbers in spring and fall though it is not known whether effort and trap effectiveness were the same in both seasons. Our field counts showed a spring-to-fall ratio about even in central Illinois, and about 4 to 1 in the south, but in the more precise census transects the ratio was 1.0 to 2.4 in central Illinois and 1.0 to 1.4 in the south. In a sample of 714 ovenbirds killed at the central Illinois towers, 9 September–15 October, 60.4 percent were adults, the equivalent of a spring-to-fall ratio of 1.0 to 1.7. When we divided the sample at 26 September into early and late segments, the early (9–25 September) sample was 69 percent adults, and the later sample (27 September–15 October), 54 percent adults, i.e., the equivalents, respectively, of 1.0 to 1.4 and 1.0 to 1.9 from spring to fall.

Ovenbirds used all the woody habitats censused in fall, with highest densities in the south in bottomland forest. Highest densities in the central region were in both bottomland and upland forest (Table 30).

## Specimen Data

Our series of 42 ovenbird skins (4 spring, 38 fall) is so uniform in color that we found it impossible to pick out darker or lighter individuals. They represent the eastern form *S. a. aurocapillus*. Bartel (1969) trapped a largely white ovenbird which did not have pink eyes.

Hancock (1888a) gave gross weights for two female ovenbirds killed in May as 16.5 and 17.1 g. Each of two May females in the INHS collection weighed 19.9 g and was moderately fat. Two males killed in May weighed 17.5 and 21.1 g and had, respectively, little fat and much fat.

The ranges of gross weights of ovenbirds killed 9–25 September were, for 27 adult males, 18.0–26.5 g (mean = 20.56, SE = 0.38); for 15 immature males, 17.5–24.8 g (mean = 20.63, SE = 0.55); for 52 adult females, 17.8–28.3 g (mean = 19.46, SE = 0.24); and for 30 immature females, 17.4–28.9 g (mean = 21.19, SE = 0.51). Ovenbirds killed 27 September–15 October averaged slightly heavier: 50 adult

males, 17.6–27.5 g (mean = 20.91, SE = 0.39); 47 immature males, 17.9–27.7 g (mean = 21.16, SE = 0.39); 95 adult females, 16.3–28.2 g (mean = 20.17, SE = 0.25); and 104 immature females, 16.9–28.7 g (mean = 20.79, SE = 0.27). The differences may represent differences in flying time before the kill (Grabert & Graber 1962). Many of the birds were very to extremely fat, and even those of average weight were quite fat (3 on a scale of 0–5).

Hancock (1888a) and Grabert & Graber (1965) recorded brain weights of ovenbirds, the latter study indicating that about 9 percent of birds classified as adults on the basis of skull ossification were actually, according to brain weight, immature birds of the year.

## NORTHERN WATERTHRUSH (*Seiurus noveboracensis*)

(Fig. 87)

Because of the close similarity in appearance between this species and *Seiurus motacilla* (Balch 1978), there is a distinct possibility that some records have been erroneously attributed in both species.

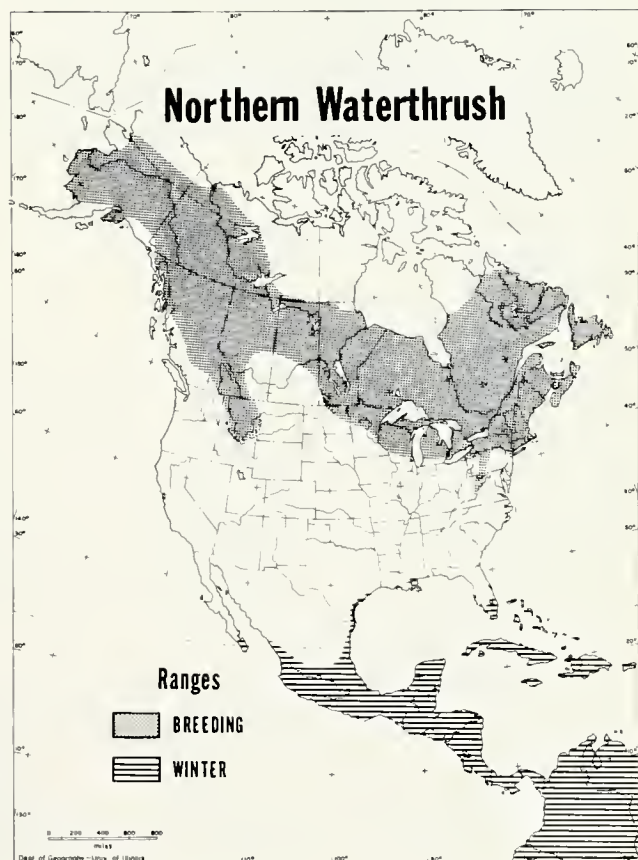


Fig. 87. — General distribution of the northern waterthrush.

## Spring Migration

The earliest reports of northern waterthrushes in Illinois were 1–2 April in the north (Nelson 1876–1877, Smith and DuMont 1944a), 9 April in the central region (R. Chapel unpublished 1978), and 10 April in the south (Fig. 88). Highest numbers have been seen 27 April–6 May in the south (21–53 per day), 29 April–15 May in the central region (15–50 per day), and 2–21 May in the north (7–24 per day). The counts of Smith et al. at Urbana (1904–1925) were similar to our more recent counts. The last northerns of the season were seen 31 May in both the St. Louis area and central Illinois (Widmann 1907, F. Smith unpublished 1907) and 8 and 29 June in the north (Ford et al. 1934, Smith 1941b).

Northern waterthrushes showed a strong and consistent preference for bottomland forest habitat (Table 32). The males are strong singers, and at least in central and northern Illinois, some of them appear to establish territories, which they defend and occupy for a week or more, in swampy habitat. Farwell (1919) described the song, which is distinctive from the Louisiana's song as "Wee- wee-wee, wee-chy-wee-chy." Silloway's (unpublished 1921) version of the phonetics was, "Twit-twit-tee- chee-chee," clear and ringing with an abrupt end.

Two spring recoveries of banded northern waterthrushes—one banded 8 May 1975 near Springfield and recovered 9 May 1975 near Rockford, and one banded 15 May 1975 near Rockford and recovered 30 April 1977 near Columbia, Tennessee—indicate spring flight directions almost straight north (Annual Reports by Region of Banding 234).

References to the breeding of northern waterthrushes in northern Illinois (Nelson 1876–1877, Davie 1898, Woodruff 1907, Ridgway in Gault 1922) perhaps referred to (1) an old

breeding population that has since receded to the north; (2) transients, because of their strong territorial behavior; (3) mis-identified Louisiana waterthrushes, which however, are rare in the north. The reports are mainly for the last century though a record for Lake County on 29 June 1941 (Smith 1941b) is late for a transient.

## Fall Migration

Northern waterthrushes are among the first of the transient warblers to reappear in fall (Widmann 1907). The earliest reports were 21 and 23 July in the north (F. Smith unpublished 1906), 27 and 31 July in central Illinois (F. Smith unpublished 1907, H.D. Bohlen unpublished 1979), and 2 August in the St. Louis area (Wilhelm 1957). There are early August records for all regions (Cunningham 1943, Kleen & Bush 1972c, Lewis 1923c, Brodkorb 1926a, Sanborn 1934). Highest numbers have been seen 1–14 September in northern Illinois (7–20 per day in the northeast), and 3 September–2 October in the central region (4–6 per day). In the south usually only one to three have been seen per day, the higher records occurring between 11 and 28 September (Fig. 88). The last northern waterthrushes of the season have been seen 30 October in the north and in the St. Louis area (Ford 1956, Wilhelm 1957) and 14 October in the central region (Fig. 88).

Whether the numbers of northern waterthrushes killed at television towers are actually much lower in the south than in central Illinois can only be determined if the two areas receive equal coverage. Relative to the numbers seen in the field, many (279 picked up) northern waterthrushes have been killed at the Illinois towers 2 September–7 October (Fig. 88).

TABLE 32.—Population densities of northern waterthrushes in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (16 April-20 May)						
Woods (unspecified)	Central	1907		12		3.3
Small grain	Central	1907		235		0.2
Mature bottomland forest	Piatt (C)	1979-1980	6	122	22.9	8.6
Mature bottomland forest	Johnson (S)	1979-1981	16	347	33.9	8.1
Mature upland forest	Piatt (C)	1979-1981	7	168	3.8	0.5
Mature upland forest	Pope (S)	1979-1981	15	311		0
Forest edge and shrub	Piatt (C)	1979-1981	7	143	3.6	0.8
Forest edge and shrub	Pope (S)	1979-1981	14	277	2.0	0.7
Fall (12 August-7 October)						
Pastures	North	1909		302		0.3
Cornfields	Central	1907-1909		549		0.1
Mature bottomland forest	Piatt (C)	1979-1980	12	245	13.5	5.3
Mature bottomland forest	Johnson (S)	1979-1981	9	193	5.7	1.9
Mature upland forest	Piatt (C)	1979-1981	16	312	2.0	0.1
Mature upland forest	Pope (S)	1979-1981	9	175	4.4	0.2
Forest edge and shrub	Piatt (C)	1979-1981	18	363	6.2	0.6
Forest edge and shrub	Pope (S)	1979-1981	8	154		0

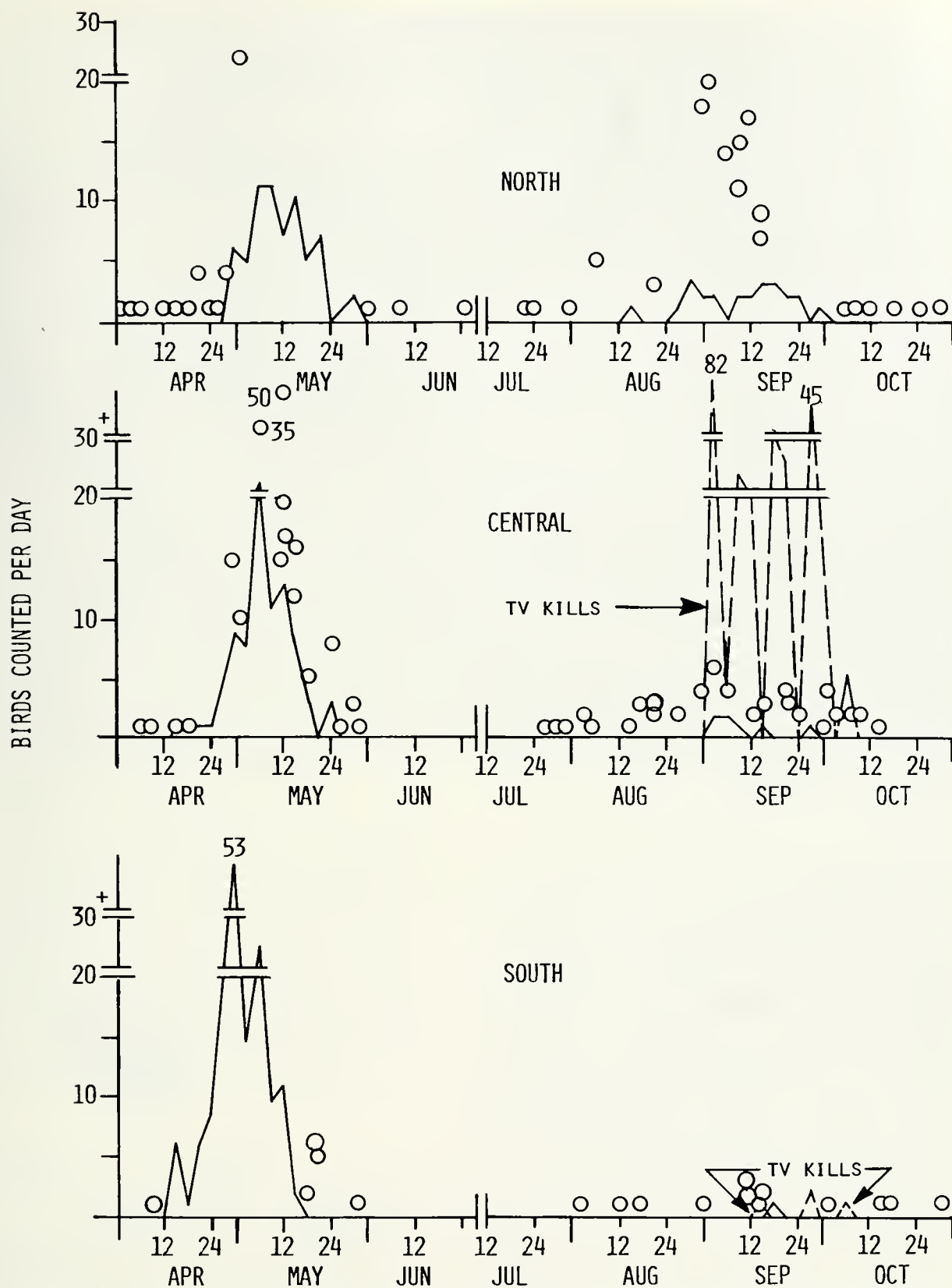


Fig. 88.—Migration seasons of the northern waterthrush in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Dash lines show numbers killed at television towers during fall migration in Illinois.

One of the few examples of a purely transient bird's having been recovered at the place where it was banded was that of a northern waterthrush banded near Shirland 9 September 1967 and re-trapped there 7 September 1969 (Johnson & Ellis 1974). The authors noted that they had had only five such cases out of 36,000 birds of all species banded at their station.

As in spring, fall populations of northern waterthrushes were highest in bottomland forest habitat, but with densities definitely lower in fall (Table 32). The pattern of high fall counts in northeastern Illinois holds for the northern waterthrush. Bennett (1952) saw, on average, about seven times more northern waterthrushes at Chicago than we saw in northwestern Illinois. The range in annual variation of his counts was 15–73 percent per year (average, 46.4). Also at Chicago, Dreuth saw northern waterthrushes with a frequency of about 1.0 in spring to 1.9 in fall. Our counts were higher in spring than fall by ratios of 3 to 1 in northwestern Illinois, 17 to 1 in central Illinois, and 117 to 1 in the south. The census transects produced ratios of 1.1 to 1.0 in the central region, and 6.8 to 1.0 in the south. In a sample of 81 specimens killed 9 September–15 October at the central Illinois towers, only 19 were adults, the equivalent of a spring-to-fall ratio of about 1 to 4—one of the highest fall ratios in our samples of warblers. However the sample (69 sexed specimens) was preponderately (78 percent) females, suggesting that the ratio has more to do with migration routes or seasons than with productivity.

Cooke (1885) and Ridgway (1874a) stated that northern waterthrushes sometimes remained through the winter in southern Illinois. Though there is no definite winter population and it is uncertain whether the waterthrush could survive Illinois winters, there are a few scattered winter records for central and northern Illinois (Sausaman 1957, Sanders 1976, 1980, Kleen 1977b, 1980b).

## Specimen Data

In attempting to identify the Illinois Natural History Survey series of northern waterthrush skins (39 fall specimens) to subspecies, we encountered the same problem described by Mengel (1965), i.e., great variation without consistent segregation of characters. Most of the specimens were strongly washed with yellow below, but two were essentially white below. Even the whitest bird had buffy superciliaries. Size of bill and length of wing showed no correlation with color. Compared with migrant specimens we have seen from western Kansas, the Illinois specimens are small (longest wing chord, 76.0 mm) and dark, and we conclude that the variation shown in the Illinois series is within the limits of *S. n. noveboracensis* (Du Mont 1930).

The range of gross weight of northern waterthrushes killed 9 September–15 October in central Illinois was, for 5 adult males, 16.4–24.0 g (mean = 21.46, SE = 1.81); for 9 immature males, 19.1–24.6 g (mean = 21.54, SE = 0.61); for 11 adult females, 16.4–24.1 g (mean = 19.34, SE = 0.65); and for 40 immature females, 15.8–25.6 g (mean = 20.47, SE = 0.45). Specimens of average weight were quite

to very fat (3 or 4 on a scale of 0–5), and many of the specimens were very to extremely fat (4 or 5).

## LOUISIANA WATERTHRUSH (*Seiurus motacilla*)

(Fig. 89 and 90)

Ridgway (1874a) stated that the Louisiana waterthrush reached the lower Wabash valley as early as February, and it is possible that he once found the species that early though Widmann's (1907) earliest record for southeast Missouri was 12 March. Otherwise, the earliest reports of the species in Illinois were 23–24 March in the south (Kleen 1975b, Jones 1935a), 31 March in the central region (Smith & DuMont 1945b, DuMont & Smith 1946b), and 28 March in the north (Bent 1953). Louisiana waterthrushes regularly reach southeastern Illinois during the last week of March. Highest numbers have been seen 2 April–28 May in the south (six to nine per day) and 13–28 April in the central region (three per day). The species is especially common in spring in some years (Ridgway 1878, Brodtkorb 1928a). In the north usually only one is seen per day (Fig. 91). Population densities in spring were well above the June densities, especially in bottomland forest. The breeding range of the Louisiana water-

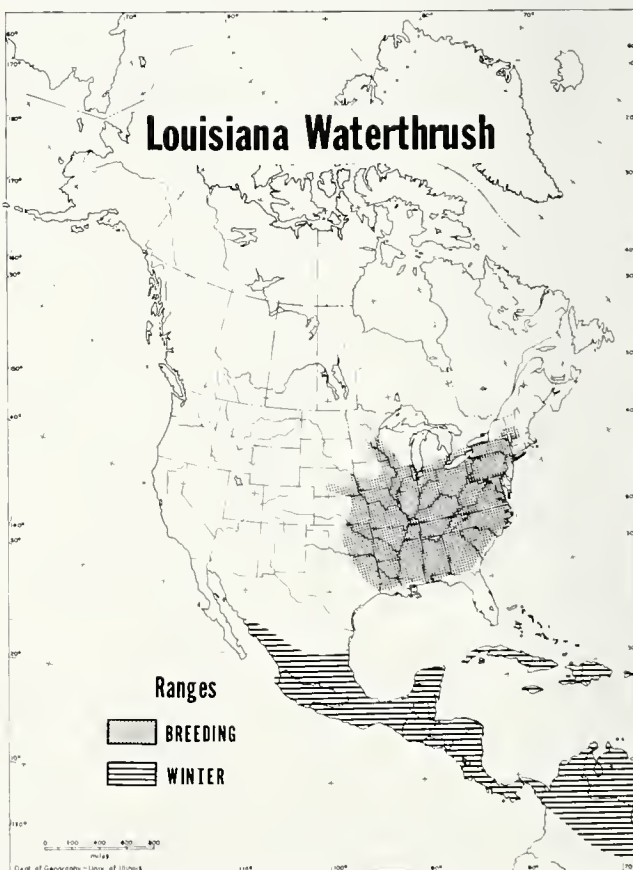


Fig. 89. — General distribution of the Louisiana waterthrush.



Fig. 90. — Louisiana waterthrush approaching its nest. The angle of the photo emphasizes the heavy bill, characteristic of the species. Photo taken 20 May in Pope County, Illinois.

thrush extends north of Illinois in the Mississippi Valley (Fig. 89), and transients may prefer the rich bottomland. There are many May records of Louisiana waterthrushes in northern Illinois (Sanborn 1921*b*, Bartel & Reuss 1932, Boulton & Blake 1936, Dillon 1971, and others), but whether these birds are transients, local breeders, overmigrants, or something else remains to be determined. Two were seen in northwestern Cook County on 14 June (Kleen 1980–1981). A bird present on 5 June in Trelease Woods (central Illinois), where there is no breeding population (Kendeigh 1948), was probably a late transient. Coursen's (1947) latest spring record at Orland was 2 June.

### Breeding

Nelson (1876–1877) believed that the Louisiana waterthrush was not uncommon as a breeding bird, but all subsequent observers have considered it rare or uncommon in the northeast at any season (Smith 1946, Clark & Nice 1950, Fawks 1970*b*, Balch 1978), and spring populations have been low even in central Illinois (Table 33). Barnes (1890, 1912) did not list the Louisiana as a breeding bird in Marshall County, and T.E. Musselman (unpublished notes) ap-

parently never found a Louisiana nest in Adams County though in at least 1 year the species was common (Smith & DuMont 1944*b*). Eifert (1945) and DuMont & Smith (1945) suggested that the Louisiana waterthrush was a common nesting bird in Sangamon County, where in more recent years it has been uncommon (H.D. Bohlen unpublished 1974–1979). Hess (1910) considered it a rare summer resident in Champaign County, and its status remains unchanged today. There are no population measurements between the far south, where the species is common, and the central region, where it is uncommon, but the population definitely falls off between 39 and 40 degrees north latitude. Even where common, the Louisiana waterthrush does not appear to reach high population densities (Table 33). We would expect the Louisiana waterthrush to nest in all the counties of the southern half of the state and in western Illinois bordering the Mississippi Valley (Hodges 1949, 1950, Johnson 1942), but the precise distribution remains to be worked out. In addition to records plotted in Fig. 92, there are breeding records for unspecified localities in Sangamon (Eifert 1945), Lake, and Cook counties (Kleen 1977*d*, 1978–1979).

Ridgway (1889) in the south and Nelson (1876–1877) in

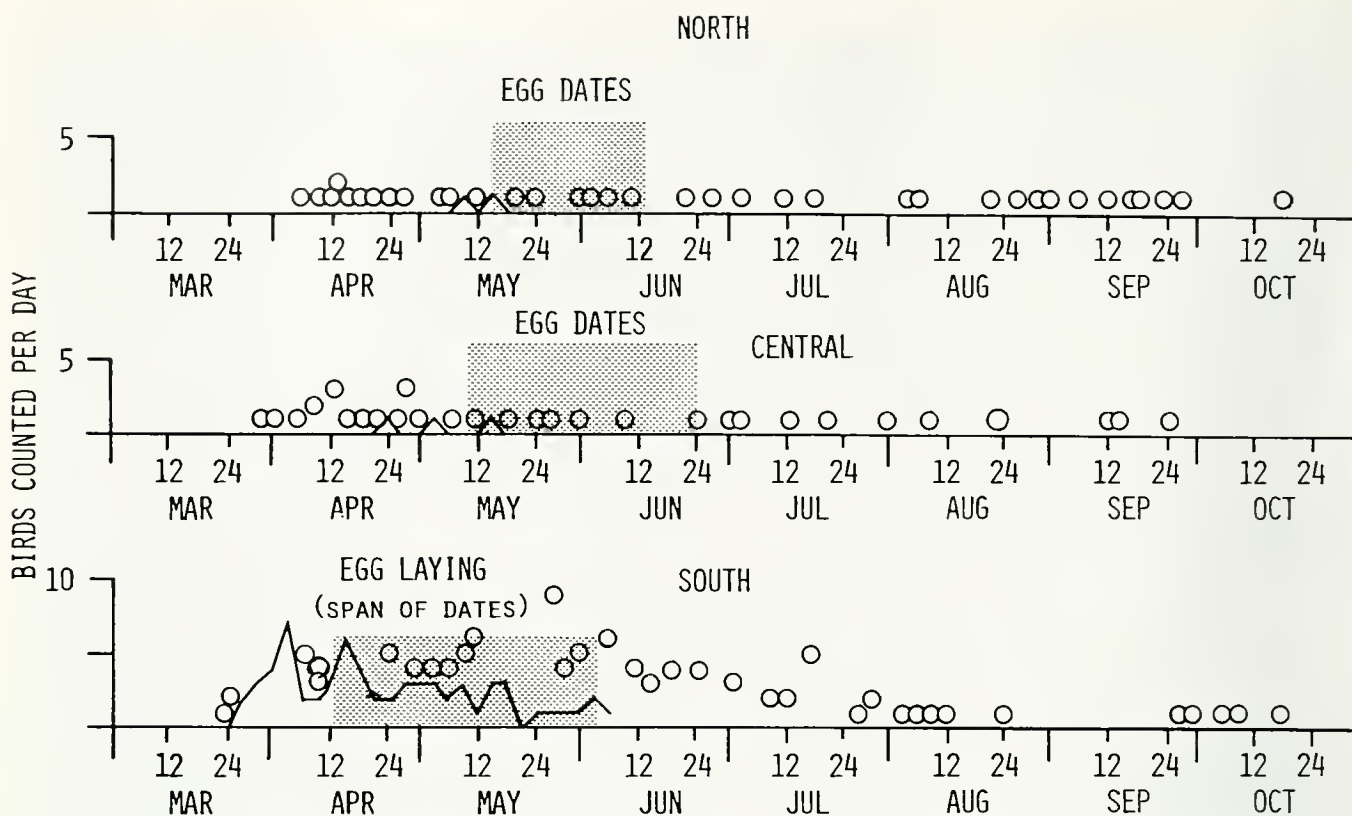


Fig. 91.—Egg-laying and migration seasons of the Louisiana waterthrush in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967–1970). Hollow circles represent counts made in other years or by other observers. Shaded areas show the span of dates during which eggs have been found.

TABLE 33.—Population densities of Louisiana waterthrushes in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (3 April-28 May)						
Mature bottomland forest	Piatt (C)	1979-1980	9	185	1.8	0.2
Mature bottomland forest	Johnson (S)	1979-1981	21	436	9.4	3.3
Mature upland forest	Piatt (C)	1979-1981	15	296		0
Mature upland forest	Pope (S)	1979-1981	22	454	5.6	1.5
Forest edge and shrub	Piatt (C)	1979-1981	13	261		0
Forest edge and shrub	Pope (S)	1979-1981	19	375	4.2	1.1
Breeding (June)						
Woods (unspecified)	North	1957-1958		72	1.0	0.6
					(Graber & Graber 1963)	
Mature bottomland forest	South	1973-1980	62	1,108	5.2	0.2
Mature upland forest	South	1974-1980	30	602	7.5	0.6
Forest edge and shrub	Pope (S)	1979-1980	2	42	2.0	1.0
Upland deciduous forest	Jackson (S)	1976-1977		6		13.2
					(Morrison & Peterjohn 1977, Morrison 1978)	
Fall (31 July-24 August)						
Mature bottomland forest	Johnson (S)	1979-1981	4	86		0
Mature upland forest	Pope (S)	1979-1981	5	96	1.8	0.4

# Louisiana Waterthrush

## BREEDING RECORDS

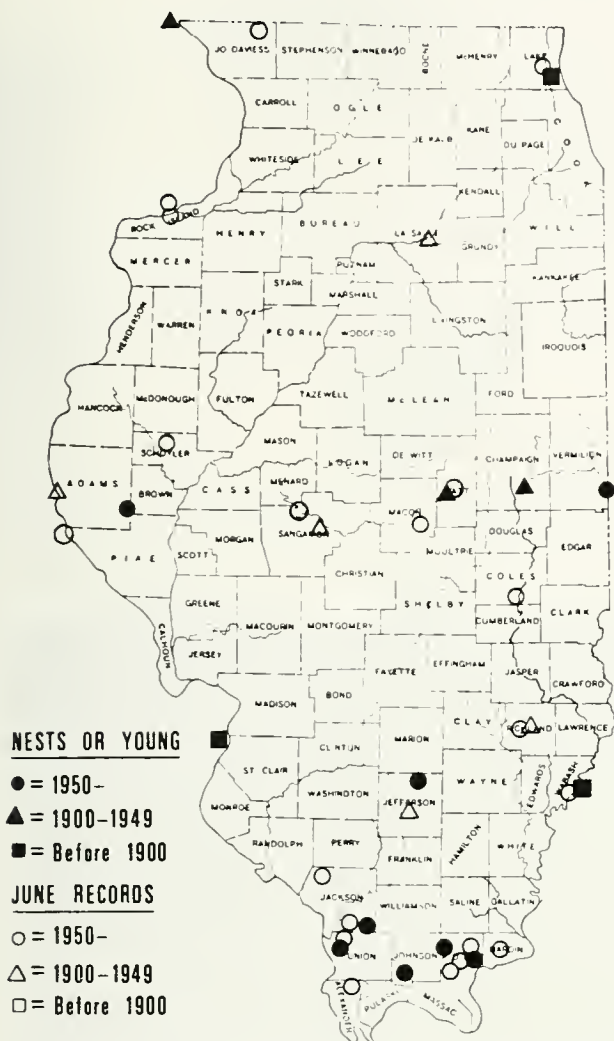


Fig. 92. — Breeding records of the Louisiana waterthrush in Illinois.

the northeast considered the Louisiana waterthrush to be a swamp bird like the prothonotary. Widmann (1895) observed that in nearby Missouri, Louisiana waterthrushes were uniformly distributed through the cypress swamps, not restricted to watercourses as in other areas. It is strange that these early authors made no mention of the upland forest "branch" habitat per se which now probably supports most of the extant population. Most bottomland forest habitat that we have censused in June has lacked Louisiana waterthrushes, and when we have found them in bottomland in the south, it has always been in or near cypress swamp. On average, June densities have been lower in bottomland than in upland (Table 33). In more northern areas, lowland forest other than cypress has been utilized by the species (Hess 1910, Allison 1947). Brewster (1878c) hinted that Louisiana waterthrushes were uncommon in the swamp habitat

because of the flooding problem and that the species survived better in upland areas. In upland forest Louisiana waterthrushes appear to occupy the more permanently wet areas, especially spring-fed rivulets, avoiding most of the dry "branches." This choice of habitat automatically spaces the pairs widely and reduces population density. There are several possible explanations for the difference between Ridgway's (1889) statement that the Louisiana was an abundant bird in all swampy woods and our recent observations of low densities in that habitat—other than reduced use of the habitat. Annual variation is one possible answer, and it is largely unknown. Also, June is late for censuses of this early nester, and the spring densities (Table 33) may better reflect the species' use of swamp habitat for nesting.

The rich, loud, liquid song of the Louisiana waterthrush was described by Farwell (1919) as starting with three notes—clear, piercing whistles—then finishing in an intricate jumble of fine, softer notes. Our phonetics for it are "Sweet-you, sweet-you, come up and see me," the first notes high and rather slow, the last phrase fast and somewhat run together. Ridgway (Baird et al. 1874) suggested that singing was largely over in April, and though the song may be heard at least into July, singing is much reduced after April. Flooding may re-start the nesting cycle, and hence, the song period.

In swamp habitat Louisiana waterthrushes often place their nests up off the ground as high as 6 feet in the roots of upturned trees (Brewster 1878c, Jencks 1882). Upland nests are usually embedded in the bank of the "branch," often among tree roots or under the edge of a log. Brewster described one nest as 3.5 inches in diameter by 3.5 inches deep, with an outer shell of soggy leaves plastered together with mud. The inner nest (2.5 x 2.5 inches) was of small twigs and green moss and was lined with dry grass and mammal hair. The eggs possessed a high polish, had a ground color of white and large blotches of dark umber and lavender at the large end, and were otherwise speckled thickly with red-brown. The laying season extends from at least 12 April to 3 June in southern Illinois, and in central Illinois egg dates occur from at least 9 May to 23 June (Fig. 91). A female taken from a nest in Lake County was laying on 11 June (Gault unpublished 1889). The clutch at that nest would have been at least 5 eggs (4 in the nest and 1 in the oviduct). Clutch size in two apparently unmolested nests in central Illinois was 5 eggs (Hess 1910), and of four nests in southern Illinois and adjacent Indiana, one had 6 eggs, two had 5 eggs, and one, 4 eggs (Brewster 1878c). In southern Illinois we have seen at least three broods with cowbird young, including a nest with two cowbirds and one host young. Another nest had one cowbird egg and four warbler eggs. In central Illinois Allison (1947) also observed an instance of parasitism. Data are needed on rates of parasitism and, indeed, on all phases of the nesting cycle, including success and productivity.

## Fall

Few Louisiana waterthrushes are seen after the nesting season, usually no more than one per day (Fig. 91). In

southern Illinois one was in heavy molt, with tail missing, on 28 July. The last records of the season are 18 October in the north (Ford 1956), 25 September in the central region (Fawks 1966*d*), and 18 October in the south (George 1968).

Ridgway (1889) suspected that this species sometimes wintered in southern Illinois, but there are no definite winter records for Illinois.

## KENTUCKY WARBLER (*Oporornis formosus*)

(Fig. 93 and 94)

### Spring Migration

The earliest reports of Kentucky warblers in Illinois were 7 April in the central region (Kleen 1974*b*), 12 April in the south (Bent 1953), and 4 April in the north (Kleen 1981*b*). Records for 30 March (Kleen 1975*b*) and 9 April (Widmann 1907) in southeast Missouri indicate potentially early dates for southern Illinois. Highest numbers of Kentucky warblers have been seen 26 April–13 May in the south (12–23 per day), 6–25 May in the central region (4–11 per day), and

7–27 May in the north (2–6 per day). The highest June counts are nearly as high as the spring counts in all regions (Fig. 95).

Kentucky warblers killed at the Charleston television tower indicate active migration 6–9 May in east-central Illinois (L. B. Hunt unpublished 1972–1973), an interesting observation, as we have never found a Kentucky warbler at the central towers in fall. The observation may signify much higher flight densities of Kentuckies in spring than fall and, possibly, overmigration.

Spring populations of Kentucky warblers were highest in habitats (bottomland forest and forest edge) where the June population was lowest (Tables 34 and 35). The high counts of Smith et al (1904–1925) were consistently lower than our more recent counts (Fig. 95), possible evidence that the species has made some population gain since 1900 in the central region.

### Breeding

Nelson (1876–1877) and Hancock (1888*b*) considered the Kentucky warbler to be a very rare spring and summer visitor to northeastern Illinois, and its status there remained essentially unchanged at least until recent years (Ford et al.



Fig. 93. Kentucky warbler at its nest. Photo taken 1 June in Pope County, Illinois.

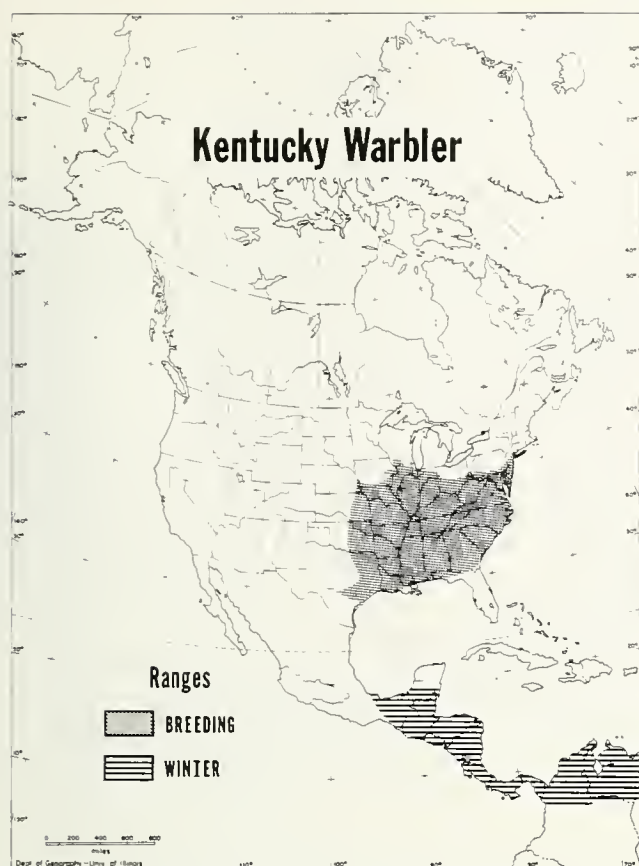


Fig. 94.—General distribution of the Kentucky warbler.

1934, Nolan 1953, Kleen 1978-1979). In the Mississippi Valley Giddings (1897) found the Kentucky to be a rare but regular summer resident. It was still rare at Dubuque in 1942 (Johnson 1942), but now it is fairly common even in

southwestern Wisconsin (Kumlien & Hollister 1951); i.e., it has gained more in population in northwestern than in northeastern Illinois. Quite early the Kentucky warbler was common well north in the Illinois Valley (Barnes 1890, Gault 1922), and in recent years it has been regular as a breeding bird in Ogle County (Swan 1977, Fig. 96). The population has apparently increased slowly in the north. In addition to the records plotted in Fig. 96, there are breeding records for unspecified localities in Putnam (Gault 1922) and Mercer counties, Illinois (U.S. National Museum Oology Collection #18366), and Lee County, Iowa (DuMont 1936).

Both Ridgway (1889), referring to the south, and Gates (1911), in central Illinois, called the Kentucky warbler a dominant species of bottomland woods. Ridgway (1874a) also described the habitat as the dark, damp portions of the forest but made no mention of the upland habitat that now supports most of the population. Though spring populations in southern Illinois were higher in bottomland than in upland forest, June populations have been highest in upland forest (Table 35). In both regions breeding population densities averaged two to three times higher in upland than in bottomland forest. Annual variation in the population was less in upland than in bottomland. In southern Illinois the range of variation (13-93 percent per year) was similar in the two habitats but averaged 40 percent in upland, and 53 percent in bottomland. Kentuckies nest on or near the ground, and the flooding of nests appears to pose a serious threat in bottomland areas. Comparative studies of nesting success in upland and bottomland areas would be worthwhile. In southern Illinois the preferred habitat of the Kentucky appears to be heavily shaded woods, especially sylvan ravines with shade-loving plants, such as ferns. In our forest study areas in southern Illinois the only features that we measured which showed correlation with Kentucky warbler population densities were Importance (Y) of *Vitis* ( $r = 0.975$ ,  $P =$

TABLE 34.—Population densities of Kentucky warblers in Illinois, spring and fall, 1979-1981.

Season and Habitat	County or Region	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
				Maximum	Mean
Spring (20 April-28 May)					
Mature bottomland forest	Piatt (C)	6	123	2.2	0.3
Mature bottomland forest	Johnson (S)	15	312	13.7	4.8
Mature upland forest	Piatt (C)	11	220	5.7	2.8
Mature upland forest	Pope (S)	14	286	11.5	2.7
Forest edge and shrub	Piatt (C)	9	183	4.0	0.9
Forest edge and shrub	Pope (S)	15	297	16.2	7.8
Pines	Pope (S)	6	110	4.4	1.5
Fall (1 August-11 September)					
Mature bottomland forest	Piatt (C)	10	142	2.0	0.6
Mature bottomland forest	Johnson (S)	10	214	5.6	2.6
Mature upland forest	Piatt (C)	11	216	3.9	1.2
Mature upland forest	Pope (S)	10	196	1.8	0.4
Forest edge and shrub	Piatt (C)	11	201	11.3	2.1
Forest edge and shrub	Pope (S)	11	218	5.9	1.7
Pines	Pope (S)	5	90	2.2	0.4

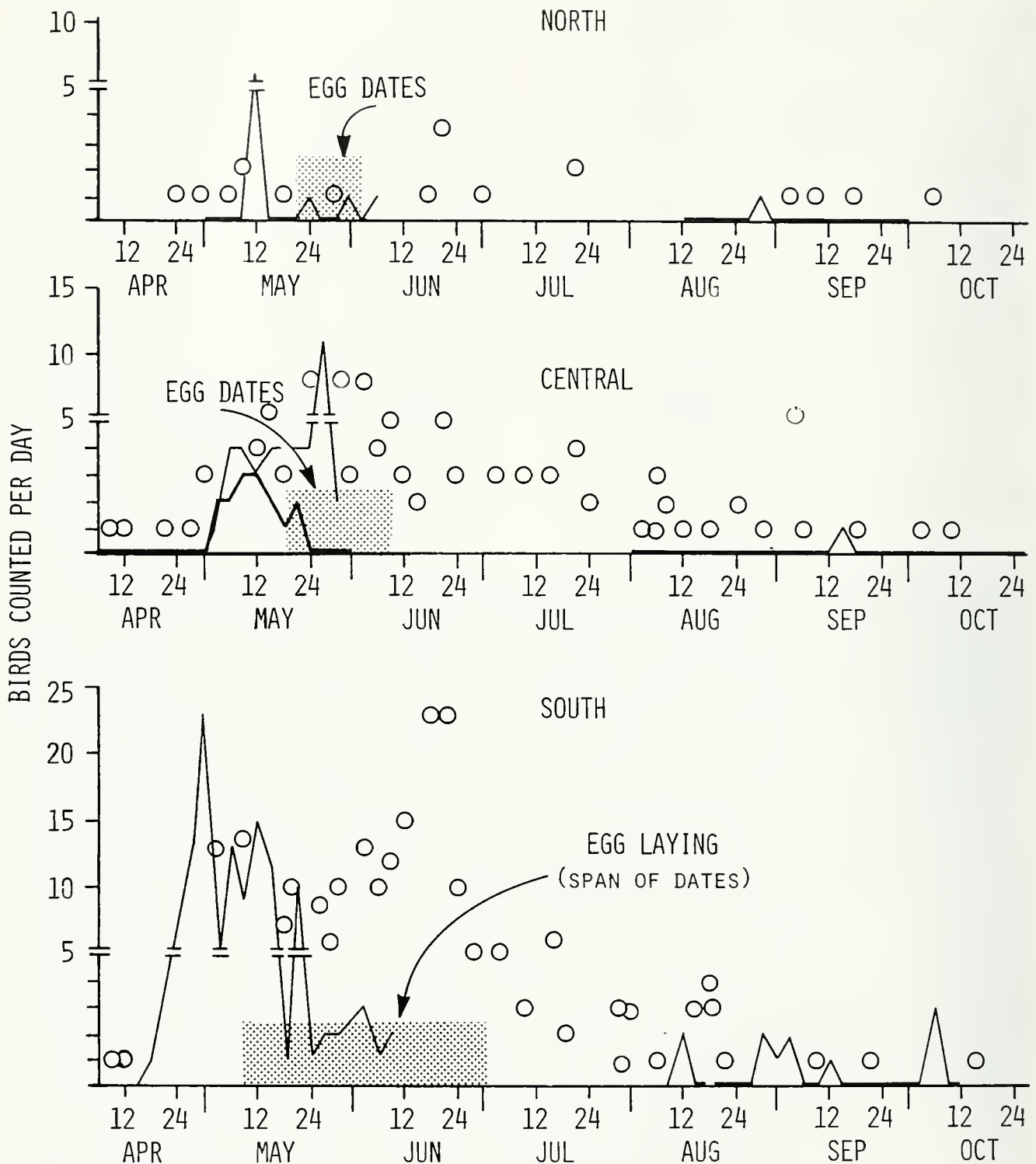


Fig. 95.—Egg-laying and migration seasons of the Kentucky warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967–1970). Hollow circles represent counts made in other years or by other observers. The heavy line (central spring) represents counts of Smith et al. at Urbana. Shaded areas show the span of dates during which eggs have been found.

$< 0.001$ ) and of *Fagus* in the understory ( $r = 0.844$ ,  $P = < 0.02$ ).

Territories of Kentucky warblers measured in central Illinois were 1.1 and 2.5 acres in different bottomland forest areas and years (Fawver 1947a, Calef 1953b).

As it is with most species, the nesting cycle of the Kentucky warbler is poorly known in Illinois. The periodicity of singing is unrecorded but lasts at least into July. Ridgway (1889) considered the song to be cardinal-like. The common song is a lilting repetition of a phrase, something like "Fil-ip-

fil-ip- fil-ip," with emphasis on the second syllable, slightly suggestive of the ovenbird's song in cadence. We have also seen and heard a more complicated flight song. The time required for nest construction is unknown. The nest is built on, or within a few inches of, the ground. A nest we found in Hardin County and one in Pope County were in the center of clumps of Christmas fern (*Polystichium*), and a nest in the north was also among ferns (Giddings 1897). The nest shown in Fig. 93 is typical of nests we have seen in southern Illinois. The bulk of the structure was layers of leaves (in this case maple, a dominant plant in the area), with a thin lining of leaf veins, rootlets, and thin weed stems. Giddings (1897) described a similar nest with leaves of oak and with hair in the lining. In central Illinois nest construction began as early as 15 May (Hess unpublished 1913).

The eggs have a background color of white, marked with reddish spots and speckles, often heavily wreathed at the large end (Hess 1910). The egg-laying season extends from at least 8 May to 2 July in southern Illinois (Fig. 95) though the newly fledged young found by Nelson (1877) at Mt. Carmel in late July would likely have come from a later laying. Clutch sizes in nine Illinois (or near) nests (not obviously parasitized) were: 6 eggs, one nest; 5 eggs, four; 4 eggs, one; 3 eggs, three (Hess 1910, 1914, DuMont 1936, DuMont & Smith 1946c). Of 18 nests with known contents, at least 7 had been parasitized (Poling 1890, Giddings 1897). For most species the old oological records show few parasitized nests,

but for the Kentucky even the oldest records seem to indicate a problem with the cowbird. Kentucky warblers often rear cowbirds. Thom (1973) observed two fledged cowbirds in the care of a Kentucky warbler. In Lake County young Kentucky warblers were in the care of the adults at least 28 days (Nolan 1953). At a Pope County nest (Fig. 93) both adults fed the nestlings. The juvenile plumage was described by Brewster (1878b). The number of broods raised or attempted is unknown, and nothing is known of nesting success or productivity.

## Fall Migration

By 28 August an adult male Kentucky warbler in northwestern Illinois appeared to be in fresh plumage.

As with most southern-ranging species, few Kentucky warblers are seen in fall (Fig. 95). At Chicago, Bennett (1952), an experienced observer, saw only one in 5 years, and we saw only one in northwestern Illinois. There was no obvious peak in the fall numbers, even in southern Illinois. We saw 20 Kentucky warblers in spring to 1 in fall though within the census transects the ratio was 4.3 to 1.0 (1.0 to 1.0 in the central region).

The last Kentucky warblers of the season were seen 4 October in the north (Smith 1946), 10 October in the central region (C.T. Nearing unpublished 1961), and 15 October in the south (Ridgway 1874a).

TABLE 35.—Breeding population densities of Kentucky warblers in Illinois.

Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
					Maximum	Mean	
Oak-maple forest	Champaign (C)	1927-1948	44 years	22	7.3	0.9	Kendeigh 1948, Kendeigh & Clemans 1970, Johnson 1947
Oak-maple forest	Champaign (C)	1943		26		6.2	
Virgin floodplain forest	Sangamon (C)	1948		31		16.0	Snyder et al. 1948
Mature bottomland forest	McLean (C)	1950-1951	2 years	25	3.2	2.4	Calef 1953b
Bottomland forest	Vermilion (C)	1966		6		52.0	Karr 1968
Grazed bottomland woods	Macon (C)	1955		21		3.8	Chaniot & Kirby 1955
Wet oak forest	Newton, IN (C)	1974, 1978	2 years	11	7.3	3.6	Hopkins 1974, 1978
Oak-hickory-maple forest	McLean (C)	1976-1979	4 years	13		6.2	Birkenholz 1977-1980
Upland oak-hickory	Hancock (C)	1967		10		2.1	Franks & Martin 1967
Woods (unspecified)	Central	1957-1958		87	4.3	2.3	Graber & Graber 1963
Mature bottomland forest	Central	1978-1980	7	154	1.8	0.8	This paper
Mature upland forest	Central	1978-1980	4	85	7.7	2.9	This paper
Upland deciduous forest	Jackson (S)	1976-1977	2 years	6	78.0	59.0	Morrison & Peterjohn 1977, Morrison 1978
Woods (unspecified)	South	1957-1958		138	10.8	9.4	Graber & Graber 1963
Mature bottomland forest	South	1973-1980	62	1,108	8.7	2.4	This paper
Mature upland forest	South	1974-1980	30	602	15.5	5.4	This paper
Forest edge and shrub	Pope (S)	1979-1980	2	42	5.5	4.8	This paper
Pines	Pope (S)	1979-1980	2	36	4.4	3.4	

# Kentucky Warbler

## BREEDING RECORDS

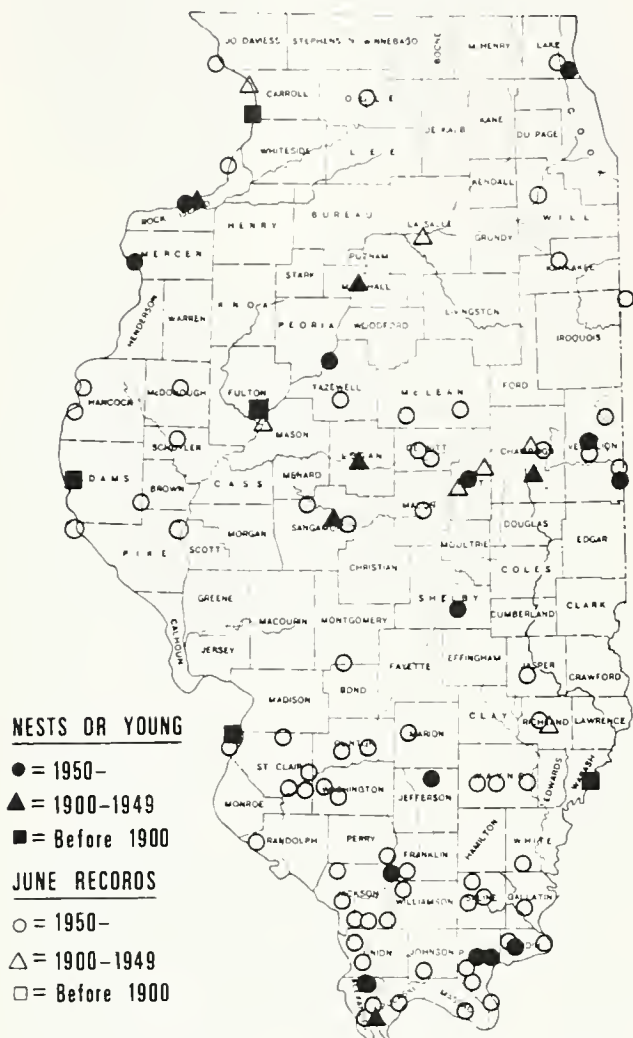


Fig. 96. -- Breeding records of the Kentucky warbler in Illinois.

### Specimen Data

Two specimens, a male, and a female, killed in May at the Charleston television tower weighed, respectively, 13.8 and 12.6 g.

## CONNECTICUT WARBLER

*(Oporornis agilis)*

(Fig. 97 and 98)

### Spring Migration

A late migrant, the Connecticut warbler is not usually seen in Illinois until May (Fig. 99). The earliest reports were

29 April in the north (Abbott et al. 1933), 30 April in the south (Fig. 99), and 4 May in the central region (Smith 1930). Opinions as to the Connecticut's abundance have varied greatly, and the differences may reflect large annual variation. Highest numbers have been seen 12-21 May in the south (3 per day), 16 May-1 June in the central region (3-7 per day), and 18 May-1 June in the north (4-11 per day). Widmann (1907) found this species a regular but rather rare migrant in the St. Louis area. The last Connecticuts of the season have been seen 17 June in the St. Louis area (Comfort 1942) and 28 June in the north (Ford 1956). Most of the birds seen are probably males made conspicuous by their loud, vibrant song, which Ferry (1908) phoneticized as, "Whit-it-wheeta-wheeta-wheeta-wheet," resonant, loud syllables closely run together. Gault (unpublished 1876-1927) often noted that he saw mainly singing birds and few females. They were often in weedy patches and gooseberry. Ridgway (1889) mentioned bushy swamps as the primary habitat in the south. While censusing in the south, we heard Connecticut warblers in bottomland forest but detected none within our census transect either in spring or fall. Densities were low even in the central region, where there is less concealing cover, and Connecticuts were more numerous in forest edge and shrub than in forest proper (Table 36).

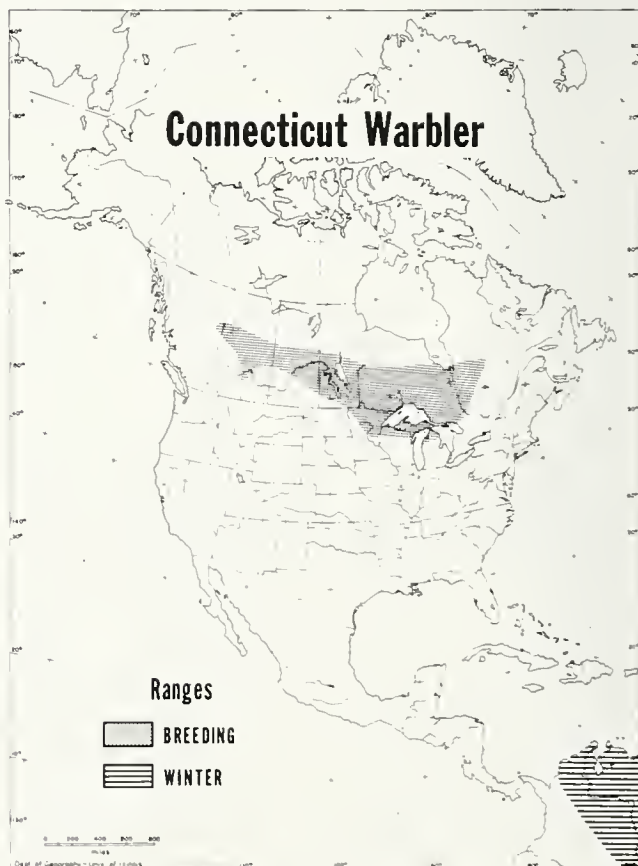


Fig. 97. -- General distribution of the Connecticut warbler.



Fig. 98. — Connecticut warbler. Note the complete eye ring and large bill. Photo taken 25 September at Urbana, Illinois.

### Fall Migration

The earliest fall reports of Connecticut warblers in Illinois were 14 August—an immature specimen (B.T. Gault unpublished 1896, Ford 1956)—in the north, 24 August in the central region—an immature killed at a TV tower—(Kleen 1977a), and 20 September in the south (Jones 1938). Nelson (1876–1877) believed the Connecticut warbler to be as abundant in fall as in spring. Highest numbers have been seen 26 August–23 September in the north (4–12 per day) and 28 August–27 September in the central region (3–9

per day, including kills at one tower only). Only one per day has been seen in the south (Fig. 99). Connecticut warbler specimens have been picked up at central Illinois television towers between 24 August and 6 October in numbers greater than we see in the field (Fig. 99). The last Connecticut warblers of the season were seen 15 October and 1 November in the north (DuMont & Smith 1946a, Fawks 1968a), 9 October in the central region—one bird netted—(R. Bertin unpublished 1976), and 4 and 29 October in the south (Fig. 99).

At Chicago, Dreuth saw Connecticut warblers with a

TABLE 36. — Population densities of Connecticut warblers in Illinois, 1979–1981.

Season and Habitat	County or Region	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
				Maximum	Mean
Spring (13-25 May)					
Mature bottomland forest	Piatt (C)	5	123	2.0	0.3
Mature upland forest	Piatt (C)	8	159	1.9	0.5
Forest edge and shrub	Piatt (C)	6	120	2.2	1.0
Fall (18-30 September)					
Mature bottomland forest	Piatt (C)	5	100	4.0	0.8
Mature upland forest	Piatt (C)	7	133		0
Forest edge and shrub	Piatt (C)	8	150	2.2	0.5

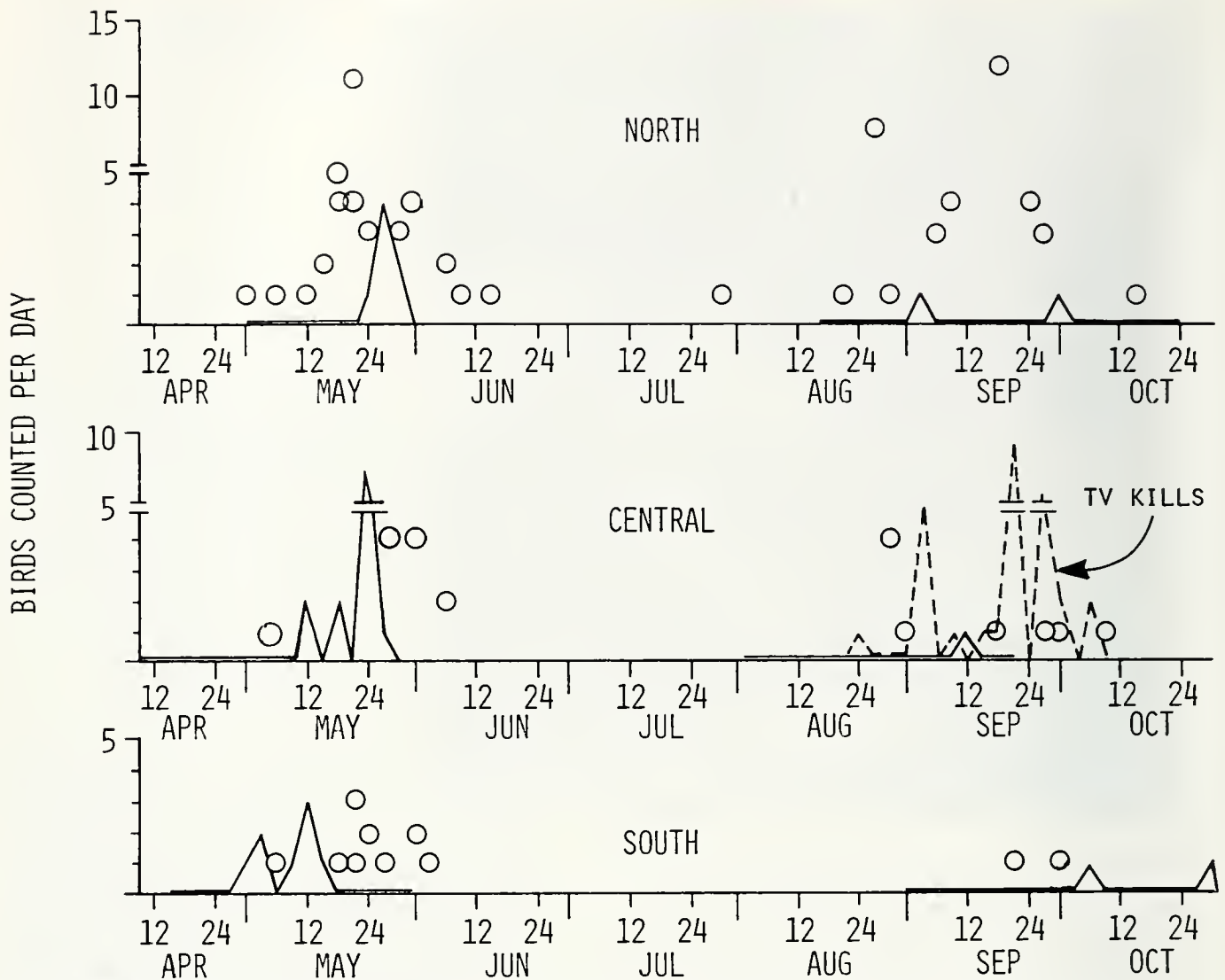


Fig. 99. — Migration seasons of the Connecticut warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois.

relative frequency of 1.0 in spring to 1.4 in fall. Our random counts in the northwest had a ratio of about 4 in spring to 1 in fall, and in central Illinois, 20 to 1. Within the central census transects the ratio was 1.5 in spring to 1.0 in fall. In a sample of 16 Connecticut warblers killed 9-27 September at central Illinois television towers, only 4 were adults.

### Specimen Data

The ranges of gross weights of Connecticut warblers killed 9-27 September were, for one adult male, 17.3 g; for five immature males, 13.5-25.0 g (mean, 18.08); for three adult females, 14.3-15.7 g (mean, 15.13); and for five immature females, 13.5-20.1 g (mean, 16.42). Immature birds of average weight were very fat, and the heaviest birds were as fat as any birds we have examined. Connecticut weights also showed greater variation than any species we have examined.

## MOURNING WARBLER (*Oporornis philadelphia*)

(Fig. 100 and 101)

### Spring Migration

Mourning warblers are typically late migrants, the earliest reports in Illinois being 2 May in the north (Walter & Walter 1904), 5 May in the central region (H. D. Bohlen unpublished 1978), and 30 April in the south. Highest numbers have been seen 16-30 May in the south (3-15 per day), 12-28 May in the central region (4-14 per day), and 15-30 May in the north (3-14 per day). Mourning warblers are generally uncommon, and counts are usually less than 5 per day (Fig. 102); however, in some years high populations are noted with counts of 10 or more per day (Morrissey et al. 1954,



Fig. 100. — Immature mourning warbler. Note the broken eye ring and the suggestion of a hood. Photo taken 23 September at Urbana, Illinois.

Hanselmann 1963–1964, Kleen 1979e). The counts of Smith et al. at Urbana (especially 1904–1917) were similar to our more recent counts, except that arrivals were earlier during the Smith years (Fig. 102). The end of the spring migration

probably regularly extends into June, with records as late as 17 June in the St. Louis area (Comfort 1942) and 25 June in the central (Keokuk) region (Widmann 1907). A sparse breeding population in northern Illinois may obscure the end of the migration there, but migrants may be present throughout June. Mourning warblers are found in low, dense vegetation in all habitats (Table 37).

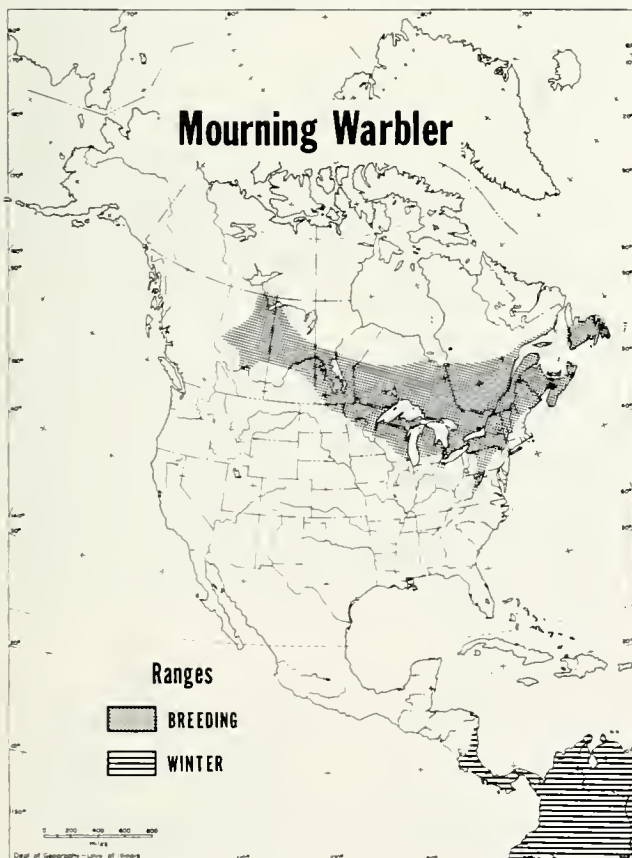


Fig. 101. — General distribution of the mourning warbler.

## Breeding

The distinctive song of the mourning warbler greatly increases the conspicuousness of the species in spring, and transient males sing even in the far south. The vibrant song of five to seven notes has been phoneticized as: "Tee- te-o, te-o, te-o" (Pitelka 1935) and as: "True-true-true-true-too," the voice rising on the first three syllables and falling on the last two (Long 1928).

On the basis of June records, Ridgway (1881, 1889) suspected that the mourning warbler nested in southern Illinois, and the statement was copied by others (Cooke 1888, Davie 1898). However, the only certain breeding records for the state are in Cook County near Des Plaines (Gault unpublished 1885) and La Grange Park (Pitelka 1935, 1939c). The species probably nests also in Lake and McHenry counties at least (Nolan 1952, Petersen 1965b, 1966b, Kleen 1977d, 1978–1979) and should be looked for in all the northern counties. The habitat is wet, brushy second-growth woods, but what specific characteristics the mourning warbler requires are unknown. No breeding population has been measured on a prescribed area, but the presence of four territorial males near Libertyville (Lake County) indicates a measurable population (Kleen 1977d). Benjamin Gault (unpublished 1885) found a mourning warbler nest with three fresh eggs on 31 May near Des Plaines in open second-growth

woods. As is typical for the species, the nest was on the ground. More recently in the same area C.T. Clark (unpublished 1962) has seen at least one pair of mourning warblers that was probably nesting (the female was carrying food). Mourning warblers at La Grange Park were apparently attending a fledgling cowbird (Pitelka 1935).

### Fall Migration

Mourning warblers seen 30 July-1 August in north-eastern Illinois (Kleen & Bush 1972c) could have been either local breeders or early transients. Mourning warblers seen 15 August in central Illinois (H.D. Bohlen unpublished 1979) and in "late August" in the south (George 1968) were

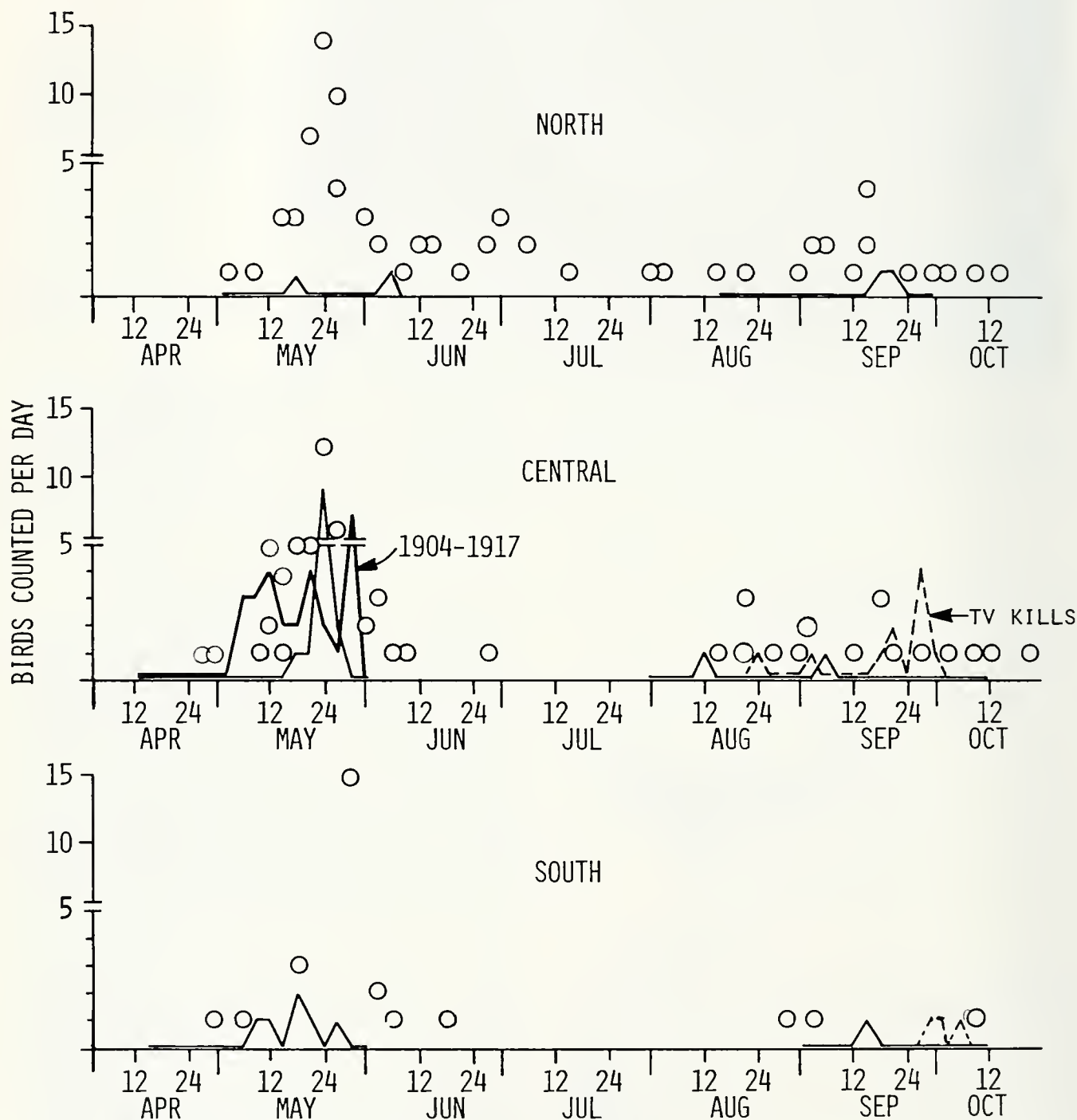


Fig. 102. — Migration seasons of the mourning warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The heavy line (central spring) represents counts of Smith et al. at Urbana. Dash lines show numbers killed at television towers during fall migration in Illinois.

TABLE 37.—Population densities of transient mourning warblers in Illinois, 1979–1981.

Season and Habitat	County or Region	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
				Maximum	Mean
Spring (30 April-27 May)					
Mature bottomland forest	Piatt (C)	7	144	5.9	1.7
Mature upland forest	Piatt (C)	11	220	2.0	0.2
Forest edge and shrub	Piatt (C)	9	183	10.1	2.0
Forest edge and shrub	Pope (S)	7	135	2.3	0.6
Fall (22 August-17 September)					
Mature bottomland forest	Piatt (C)	7	144	1.9	0.3
Mature upland forest	Piatt (C)	9	177	4.0	0.5
Forest edge and shrub	Piatt (C)	10	187	6.2	0.9

definitely migrants. Highest numbers have been seen 1–13 September in the north (two to four per day), and 21 August–16 September in the central region (three per day). No more than one per day has been seen in the south in fall (Fig. 102). A few mourning warblers have been killed at central Illinois television towers between 24 August and 27 September and at the Cape Girardeau and Creal Springs towers, one each on 29 September, 1 October, and 6 October (Heye 1963, Fig. 102).

Latest fall records are 13 October in the north (J. J. Schafer unpublished 1918), 20 October in the central region (H. D. Bohlen unpublished 1978), and 10 October in the south (Bohlen 1978).

At Chicago, Dreuth saw mourning warblers with a relative frequency of 5 birds in spring to 1 in fall. In central Illinois we saw 9 in spring to 1 in fall (2.2 to 1.0 in the census transects), and in the south, 3 in spring to 1 in fall (none in the fall transects). We have heard the song only once in fall (August), and much of the apparent difference in numbers between spring and fall reflects differences in conspicuousness due to spring song.

### Specimen Data

There is great variation in the eye-ring pattern of this species (Lanyon & Bull 1967), and we have seen at least one specimen, and H.D. Bohlen (unpublished 1978) another, with the eye pattern as in *tolmiei*. Measurements in both cases showed the specimens to be *philadelphia*. Two adult males killed in September in central Illinois weighed 14.3 and 13.5 g, both very fat. Two adult females killed in September weighed 11.3 and 12.2 g, and were quite to very fat. Three immature females killed in September weighed 11.2, 13.4, and 14.0 g (quite to very fat).

## MAC GILLIVRAY'S WARBLER (*Oporornis tolmiei*)

In view of the strong similarity between this species and *O. philadelphia* and the notable variation in both, the

specimen allegedly of this species collected 1 June 1876 (Ford 1956) should probably be re-examined. A possible second record was the report of a singing bird in the St. Louis area, 21–22 May 1950 (Comfort 1951). Records of this species in Illinois should be based on collected, or at least measured and photographed, specimens. Hybrids between *philadelphia* and *tolmiei* have been reported (Hall 1979) but not from Illinois as yet.

## COMMON YELLOWTHROAT (*Geothlypis trichas*)

(Fig. 103, 104, 105)

### Spring Migration

There is an extremely early record of a yellowthroat in Jackson County on 8 March (Kleen 1975d). The earliest date for the species at St. Louis is 1 April (Wilhelm 1957). Cooke (1905b) found the average arrival in a 7-year record to be 18 April in the St. Louis area. The bulk of migrant yellowthroats pass through southern Illinois in late April, with migration concluding in late May (Fig. 106). In central Illinois, yellowthroats generally arrive in late April, the earliest record being 14 April (R. Chapel unpublished 1977). The peak of migration in central Illinois occurs in the second week of May, with migration declining in late May (Fig. 106). The earliest arrival in northern Illinois was 20 April at Chicago (Bent 1953, Ford 1956). Dreuth's earliest record of the species at Lincoln Park in Chicago during 16 years of observations was 25 April. Most of the migrant yellowthroats pass through northern Illinois from mid-May to the last of May. Dreuth's average date for the last seen in Lincoln Park (Chicago) was 27 May, and his latest, 2 June.

Possible flight direction is indicated by an adult male yellowthroat banded near Rockford 16 May 1977 and killed at a tower in southeastern Arkansas in May 1980, south-southwest of the banding station (Band. report, Region 234).

While yellowthroats may be found in a wide variety of habitats, including towns, during migration, they were most numerous in forest edge and shrub, with maximum densities



Fig. 103.—Adult male common yellowthroat. Photo taken 25 September at Urbana, Illinois.



Fig. 104.—Immature male common yellowthroat, showing the beginning of the facial mask. Photo taken 25 September at Urbana, Illinois.

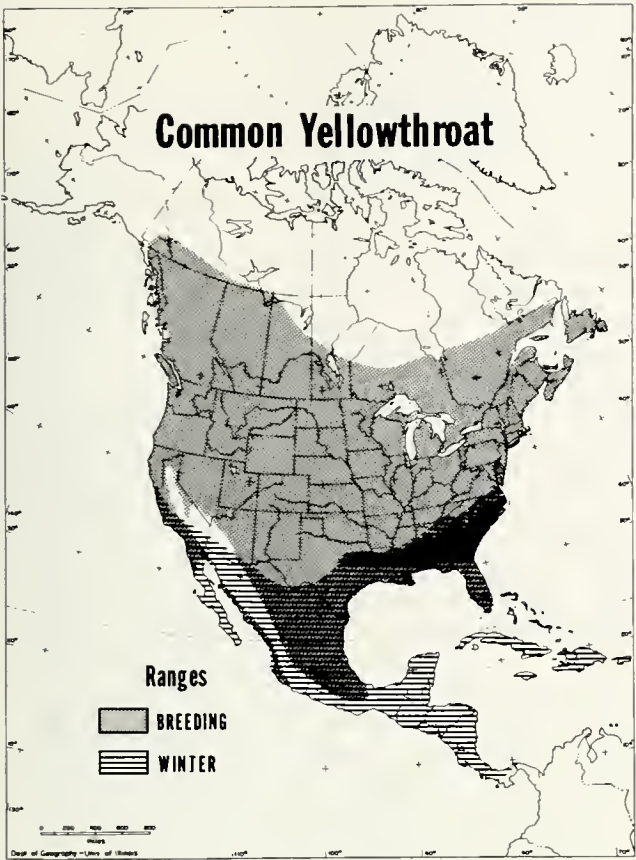


Fig. 105.—General distribution of the common yellowthroat.

higher in spring than in June (Tables 38 and 39). Note that no marsh or meadow habitats were censused in spring or fall.

TABLE 38.—Population densities of common yellowthroats in Illinois, spring and fall.

Season and	County or		Number of	Cumulative Hectares	Birds per 40.5 ha	
Habitat	Region	Year(s)	Censuses	Censused	Maximum	Mean
Spring (11 April-26 May)						
Pastures	Central	1907		253		0.2
Small grain	Central	1907		385		0.1
Cornfields	Central	1907		176		0.2
Corn stubble	Central	1907		85		0.5
Mature bottomland forest	Piatt (C)	1979-1980	7	144	12.9	3.7
Mature bottomland forest	Johnson (S)	1979-1981	12	246	13.0	1.8
Mature upland forest	Piatt (C)	1979-1981	11	220	2.0	0.2
Mature upland forest	Pope (S)	1979-1981	14	287	2.3	0.1
Forest edge and shrub	Piatt (C)	1979-1981	9	183	25.3	11.1
Forest edge and shrub	Pope (S)	1979-1981	16	317	23.4	7.8
Fall (1 August-15 October)						
Cornfields	Central	1906		194		0.2
Orchards	South	1908		413		0.8
Woods (unspecified)	South	1909		24		6.7
Mature bottomland forest	Piatt (C)	1979-1980	16	325	4.0	0.3
Mature bottomland forest	Johnson	1979-1981	17	362	2.3	0.1
Forest edge and shrub	Piatt (C)	1979-1981	23	430	31.7	8.7
Forest edge and shrub	Pope (S)	1979-1981	17	335	12.8	6.1

Nesting Habitats and Populations

The yellowthroat has an extremely large breeding range in North America (Fig. 105). It probably breeds in every county in Illinois, but as yet we have no record for some counties. In addition to the records shown in Fig. 107, there are breeding records lacking specific locality data for Lee County (J. Keegan unpublished 1962), Carroll County (P.C. Petersen unpublished 1962), Whiteside County (Thompson 1960), Winnebago County (USNM oology collection), Lake County (B.T. Gault unpublished 1885), Putnam County (UIM oology collection), and Grundy County (Polderboer 1949).

The rather ubiquitous yellowthroat exhibits a definite preference for prairie marsh ecotone. The highest numbers of yellowthroats per 40.5 ha (disregarding census samples of less than 16 ha) were found in prairie, marsh-wet prairie, meadow, and low-lying shrub areas (Table 39). Forest edge also had good populations. Certain cultivated fields—red clover, alfalfa, mixed hay, grassy fallow fields, and small-grain fields—provided some breeding habitat for this species. Few yellowthroats were found in pastures, forests, and cornfields. Forbes & Gross (1922) considered the yellowthroat one of the most abundant species in fallow fields. At Havana, Gates (1911) found the yellowthroat to be a dominant species in hydrophytic thickets and of tertiary abundance in prairie swamps and mixed forest.

The findings of 17 nests in an hour in a half acre of “swamp” (probably marsh) near Philo by Hess (1910) is difficult to believe. It is not certain from the account that the nests were all active; nevertheless this statement seems unlikely in view of the usual territory size of the yellowthroat and other population studies of this species.

The density of the ground cover and low vegetation is probably important to the yellowthroat. Willson (1974) said

TABLE 39. —Breeding population densities of common yellowthroats in Illinois.

Habitat	County or Region	Year(s)	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
				Range	Mean	
Woods (unspecified)	Rock Island (N)	1914-1923	22		1.4	J.J. Schafer unpublished
Second-growth hardwoods	Rock Island (N)	1937-1938	6		13.0	Fawks 1937, 1938
Forest (all types, including edge)	North	1957-1958	72	0 - 2.0	1.1	Graber & Graber 1963
Shrub area	North	1957-1958	13		9.4	Graber & Graber 1963
Disturbed prairie shrub	Grundy (N)	1975-1977	16	5.1-25.3	13.5	Linkletter 1975, 1977, Linkletter & Wooley 1978
Meadow marsh	Lake (N)	1937	14		11.9	Beecher 1937
Mixed sedges	Lake (N)	1937	16		20.0	Beecher 1937
Bluepoint grass ( <i>Calamagrostis</i> )	Lake (N)	1937	15		27.7	Beecher 1942
Marsh, unspecified meadow	North	1957-1958	35		3.0	Graber & Graber 1963
Grass-sedge meadow	Lake (N)	1976	6		82.2	Madding & McClain 1977b
Cattail marsh	Lake (N)	1976	7		10.8	Madding & McClain 1977a
Cattail-bulrush marsh	Grundy (N)	1978	29		7.0	This paper
Prairie	Grundy (N)	1978-1979	66	10.1-17.0	14.1	This paper
Managed grass ( <i>Bromus</i> )	Will (N)	1978	25		0	This paper
Weedy blue grass	Grundy (N)	1979	44		4.2	This paper
Pastures	North	1907-1909	78		0.5	Graber & Graber 1963
Weedy fallow fields	North	1978-1979	44	0 -12.4	5.6	This paper
Hayfields (mixed)	North	1957-1958	49		1.7	Graber & Graber 1963
Cornfields	North	1909	142		0.3	Graber & Graber 1963
Oak-maple forest and edge	Champaign (C)	1927-1976	2 km	0 - 7.0	2.4/km	Kendeigh 1944, 1948, Kendeigh & Edgington 1977
Oak-maple forest edge	Champaign (C)	1943	26		6.2	Johnston 1947
Mature bottomland forest	McLean (C)	1950-1951	25	3.2- 6.4	4.8	Calef 1953a, 1953b
Bottomland forest	Vermilion (C)	1966	6		12.0	Karr 1968
Grazed bottomland forest	Macon (C)	1955	21		3.8	Chaniot & Kirby 1955
Wet oak forest	Newton, IN (C)	1974,1977	11		43.9	Hopkins 1974a, 1978
Mature bottomland forest	Central	1978-1979	137	0 - 0.4	0.3	This paper
Forest (all types, including edge)	Central	1957-1958	87	0 - 1.0	0.5	Graber & Graber 1963
Second-growth oak-hickory	Sangamon (C)	1941-1944	23	10.7-21.4	15.5	Robertson 1941b, 1942b, 1944b
Late shrub	Vermilion (C)	1966	9		10.0	Karr 1968
Shrubby grassland	Newton, IN (C)	1974	9		66.0	Hopkins 1974b
Wet prairie marsh	Iroquois (C)	1978-1979	66	14.2-17.6	15.9	This paper
Swampy prairie	Sangamon (C)	1941-1944	27	34.4-50.0	43.1	Robertson 1941a, 1942a, 1944a
Orchard grass- fescue meadow	McLean (C)	1976-1978	12		6.7	Birkenholz 1977b, 1978b, 1979b
Mixed hay	Central	1907,1909	51		0.8	Graber & Graber 1963
Pastures	Central	1907,1909	179		0.2	Graber & Graber 1963
Small-grain fields	Central	1907,1909	310		0.1	Graber & Graber 1963
Cornfield	Central	1907,1909	468		0.2	Graber & Graber 1963
Mature bottomland forest	South	1973-1979	1,086	0 -10.7	0.9	This paper
Forest (all types, including edge)	South	1907,1909	24	0 -17.5	11.7	Graber & Graber 1963
Forest (all types, including edge)	South	1957-1958	138	0 - 4.0	2.3	Graber & Graber 1963
Forest edge and shrub	Pope (S)	1979-1980	42	2.0-14.8	8.6	This paper
Orchards	South	1907,1909	18	3.8-10.5	6.7	Graber & Graber 1963
Orchards	South	1957-1958	32		3.8	Graber & Graber 1963
Shrub areas	South	1907,1909	23		26.8	Graber & Graber 1963
Shrub areas	South	1957-1958	52	6.4-14.9	10.8	Graber & Graber 1963
Swamp and thicket	Jackson (S)	1950	5		76.9	Brewer 1955, Brewer & Hardy 1950
Pastures	South	1907,1909	357		1.1	Graber & Graber 1963
Ungrazed grass	Pope (S)	1979	20		6.0	This paper
Mixed hay	South	1907,1909	216		1.6	Graber & Graber 1963
Mixed hay	South	1957-1958	24		1.7	Graber & Graber 1963

TABLE 39. (Continued).

Habitat	County or Region	Year(s)	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
				Range	Mean	
Alfalfa	South	1957-1958	20		2.0	Graber & Graber 1963
Red clover	South	1957-1958	34		5.9	Graber & Graber 1963
Red clover	Pope (S)	1979	18		4.4	This paper
Fallow fields	South	1907, 1909	129	0.7- 3.3	2.5	Graber & Graber 1963
Fallow fields	South	1957-1958	93	0.6- 10.4	3.9	Graber & Graber 1963
Small-grain fields	South	1907, 1909	196		1.0	Graber & Graber 1963
Small-grain fields	South	1957-1958	56		0.7	Graber & Graber 1963
Cornfields	South	1907, 1909	398	0.2- 0.5	0.4	Graber & Graber 1963

that the percentage of vegetative cover tended to be large for the yellowthroat, as expected for leaf gleaners. Karr (1968) found five pairs of yellowthroats per 40.5 ha in late shrub, which had developed 37 years after strip mining in Vermilion County, but none in early shrub (10 years after strip-ping). The late-shrub area had more foliage and more moist area. Brewer (1958b) found yellowthroats only in the 18-20-year-old habitat (after strip mining) in Perry County. These studies suggest that more than 10 years may be required after stripping for the succession to reach a ground foliage density suitable for yellowthroats.

The nests of yellowthroats are usually concealed in dense vegetation in dank areas. Nests have been found in grass clumps or tussocks, weeds, bull thistle (*Cirsium lanceolatum*) (Polderboer 1949), ground cherry, mayapple, sedge, flags, small willows, blackberry, dewberry, and in strawberry patches (egg sets in USNM, UIM, and LSM). Two nests were situated over water, one in a small willow 10 cm above the water (FMNH egg set 12839) and the other in cattails 15 cm above water which was 46 cm deep (Sanborn & Goelitz 1915). The nests are usually low and well hidden. Nests were placed from 0 to 1.8 m (average of 13 nests, 52.6 cm) high in northern Illinois. The average height of six nests in central Illinois was 27 cm (range, 0-61 cm), and of six nests in the south, where five of the six nests were on the ground, 3 cm (range, 0-20 cm).

The territory of the yellowthroat is relatively small. Eleven territories measured at Allerton Park (Piatt County) averaged 1.4 acres (Allison 1947, Hensley 1948, Reese 1949). Three territories measured at Funk Forest (McLean County) averaged 0.88 acre (Calef 1953b). Brewer (1955) measured five yellowthroat territories in southern Illinois and found that they averaged 0.56 acre (range, 0.24-1.09 acres).

### Nesting Cycle

Males generally arrive (or are noticed because of their song) first. The song of the yellowthroat in Illinois has been described by Farwell (1919) as "Wheee-che-tee" repeated three or four times and sometimes varied a little by the individual bird. Ridgway (1889) phoneticized the song as "Witchity-witchity-witchity." The flight song has not been described.

Breeding activities begin in early May in southern Illinois. Yellowthroats were paired by at least 2 May, and a female was carrying nest material on 4 May. Nests are made of grass, sticks, shreds of bark (grapevine bark in some cases), leaves, straw, and rootlets. The lining is made of fine grass, sometimes with hair, and in one case fibers from milkweed

stalks. The span of egg dates in southern Illinois is 15 May-15 June which means that nesting activities last into the first weeks of July.

In central Illinois the earliest egg date is 14 May, and the latest 2 July. A pair of yellowthroats observed by Janine Polk at Urbana in 1978 was in the last stages of nest building on 16 June. The first of four eggs was laid on 18 June, and the eggs hatched between 2 and 5 July. Wiloski (1924) found a pair of yellowthroats feeding two young cowbirds in a nest on 16 July in McDonough County. We have seen adults feeding fledged young still in post-juvenile molt as late as 24 August in central Illinois.

In northern Illinois the earliest egg date on record is 7 May, and the latest 9 July. Young which had just left the nest were observed on 8 August by Mrs. Kenneth Fiske near Woodstock in 1960, and B.T. Gault saw an adult with young out of the nest on 23 August 1908 near Lisle.

The longer span of egg dates for the north reflects mainly more observers. Most nest observations consisted of a single observation, and often full details were not recorded even then. Of 54 nests from Illinois (all regions), there are only 14 sets of which we can be certain that laying was finished and probably no eggs had been removed. Of these 14 clutches, eight had 6 eggs, four had 5 eggs, and two had 4 eggs. The incidence of cowbird parasitism was 5 of 30 nests (16.7 percent) in northern Illinois, 7 of 26 nests (26.9 percent) in central Illinois, and 3 of 11 nests (27.3 percent) in southern Illinois. In most cases, only one or two cowbird eggs have been observed in yellowthroat nests; however, a female at Gorham (Jackson County) was feeding three nearly full grown cowbirds on 19 June 1963. There are no published observations on number of broods, care of the young, or nest success for Illinois yellowthroats.

The post-nuptial molt may be completed in some individuals in southern Illinois in July. A male was in fresh plumage on 28 July in Pope County. Ferry (1907b) reported that most of the yellowthroats he collected 10-24 August near Cairo were molting. A male in worn plumage, one nearly through the molt, and one in fresh plumage were seen on 3 September. Yellowthroats in southern Illinois, 14 and 22 September, were in fresh plumage. In central Illinois a very worn male was observed on 11 August, when another male was in nearly fresh plumage. On 17 August immature birds still were in juvenile plumage, and on 24 August one was still molting on the head, and a female was in new plumage. A male seen on 28 September was in new plumage and was giving a flight song. Singing is heard late July, August, September, and as late as 7 October.

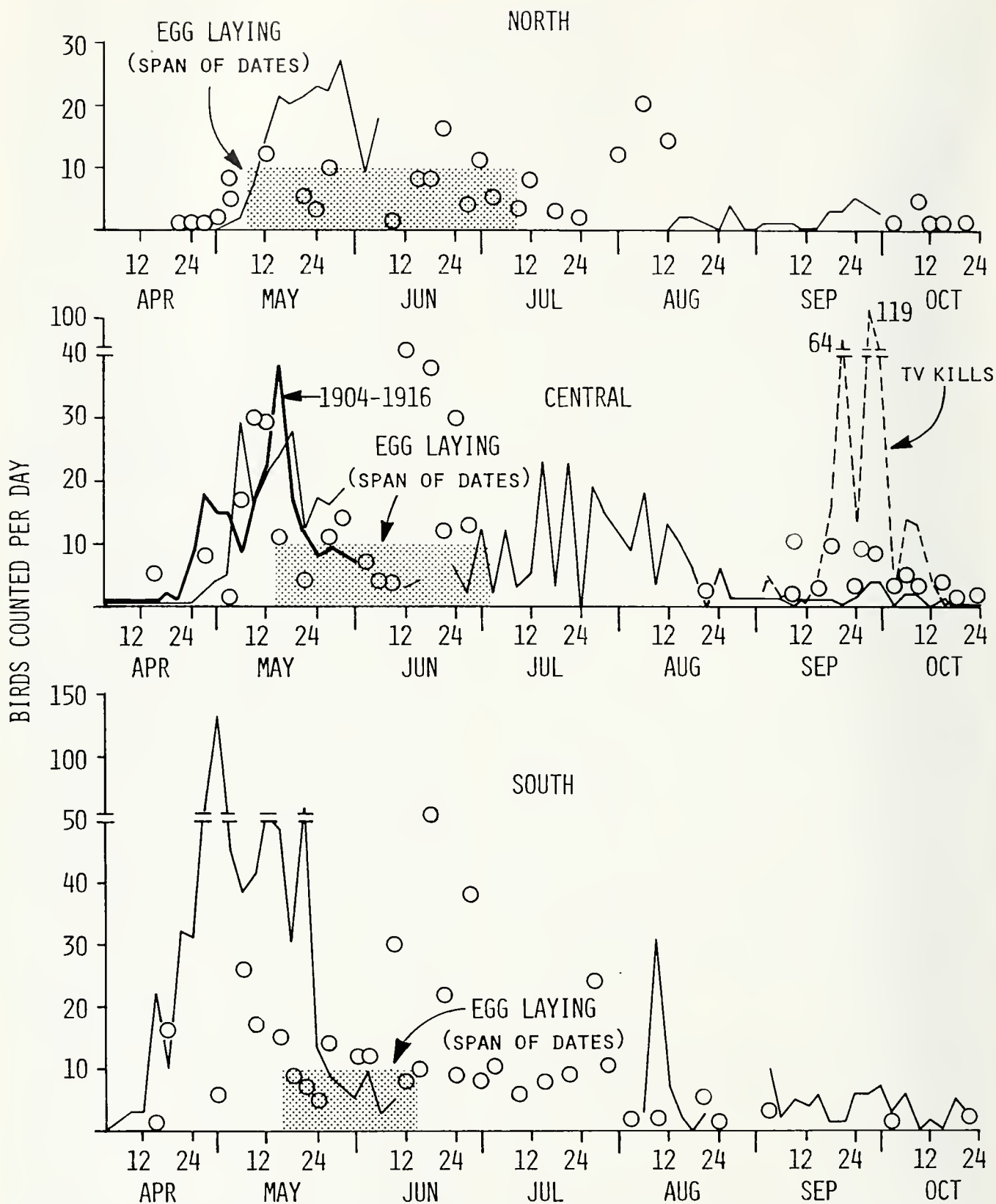


Fig. 106. - Egg-laying and migration seasons of the common yellowthroat in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The heavy line (central spring) represents counts of Smith et al. at Urbana. Shaded areas show the span of dates during which egg laying has been recorded. The dash line shows numbers killed at television towers during fall migration in central Illinois.

# Common Yellowthroat

## BREEDING RECORDS

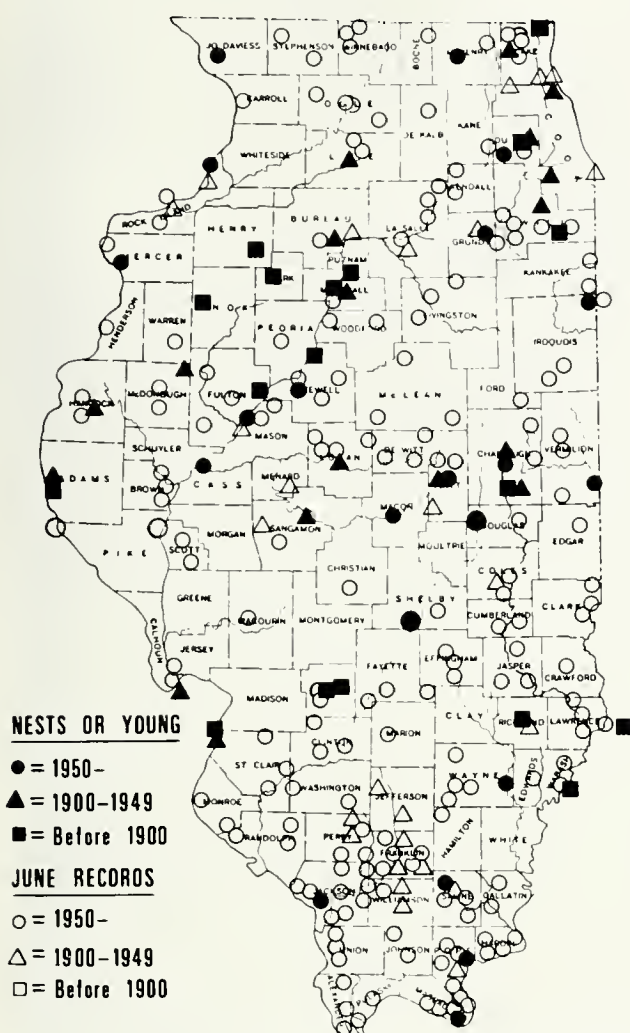


Fig. 107.—Breeding records of the common yellowthroat in Illinois.

mid-December (15–17 December) (Kleen 1976b, Ambats 1980, Sanders 1980, Struthers 1980).

Tower kills of yellowthroats (416 picked up) have occurred between 2 September and 18 October in central Illinois. The greatest numbers are killed on television towers in the third and fourth weeks of September (Fig. 106). The latest fall date for the central region was 23 November (H.D. Bohlen unpublished 1978).

In the south Widmann (1907) stated that fall migration of yellowthroats began in early September, that yellowthroats were abundant during the second and third weeks of September, and that few were left by early October. Cooke (1904) reported that the numbers of yellowthroats dwindled after 20 September at St. Louis. There is a record for 22 November in Jasper County (Kleen 1981a). There is one record for 16 December at Brussels, Calhoun County (Fawks 1971b).

The spring-to-fall ratio for southern Illinois in 1967 was 4.6:1.0, and in 1970 was 17.4:1.0. In central Illinois in 1969 the spring-to-fall ratio was 13.1:1.0, and in northern Illinois in 1968 it was 10.7:1.0. Within the census transects the ratio was 1.0 to 1.5 in central Illinois, and 1.4 to 1.0 in the south. In a sample of 72 yellowthroat specimens killed 18 August–12 October, 29 were immatures, the equivalent of 1.0 in spring to 1.4 in fall.

## Winter Records

In some years a few yellowthroats have remained in Illinois in winter. Single birds were found in late December 1941 and 1947 at Pere Marquette State Park (Pere Marquette Nature League 1942, Fawks 1971b). Three were seen in Jackson County on 11 January (Kleen 1976e). In the winter of 1979–1980 there were yellowthroat records for southern Illinois (Mills 1980, Kleen 1980b), central Illinois (Hopkins 1980, Funk & Funk 1980, Kleen 1980b), and one to three yellowthroats in the Chicago area through 14 January (Kleen 1980b).

## Food

Forbes (1883, 1878) found these items in stomachs of at least four yellowthroats taken in Tazewell County: Lepidoptera, 80 percent, cankerworms and other species; Coleoptera, 8 percent, *Pseneocerus* sp., Lathridiidae, Curculionidae, Staphylinidae, and others; Diptera, 4 percent, gnats and another dipterans; Hemiptera, 5 percent, *Piesma cinerea* and another hemipteran; Hymenoptera, one; and Arachnida, one spider and one harvestman.

Rice (1946) listed by season (spring, summer, and fall) these percentages of the food in five yellowthroats: Lepidoptera 0, 40, 15; Coleoptera 40, 30, 20; Diptera 10, 15, 10; Orthoptera 0, 10, 20; Hemiptera 15, 0, 5; Homoptera 0, 0, 25; Hymenoptera 0, 0, 5; vegetable matter 2, 0, 0; unidentified matter 35, 5, 0.

There is no information as to what Illinois yellowthroats feed their young.

## Fall Migration

Because prime habitats (marsh-grassland) for yellowthroats were not censused, no clear peaks were seen in the fall censuses in any region of Illinois (Fig. 106). However Nolan (1956a) mentioned a wave of migrant yellowthroats at Lake Forest between 9 and 12 September 1955, and Coursen (1947) said that they were often abundant in the last week of September at Orland. F.C. Gates (unpublished 1908) at Chicago found 20 on 1 September, with numbers declining to 1 on 18 September. Dreuth found migration to occur regularly at Lincoln Park (Chicago) from 29 August to 9 October. There are November records for northern Illinois (Fawks 1970a, Petersen 1970a, Kleen 1981a), and a few for

## Mortality and Longevity

An early record of a tower kill was a yellowthroat killed on an electric light tower in Decatur (Gastman 1886). Taylor (1976) stated that 5.1 percent of all warblers picked up at Illinois television towers were yellowthroats and that 11.4 percent of all birds killed at man-made structures in the USA and Canada were yellowthroats. In our Illinois sample of 8,215 warblers, yellowthroats constituted 3.7 percent.

The oldest Illinois yellowthroat on record was at least 3 years and 18 days. An adult male banded near Rockford on 15 May 1971 was recovered dead near St. Louis, Missouri, on 2 June 1974 (Annual Report of Banding unpublished 1975). This record suggests a lack of homing, but there are two other records of yellowthroats banded at Lisle (Du Page County), one in 1958 and one in 1961, both of which were retaken at Lisle a year after banding (Jurica et al 1960, 1963).

## Specimen Data

Ridgway (1889) considered that most Illinois breeding yellowthroats belonged to the race *occidentalis*. Woodruff (1907) dismissed the occurrence of the races *trichas* and *occidentalis* in Illinois and said that the Illinois birds were of the race *brachidactylus*. The relatively few specimens of breeding yellowthroats that we have examined must be assigned to *brachidactylus*. We suspect that migrants belonging to the subspecies *campicola* pass through Illinois, and one fall male in a series of nine adult males is so richly and extensively yellow below that we have tentatively called it *campicola*.

Mean gross weight in grams  $\pm$  SE of five May-July adult male yellowthroats was  $9.4 \pm 0.40$ ; that of two adult females in May, 9.1. The ranges of gross weights of fall (18 August-12 October) yellowthroats were for 18 adult males, 10.1-14.5 g (mean = 11.84, SE = 0.24); for 8 immature males, 11.0-13.8 g (mean = 12.21, SE = 0.36); for 22 adult females, 10.4-12.8 g (mean = 11.33 SE = 0.18); and for 20 immature females, 8.5-12.6 g (mean = 10.93, SE = 0.22). Birds of average weight were quite fat (3 on a scale of 0-5). Organ weights were measured by Graber & Graber (1962). The brains of adult yellowthroats were relatively heavy (compared with body weight) by comparison with those of other warblers (Graber & Graber 1965).

## YELLOW-BREASTED CHAT (*Icteria virens*)

(Fig. 108 and 109)

### Spring Migration

Our earliest record for the chat in southern Illinois is 17 April. The bulk of the migration in the south occurred 26 April-20 May, with high counts of 17-28 birds per day (Fig. 110). In the central region the earliest report was 19 April

(Widmann 1907), with peak numbers (5-17) seen 10-20 May. The earliest report for the north was 6 April (Brodkorb 1928a, Ford 1956), but there are no other records until 1 May (Jones 1895). The first week in May is the usual arrival time of the chat in the north (Nelson 1876-1877, Woodruff 1907, Clark & Nice 1950). Highest numbers (three per day) were seen after 9 May.

Spring populations of chats, like breeding populations, were found mainly in forest edge and shrub habitat (Tables 40, 41). Average densities were no higher in spring than in June.

## Nesting Habitats and Populations

The yellow-breasted chat's breeding distribution covers much of the USA and Mexico (Fig. 108). In Illinois there are June records for most of the counties and breeding records for the length of the state (Fig. 111). In addition to the records shown on Fig. 111, there are records for Cook (Butler 1898), Warren (Kleen 1976-1977), and Richland counties (Kleen 1979-1980).

The chat is a breeding bird in shrub and shrubby forest edge. Nelson (1877) found it common in dense briar patches in the river bottoms in southern Illinois, and Ridgway (1889) described the habitat as thickets, briar patches, and any low, dense growth of bushes, the thornier, the better. Ridgway (1887) found chats in the same localities as the indigo

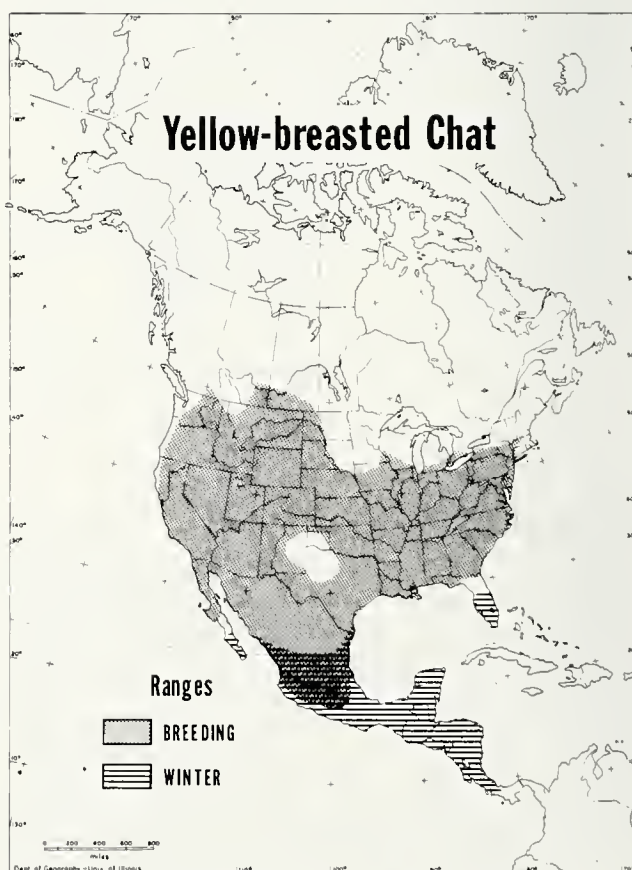


Fig. 108. General distribution of the yellow-breasted chat.



Fig. 109. Yellow-breasted chat on its nest. Photo taken 2 June in Pope County, Illinois.

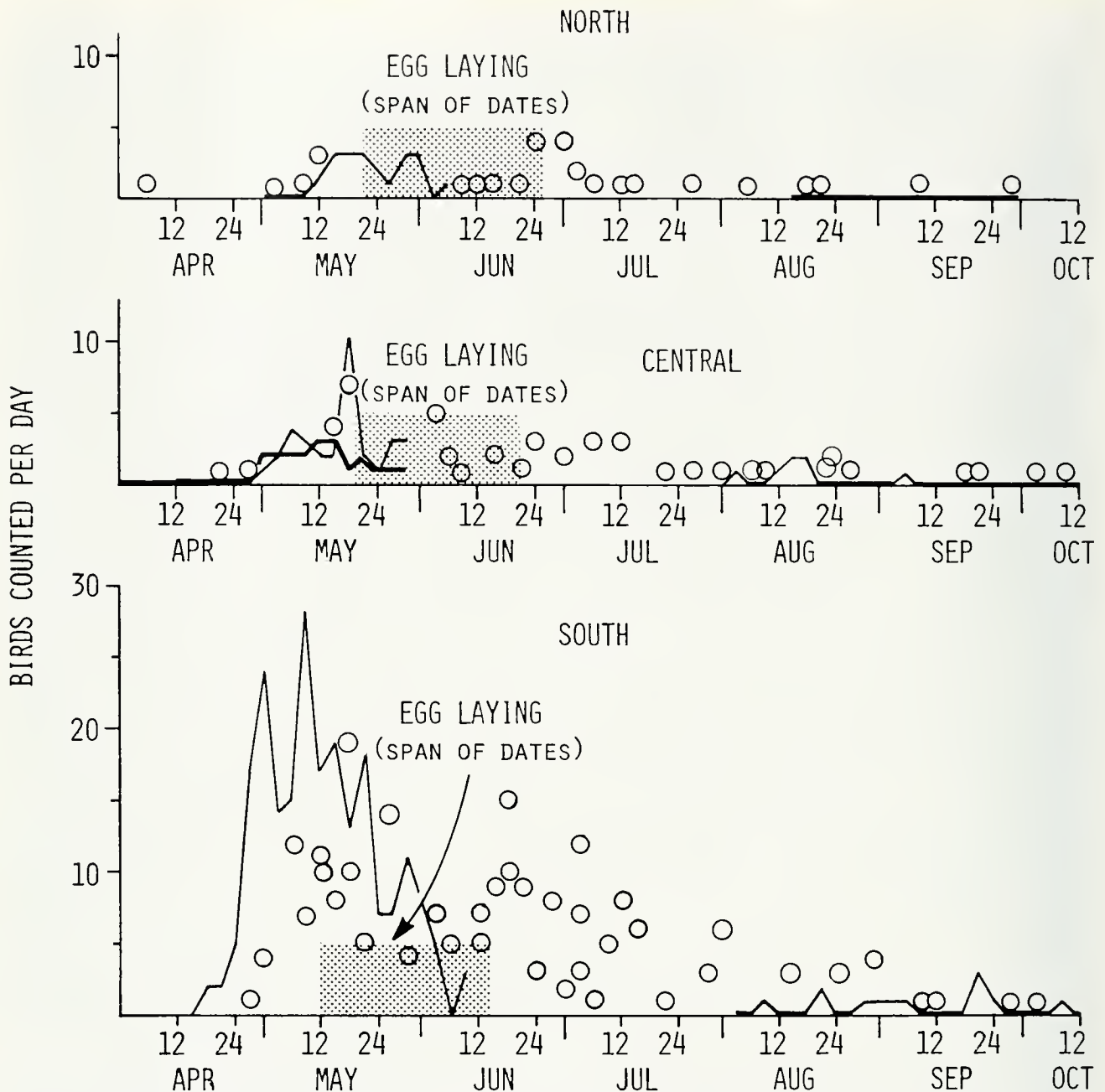


Fig. 110.—Egg-laying and migration seasons of the yellow-breasted chat in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967–1970). Hollow circles represent counts made in other years or by other observers. Shaded areas show the span of dates during which eggs have been found. The heavy line (central) shows spring counts of F. Smith and his students at Urbana.

bunting (*Passerina cyanea*), common yellowthroat, field sparrow (*Spizella pusilla*), and white-eyed vireo (*Vireo griseus*). Cahn & Hyde (1929) found it in brushy clearings in the oak-hickory association. Brewer (1958b) found that the chat population increased to a maximum in shrub habitat 14–20 years after strip mining.

In central Illinois the chat occupies briar patches and thickets and forest edge (Du Bois 1918, Hess 1910), and its preferences are clearly shown by the densities (Table 41). Loucks (1891) found them nesting in hazel thickets, and

Mundt (1883) found many nests near Fairbury, where timber had been cut and the regrowth was 5–15 feet high. Karr (1968) found chats in early shrub in strip-mined areas but none in late shrub.

Barnes (1890) stated that the chat usually nested in brushy areas on the Illinois River bluffs in Marshall County. Ford (1931) found nesting chats in brushy swales on oak ridges along Lake Michigan in what is now urban Chicago up to 1906. Baldwin (1943) described the habitat in north-eastern Illinois as usually swampy with lots of brush, trees,

TABLE 40.—Population densities of yellow-breasted chats in Illinois, spring and fall.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (20 April-27 May)						
Forest edge and shrub	Piatt (C)	1979-1981	7	142	17.8	4.3
Forest edge and shrub	Pope (S)	1979-1981	14	277	24.6	9.0
Mature bottomland forest	Johnson (S)	1979-1981	13	267	2.3	0.4
Mature upland forest	Pope (S)	1979-1981	12	242	1.9	0.3
Fall (1 August-10 September)						
Orchard	South	1908		388		0.1
Woods (unspecified)	South	1908		12		3.3
Forest edge and shrub	Piatt (C)	1979-1981	7	131	9.0	1.9
Forest edge and shrub	Pope (S)	1979-1981	10	198	6.5	2.9
Mature bottomland forest	Piatt (C)	1979-1980	6	121	5.8	1.0
Mature bottomland forest	Johnson (S)	1979-1981	8	171	1.8	0.2

weeds, and grass, but also mentioned that a nest was found in high, dry thickets at Morton Arboretum. The chat has never adapted to urban residential habitat.

Some early authors (Ridgway 1915*b*, Riis 1921, Ford et al. 1934) suggested that the chat had declined in numbers. At Urbana, Kendeigh's breeding bird censuses of Trelease Woods near Urbana (see breeding bird censuses in Audubon Field Notes 1948–1970 and American Birds 1971–1977) show a gradual decline from one to three chats per mile of

forest edge in the 1950's to none in 1965 and none since. Studies at Allerton Park, 1946–1962, (Schwager 1961, Balda 1963) showed a gradual decline in the average number of nesting pairs from around 15 per 40.5 ha, 1946–1954, to 12 in the 1955–1959 period, to 10 in 1960–1962. Shrub habitat in southern Illinois had 25.0 chats per 40.5 ha in 1907–1909, 17.8 in 1957–1958, and only 6.7 in 1979–1980 (Table 41). Thompson & Nolan (1973) concluded that the productivity of chats on their study area in southern Indiana (Bloom-

TABLE 41.—Breeding population densities of yellow-breasted chats in Illinois.

Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
					Range	Mean	
Woods (unspecified)	Rock Island (N)	1914–1923	10 years	22	0 – 4.5	0.9	J.J. Schafer unpublished
Prairie shrub	Grundy (N)	1971–1973		259		2.8	Birkenholz 1975
Oak-maple forest and edge	Champaign (C)	1944–1976	33 years	2 km		1.3/km	Kendeigh 1948, Kendeigh & Edgington 1977
Upland second-growth oak-hickory	Sangamon (C)	1941–1944	3 years	23	17.9–39.3	26.2	Robertson 1941 <i>b</i> , 1942 <i>b</i> , 1944 <i>b</i>
Forest (all types, including edge)	Central	1957–1958		87	0 – 1.0	0.5	Graber & Graber 1963
Shrub areas	Central	1957–1958		20		12.0	Graber & Graber 1963
Early shrub	Vermilion (C)	1966		9		9.0	Karr 1968
Forest (all types, including edge)	South	1907, 1909		24		11.7	Graber & Graber 1963
Forest (all types, including edge)	South	1957–1958		138		2.3	Graber & Graber 1963
Mature bottomland forest	South	1973–1979	61	1,086	0 – 2.7	0.4	This paper
Mature upland forest	South	1974–1979	30	580	0 – 5.4	0.3	This paper
Orchard	South	1958		28		2.8	Graber & Graber 1963
Forest edge and shrub	Pope (S)	1979–1980	2	42	1.8–12.0	6.7	This paper
Shrub areas	South	1907, 1909		23		25.0	Graber & Graber 1963
Shrub areas	South	1957–1958		52	8.1–26.9	17.8	Graber & Graber 1963
Shrubby field and forest edge	Richland (S)	1949		24		16	Stine 1949
Swamp and thicket	Jackson (S)	1950		5		54	Brewer & Hardy 1950
Pastures	South	1907, 1909		357		0.5	Graber & Graber 1963

# Yellow-breasted Chat

## BREEDING RECORDS

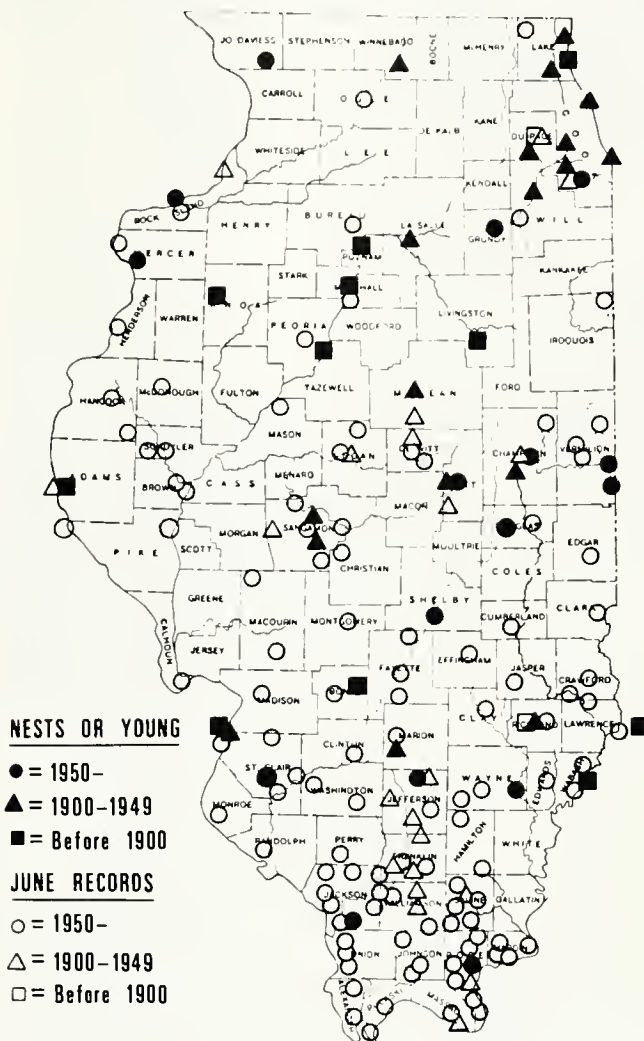


Fig. 111. - Breeding records of the yellow-breasted chat in Illinois.

ington) was insufficient to sustain the population there, which depended on recruitment from other areas to be maintained.

### Nesting Cycle

The chat's song is heard from morning until night and often at night (Widman 1907). Musselman (unpublished 1941) said that one chat sang all night on 29 June and averaged a song about every 8 seconds. Harlow (1923) and Ridgway (1889) also describe chats singing on moonlit nights. The song, as described by Ridgway (1889), Farwell (1919), Baldwin (1943), and Freeman (1950a), is a somewhat ventriloquistic (but not mimetic) series of clear whistles, mews, caws, and loud chatter. A characteristic

"wonk" sound is given every so often. The flight display is unique. The chat flies up into the air with its feet dangling, slowly clapping its wings over its back, with its tail dangling oddly and jerking as it descends again, singing all the while.

Eighteen territories of yellow-breasted chats in Piatt County ranged in size from 1 to 3.5 acres and averaged 2.5 (Allison 1947, Hensley 1948, Reese 1949). Brewer (1955) found the average chat territory in southern Illinois to be 0.3 acre (range, 0.1-0.7), notably smaller than territories of common yellowthroats in the same study area. Territories of chats in shrub habitat studied by Thompson & Nolan (1973) in southern Indiana averaged 1.2 ha (3 acres).

Chat nests varied in height from 15 cm (FMNH 13009) to nearly 2 m. The average height for 41 chat nests in Illinois (all regions) was 84 cm. The nest has most often (15 of 55 Illinois nests) been found in blackberry or raspberry (*Rubus*) stems. Other plants used for nest support were rose (13 nests), hazel (11), hawthorn (4), crabapple (2), gooseberry (1), willow (1), cedar (1), hackberry (1), locust (1), ash (1), elm (1), maple (1), dogwood (1), and buckbrush (1).

The chat nest is constructed for the most part of leaves, grass, twigs, and strips of bark (Fig. 109) and lined with finer materials—grass, weed stems, and rootlets. One nest in Sangamon County measured: inside depth, 5.1 cm; outside depth, 7.6 cm; inside diameter, 7.6 cm; outside diameter, 12.7 cm (Bent 1953). A nest from Marion County measured outside depth 11.4 cm and outside diameter 15.2 cm (Smith 1920). Ridgway (1889) said that the chat laid three to five eggs. The eggs are white and tend to be glossy with brown spots, especially at the larger end (Smith 1920). Of 11 clutches of chat eggs from Illinois that were not known to have been parasitized or plundered, three sets had 5 eggs, six had 4, and two had 3. Of 50 Illinois nests, 12 (24 percent) were parasitized by the cowbird; nine had 1 cowbird egg, two had 2, and one had 3 cowbird eggs as well as 2 chat eggs. Smith (1920) found chat nests deserted because of cowbird activities.

The nesting cycle in southern Illinois begins as early as 23 April when a pair was observed building a nest near Dix (Bowie Hannah unpublished). The latest active nest at Dix had eggs on 15 July and young on 17 July. In central Illinois the earliest nest had eggs on 20 May at Quincy (Poling 1889), and the latest nest had four eggs on 21 July at Allerton Park (Pearson 1962). In northern Illinois a nest had three eggs on 23 May (FMNH 2590). Late records for the north are: a nest with four fresh eggs near Lacon on 29 June (Illinois State Museum Oology Collection) and young fledging on 26 July in Jo Daviess County (W. Peaslee unpublished 1961). Bent (1953) reported that incubation and nestling life together required 22-23 days. If we add 3-4 days for nest building and 4 days for laying, the cycle would require 30-31 days. Of 12 nests (south and central regions) whose fates were recorded, 6 were successful in fledging young, and they produced 15 young chats.

### Fall Migration

The onset of fall migration is difficult to detect, as the chat ceases to sing in mid- to late July (Widmann 1907,

Robertson 1959, Allison 1947). Schafer (unpublished notes 1916, 1919, 1923) recorded the last resident chats in the Port Byron area between 17 and 20 August. The latest dates for migrants in northern Illinois were 13 September at Chicago (Ford 1956) and 28 September at Rockford (Van Duzen 1920). A chat was also seen as late as 28 September at Davenport (Brown 1964). In central Illinois chats left the breeding area by 2 September (Robertson 1959). The latest reports were 9 October (H.D. Bohlen unpublished 1975) and 13 October (J. Bursweicz unpublished 1961). Too few chats are observed in fall in Illinois to show any migration peaks (Fig. 110).

The departure of breeding chats from the south appears to occur from 1–2 September (Widman 1907, Smith 1920) to 20 September (George 1968). The latest date for the St. Louis area was 3 October (Wilhelm 1957), and for Pope County, Illinois, 7 October.

The spring-to-fall ratios were 7.3:1.0 in central Illinois (1.6 to 1.0 in the census transects) and 42.8:1.0 in southern Illinois (4.7 to 1.0 in the transects).

## Winter Records

In three separate instances chats appeared in central Illinois in the winter of 1967–1968, one on 27 December at Shelbyville Reservoir (Stutesman 1968), one observed in late December at a feeder in Urbana (Kendeigh 1968) and found dead on 1 January and another found dead at Chautauqua National Wildlife Refuge on 21 January 1968. Both chats that died in January had low body weights, suggesting that they had had problems obtaining suitable food although they had multiflora rose seeds in their stomachs. A number of chats were recorded in the northeastern USA in the winter of 1967–1968 at latitudes even farther north than Illinois, e.g., Massachusetts, Rhode Island, Connecticut, Long Island (1968 Audubon Field Notes, Christmas Bird Count). At Davenport, Iowa, a chat survived from mid-November to 16 January 1972, when it was captured (Petersen 1972).

## Mortality

Ridgway (1915b) felt that domestic cats were in part to blame for the population decline of chats in southern Illinois. There is only one record of a chat being killed at an Illinois television tower. A female was found at the Charleston tower on 9 May (L.B. Hunt unpublished 1972).

## Specimen Data

One adult male with little fat weighed 24.2 g in April, and a female killed in May weighed 23.4 g. The male which died in January at Urbana weighed 18.0 g, and the female found dead on 21 January at Chautauqua National Wildlife Refuge, 19.0 g.

## HOODED WARBLER (*Wilsonia citrina*)

(Fig. 112 and 113)

### Spring Migration

Hooded warblers are generally noticed in southern Illinois by the last week in April (Fig. 114). There are two very early records, one on 27 March in the St. Louis area (Wilhelm 1957) and one at Crab Orchard on 30 March (Bent 1953, George 1968). Cooke (1888) said that the height of the hooded warbler migration in the St. Louis area was 30 April. Our highest count in the south was six on 26 April. The earliest record of a hooded warbler in central Illinois was a male first seen 2 April in Champaign and found dead on 4 April (INHS WH-2). The arrival of hooded warblers in central Illinois is more often noted in the latter half of April. There were 14 sightings of hooded warblers between 21 April and 16 May near Springfield in 1974 (Kleen 1974b). H.D. Bohlen saw nine between 15 April and 8 May 1975 (four on 6 May). In 1976, he saw 10 males between 19 April and 27 May, but in 1977 and 1978 he saw only 5 males each spring. In northern Illinois the earliest dates for the hooded warbler were 27 and 28 March (Mayfield 1950a, Woodruff 1907). There are several records for the first week in April (Boulton & Beecher 1940, DuMont 1947, Mayfield 1950a, Gunn & Crocker 1951, Ford 1956). The largest number seen at

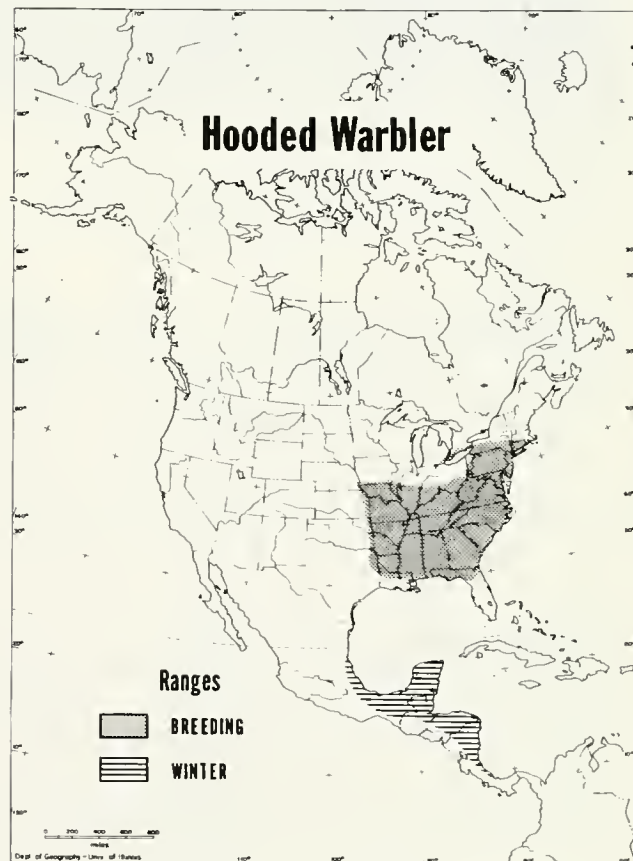


Fig. 112. – General distribution of the hooded warbler.



Fig. 113. Female hooded warbler on its nest. Photo taken 15 June in Pope County, Illinois.

Chicago on 1 day was three on 10 May (F.C. Gates unpublished 1904).

Spring densities of the hooded warbler (Table 42) were little more than those of the June population.

### Breeding

Central Illinois is about the northern limit of the regular breeding range of the hooded warbler in Illinois though the

species ranges farther north in the eastern United States (Fig. 112). It is not a common bird in Illinois, and populations are spotty even in Southern Illinois.

There are very few references to the nesting of the hooded warbler in northern Illinois. Baroody (1931) mentions a nest found "after 1905" in Palisades State Park. An egg collected by Kennicott in Cook County in June 1863 is in the USNM (7138). There are a few June records of the hooded warbler in northeastern Illinois (Fig. 115, Petersen 1966b,

TABLE 42. — Population densities of hooded warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (21 April-28 May)						
Mature bottomland forest	Piatt (C)	1979-1980	6	123		0
Mature bottomland forest	Johnson (S)	1979-1981	5	214	1.9	0.4
Mature upland forest	Piatt (C)	1979-1981	6	180	1.9	0.4
Mature upland forest	Pope (S)	1979-1981	5	168	1.9	0.2
Forest edge and shrub	Pope (S)	1979-1981	4	175	2.0	0.5
Breeding (June)						
Woods (unspecified)	South	1957-1958		138		0.6
Mature bottomland forest	South	1973-1979	61	1,086	2.1	0.1
Mature upland forest	South	1974-1979	30	580	1.6	0.2

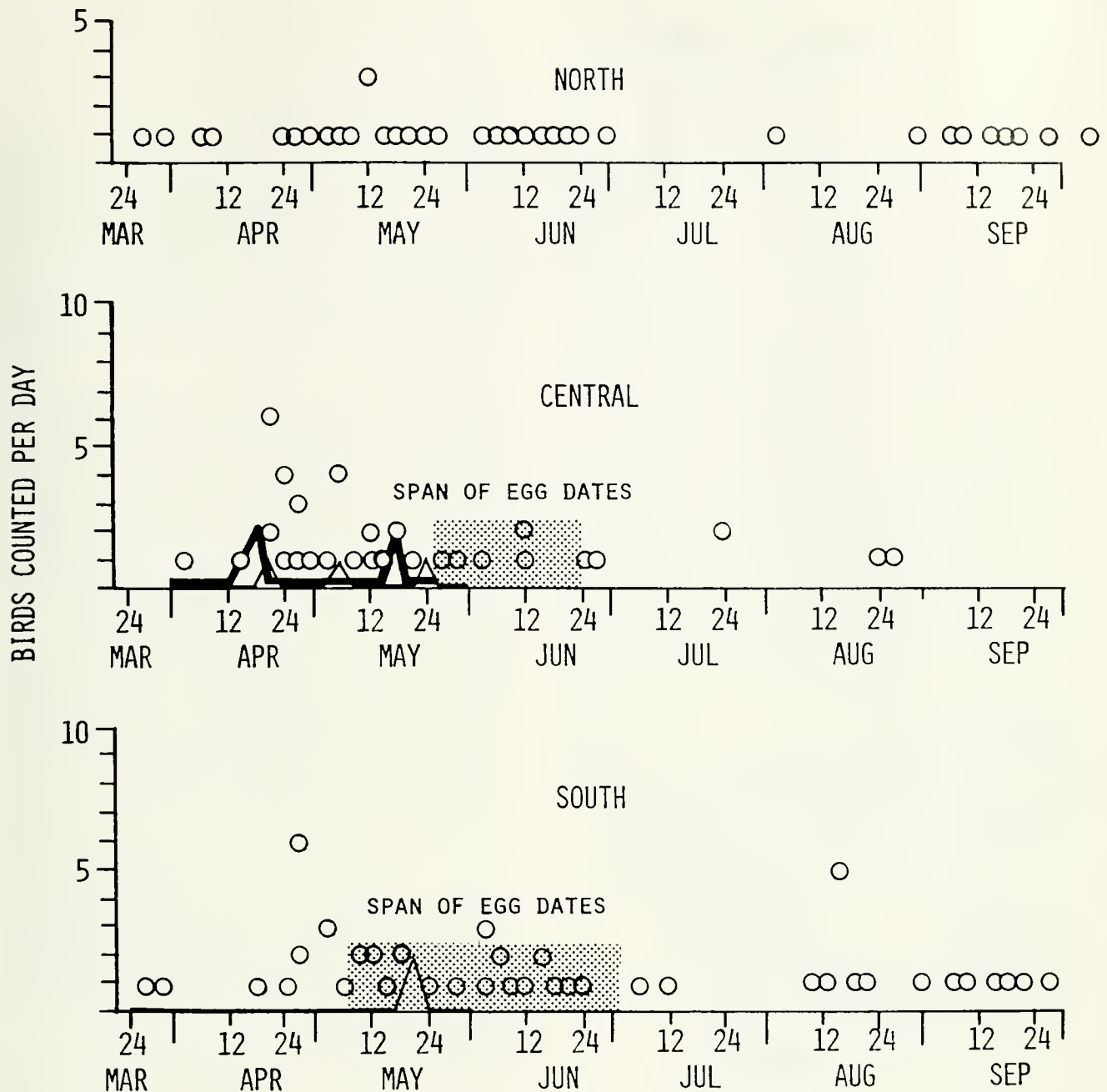


Fig. 114.— Egg-laying and migration seasons of the hooded warbler in different regions of Illinois (see Fig. 50 for regions). The spring line for the central and south regions show the highest daily count of each 3 days (1967–1970). Hollow circles represent counts made in other years or by other observers. The heavy line (central spring) represents counts of Smith et al. at Urbana. Shaded areas show the span of dates during which egg laying has been recorded.

Fawks 1966c, 1973b, Kleen 1978–1979, 1980–1981), and some authors have listed the species as a summer resident in the area (Nelson 1876–1877, Ford et al. 1934, Ford 1956). A singing bird was present 4–24 June at Riverwoods, Lake County (Kleen 1978–1979). The existence of a viable, sustained breeding population of hooded warblers in northern Illinois needs to be substantiated. A breeding population has existed at Indiana Dunes (Mumford 1959b).

There are no recent nesting records of the hooded

warbler in central Illinois, and very few old records. In 1897 a hooded nest was found near Philo (Hess 1910), and O.C. Poling (unpublished 1899) mentioned a nest near Quincy in 1899. Currier (1895) found two hooded warbler nests near Keokuk and said that the bird was common on both sides of the Mississippi River there. More recently a singing male was found on 26 June 1976 near Chautauqua National Wildlife Refuge (Bohlen 1978), and two singing males spent the 1979 summer at Allerton Park. Gates (1911) indicated that the

# Hooded Warbler

## BREEDING RECORDS

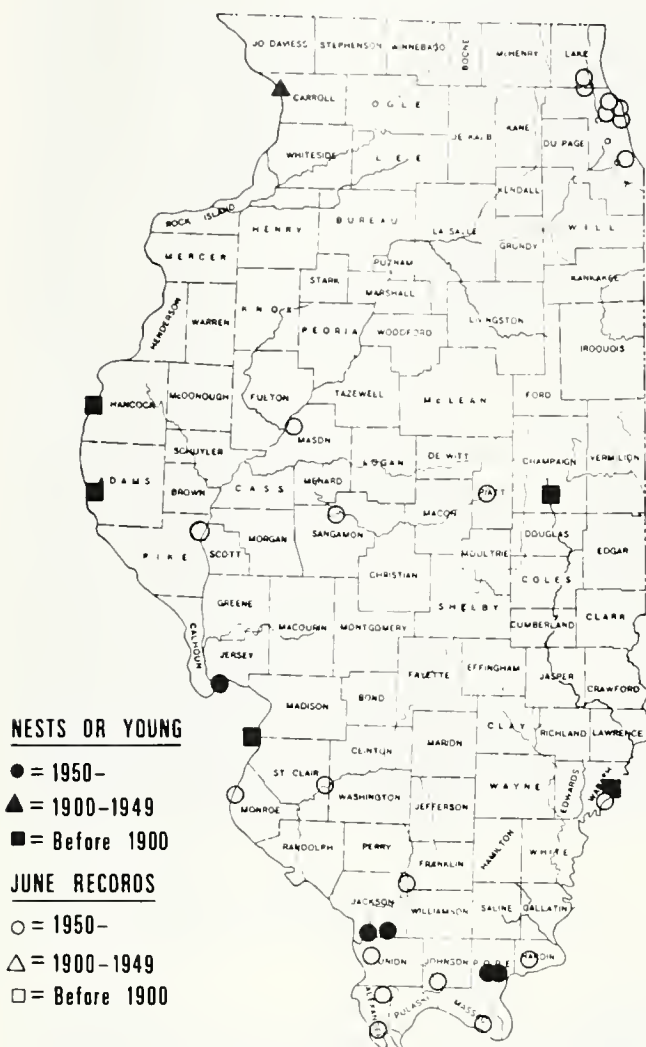


Fig. 115. - Breeding records of the hooded warbler in Illinois.

hooded warbler was a dominant in bottomland woods near Havana, but his data did not indicate that he saw more than one bird.

There are a number of June records for southern Illinois, but few nest records. Ridgway collected two sets of hooded warbler eggs (USNM 17641 and 17642) in 1878 at Mt. Carmel. A nest was found in 1884 in the St. Louis area (Hurter 1884, Cooke 1888). More recent records suggesting breeding include a bird carrying food near Pomona (Mayfield 1951) and hooded warblers seen in summer along the Mississippi River levee in Illinois between St. Louis and Kaskaskia Island (Anderson 1962, 1964a, Hanselmann 1963-1964) and at Pere Marquette State Park (Petersen 1968b, 1970b, Fawks 1968b, Anderson 1971 and Wuestenfeld 1977). Eddleman (1978) found six during sum-

mer near Pomona and said that they nested there. It is unclear whether statements that the bird nested in these areas means that nests were actually found or whether nesting was inferred from the birds' presence in summer.

The hooded warbler seems to use two kinds of nesting habitats. Most are found in riparian forest with a heavy undergrowth of weeds and shrubbery. Currier (1895) described the habitat along the Mississippi River near Keokuk as wet, heavy-timbered bottoms of large elm, sycamore, locust, maple, willow, and hackberry trees with a heavy undergrowth of grape, ivy, creepers, and a dense tangle of weeds and nettles. Davie (1898) described the hooded as a common resident in cane brakes and low shrubbery along the lower Wabash River in Illinois. Ridgway (1878, 1882) found hooded warblers in cypress swamps and river bottoms where switch cane (*Arundinaria*) was abundant. The latter two habitat descriptions could also apply to the habitat of the Swainson's warbler, but Mayfield (1951) suggested that the hooded warbler may occupy slightly higher ground than does the Swainson's warbler.

The other habitat is mature, mesic upland oak-hickory forest with denser sapling-shrub understory. We have seen hooded warblers in this habitat even when more typical bottomland habitat nearby was not occupied by this species. Although Ridgway (1889) found the hooded warbler common in bottomland woods along the Wabash River at Mt. Carmel, we found only one male in four summers (1974-1977) when we censused Beall Woods. No area that we censused in southern Illinois, 1973-1979, had many hooded warblers (Table 42). The largest number we have found in any place was five singing along a 9-mile stretch of Lusk Creek, Pope County, on 17 July 1971.

Nests are placed low in the vegetation, ranging from 6 inches at Philo (Hess 1910) to 3 feet in Pope County. Currier (1895) said that 20 inches was the most common nest height at Keokuk. Plants supporting nests in Illinois have not been identified except as "small bushes" (Ridgway 1878, Hess 1910). In Pope County one nest was in a small sugar maple (*Acer saccharum*) sapling in a thicket of maple saplings (Fig. 113), and another was in a small box elder (*Acer negundo*) in a dense stand of giant ragweed (*Ambrosia trifida*) and jewelweed (*Impatiens*).

The nest resembles that of the indigo bunting but is slightly smaller (Currier 1895). One nest we measured was 3.5 cm inside depth, 7.5 cm outside depth, 5.0 cm inside diameter, and 6.0 cm outside diameter. It was built typically upon a platform of old sugar maple leaves, and made of grapevine bark woven into a cup lined with fine grass. The nest was situated in a crotch, and although not visible from above, was readily seen from below (Fig. 113).

The clarion song can be phrased as "Sweet-sweet-I-switch-you," rising and faster on the last two notes. It is phrased like the song of the chestnut-sided warbler, but with only two notes leading into the last three more rapid and emphatic notes, and it is more vibrant than the chestnut-side's song. Mating was observed on 2 May in the St. Louis area (Cooke & Widmann 1883). The earliest date for eggs was 6 May, based on two clutches of four eggs each found near Mt. Carmel on 10 May 1878 by Ridgway. Currier (1895) found

the greatest number of clutches in the third week of June at Keokuk. We found a bird incubating eggs on 2 July in Pope County.

There are data on only five egg sets from Illinois, two from central Illinois with 5 eggs and two with 4, and one set with 3 eggs from the south. Currier (1895), who found at least 25 nests at Keokuk, never saw a clutch larger than 3 eggs. The hooded warbler suffers from cowbird parasitism. One Pope County nest had three cowbird eggs (no warbler eggs) being incubated by the female.

Baroody (1931) mentioned that the habitat at Palisades Park was fenced by the Department of Public Works to pasture sheep for the purpose of keeping down undergrowth, thus destroying the habitat for the warbler.

## Fall Migration

Currier (1895) stated that hooded warblers left the Keokuk area in August. Wilhelm (1957) noted 19 August as the beginning of the fall migration in the St. Louis area. The latest record for northern Illinois was one at Chicago on 4 October (Kleen 1974a). A noteworthy record was an adult female hooded warbler killed at the Fithian tower on 6 October—our only specimen of this species from television towers. In general, we expect tower kills only in species with relatively high flight densities. Other central Illinois records are one in Piatt County on 7 October (J. Bursewicz unpublished 1961) and one at Champaign on 20 November (Petersen 1963a). The latest records for the St. Louis area are 29 and 30 September (Cooke 1888, Widmann 1907).

We did not encounter the hooded warbler in our fall censuses (Table 42). A male we saw in Champaign County on 3 September was in the same place where one had been in June.

## Specimen Data

Ridgway (1889) stated that in the hooded warbler, both sexes require 3 years to attain full plumage, by which time the female is much like the male, except that her throat is never entirely black (Fig. 113).

The weight of one male which died at Champaign in April was 8.4 g (no fat), and the female killed at Fithian on 6 October weighed 12.6 g (very fat).

## WILSON'S WARBLER

(*Wilsonia pusilla*)

(Fig. 116)

## Spring Migration

Wilson's warbler is a regular spring migrant in Illinois, occurring in relatively small numbers. Usually 1-10 are seen in a day, 25 being the most recorded in any 1 day (Fig. 117).

The earliest date for the species in Illinois was 14 April at Urbana (R. Chapel, C. and M. Hallowell, unpublished 1977). The earliest record for southern Illinois was 21 April. Highest numbers (8-25 per day) were seen there 11-16 May. The latest reports for the region were 3 and 10 June in the St. Louis area (Comfort 1942, Wilhelm 1957, Fig. 117). In central Illinois highest counts (12-21 per day) came 10-27 May, and the latest spring record was 4 June (H.D. Bohlen unpublished 1976). In northern Illinois the earliest report of Wilson's was 30 April (Coursen 1947), and highest numbers (four to eight per day) were seen 14-27 May. By the end of May most Wilson's have left northern Illinois, but some were still present in June as late as the 26th (J.J. Schafer unpublished 1917, Ferry 1908, Smith 1946, Coursen 1947, Clark & Nice 1950, Ford 1956, Petersen 1965b, 1966b, Kleen 1978c). Smith's counts at Urbana (1904-1925) were not as high as our more recent counts (Fig. 117).

As is the general rule, males appear to arrive first (Cooke & Widmann 1883, Gault unpublished notes 1884-1923) and are often detected by their song. The song was described by Silloway (unpublished 1921) as a little rattling trill, varying from five to seven or eight notes, mostly monotonous but frequently delivered with variation in volume.

Wilson's warbler prefers shrub or forest-edge habitat (Table 43). Ries & Werner (1946) saw Wilson's especially in hawthorn groves at Starved Rock State Park. They have also been found in willows and willow thickets (Nelson 1876-1877, Gault unpublished 1899).

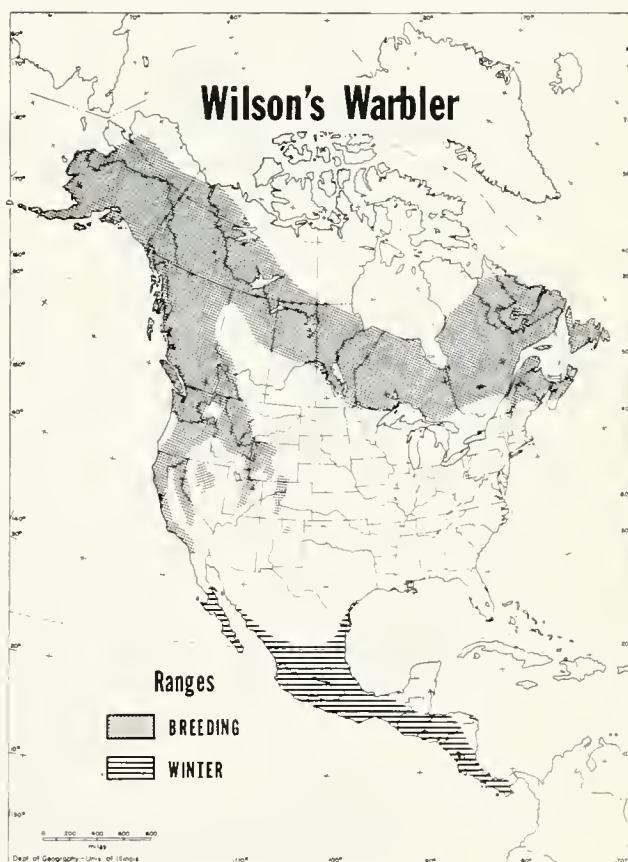


Fig. 116. — General distribution of Wilson's warbler.

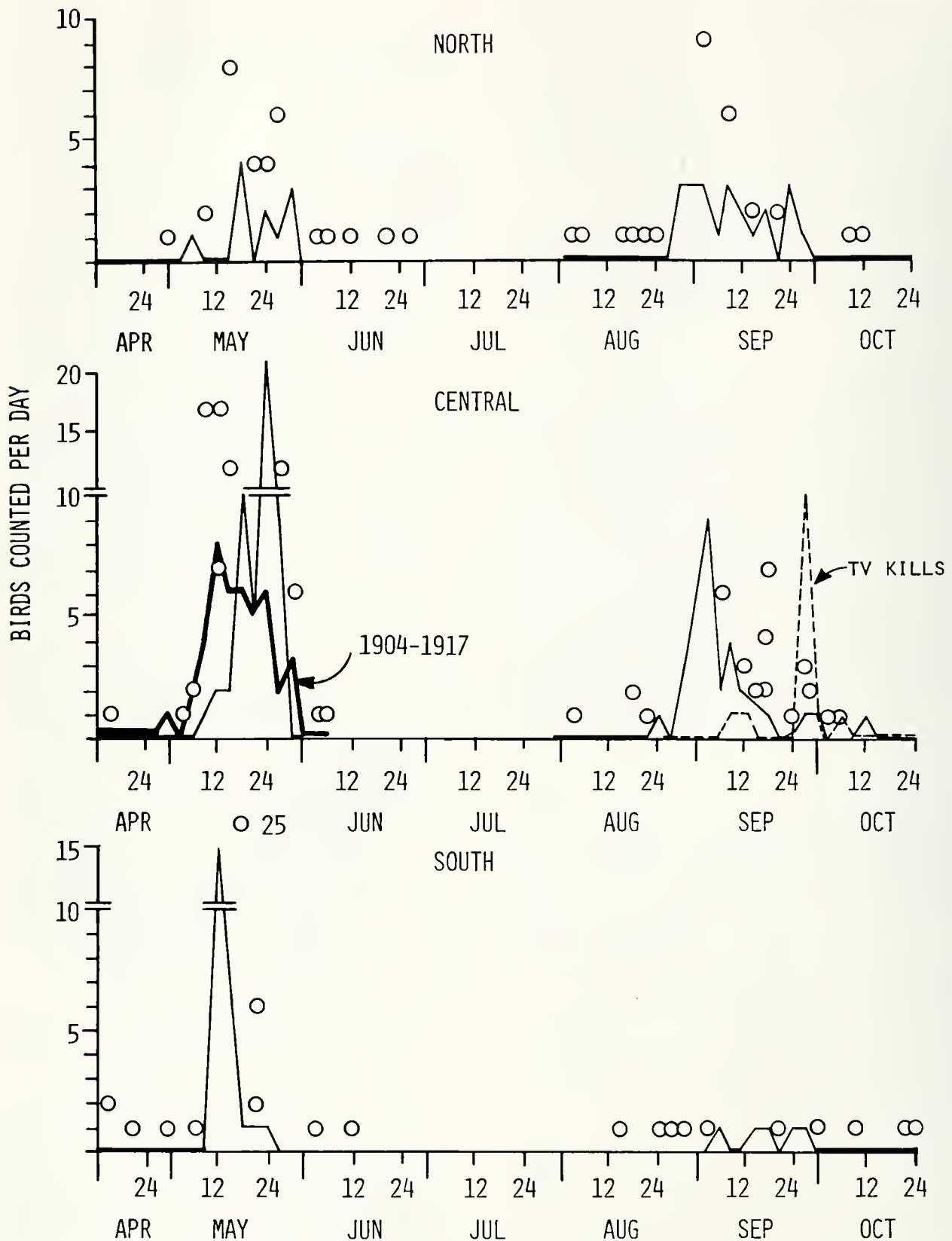


Fig. 117. - Migration seasons of Wilson's warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois. The heavy line (central spring) indicates numbers found by F. Smith and his students in Urbana.

TABLE 43.—Population densities of Wilson's warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (29 April-25 May)						
Pastures	Spring	1907		78		0.5
Mature bottomland forest	Piatt (C)	1979-1980	6	123	1.9	0.3
Mature bottomland forest	Johnson (S)	1979-1981	6	128	1.9	0.9
Mature upland forest	Piatt (C)	1979-1981	9	180	3.8	0.4
Mature upland forest	Pope (S)	1979-1981	8	158		0
Forest edge and shrub	Piatt (C)	1979-1981	7	142	15.6	4.3
Forest edge and shrub	Pope (S)	1979-1981	7	135	2.5	0.9
Fall (2-29 September)						
Mature bottomland forest	Piatt (C)	1979-1980	9	184	2.0	0.4
Mature upland forest	Piatt (C)	1979-1981	12	233		0
Forest edge and shrub	Piatt (C)	1979-1981	15	280	6.1	1.3

## Fall Migration

Wilson's warblers have appeared in northern Illinois as early as 3 August at Orland Park (Coursen 1947). More commonly they arrive in mid-August, with the peak of migration occurring in early September (Fig. 117). Most have passed through by late September, late records being 5 and 11 October (Clark & Nice 1950, Bent 1953). There is an accidental record of a Wilson's at Lisle on 1 December (Hoger 1964). The earliest record for Wilson's warbler in central Illinois is 2 August at Urbana (R. Chapel unpublished 1979). Usually Wilson's begin to appear after mid-August, with the peak of fall migration occurring in early September. The last were seen in central Illinois on 11 October (Bohlen unpublished 1978) and 23 November (Kleen 1974a). Early reports of Wilson's warbler in the south were 15 August (Wilhelm 1957) and 23-25 August in the St. Louis area (Widmann 1907). Usually they arrive in southern Illinois in early September, and the latest record was 24 October (Fawks 1971b).

Deuth saw Wilson's warblers on nearly twice as many days in spring as in fall at Chicago. We saw 1.0 (spring) to 1.2 (fall) in the north, 3.0 to 1.0 in central Illinois (1.6 to 1.0 in the transects), and 8.6 to 1.0 in the south. The east-west ratio in central Illinois in 1969 was 4.1:1.0, and the ratio was the same in the spring and fall. We saw many more Wilson's warblers in central Illinois than in southern Illinois (Table 43, Fig. 117).

A bird banded in Londonderry, Vermont, on 4 September 1970 was captured at Carbondale, Illinois, on 19 September 1971 (Kleen 1972).

Wilson's warblers have been infrequent casualties at television towers. We have records of only 17 specimens, 10 of which were from one very large kill (27 September 1972); however, the number found that day is not comparable with the remainder of the data (Fig. 117) in that specimens were gathered at eight towers on that date, versus the usual one or two.

## Specimen Data

Gross weights of Wilson's warblers killed or captured, 3 September-7 October, were for two adult males, 8.0 g (little fat) and 8.2 g (Kleen 1972); for two immature males, 7.5 g and 8.6 g (quite fat); for one adult female, 8.0 g (little fat); and for three immature females, 7.5, 7.7, and 8.8 g (quite to very fat).

## CANADA WARBLER (*Wilsonia canadensis*)

(Fig. 118, 119)

## Spring Migration

The earliest record of a Canada warbler in the south is 18 April in Knox County, Indiana (Ridgway 1882). He felt that it was one of the most numerous of migrants in that area in late April 1882. Peak numbers (4-26 per day) in Illinois have been seen 9-21 May. The latest date for the species in the region was 12 June in the St. Louis area (Comfort 1942). The earliest report for central Illinois was 26 April (R. Chapel unpublished 1979). The peak of the Canada's migration in central Illinois occurs 17-23 May when 5-20 per day have been found (Fig. 120). The latest record for the central region is 22 June (Kleen & Bush 1973d). In northern Illinois the earliest date for the Canada is 22 April (F.C. Gates unpublished 1905). In his many years of observation in northeastern Illinois, B.T. Gault never recorded a Canada warbler in April, his earliest record being 5 May. The peak of migration in the region was 18-29 May, when 4-12 were seen per day. The latest dates for northern Illinois are 26 and 27 June (Ford 1956, Mumford 1959b).

Spring populations of Canadas were highest in bottomland forest (Table 44).



Fig. 118.—Female or immature Canada warbler in fall plumage. Photo taken in Champaign, Illinois, by Allen Smith.

Canada warblers sing frequently throughout the state in spring, greatly increasing their conspicuousness. Farwell (1919) described the song as sweet, somewhat suggestive of the song of the indigo bunting but more liquid. Silloway (unpublished 1922) noted that the song often begins with two or three sharp "chip" notes and gave these phonetics: "Chip-chip, chipper-ee-ee, chip chip."

Nelson (1876–1877) reported the Canada warbler to be a rare summer resident in northeastern Illinois, and Davie

(1898) stated that the species had been known to nest in northern Illinois; however, they presented no evidence. In 1959 C. T. Clark saw a female on 27 June and a singing male on 4 July at Deerfield (Mumford 1959b). Two singing males were also seen in the area on 24 June 1962. The first certain nesting of the Canada warbler in Illinois was a nest that fledged five young on 26 June 1980 (Milosevich & Olson 1981). The nest was in a clearing in upland oak-hickory in a Joliet park. In 1956–1958 Canada warblers summered at Indiana Dunes Park, and in 1958 they were seen feeding a cowbird on 21 June (Nolan 1958). Canadas were subsequently reported there in 1959 and 1960 (Mumford 1959b, 1960d) and in 1967 (Petersen 1967). In 1975 a Canada warbler was seen carrying nest material at Indiana Dunes in late May (Kleen 1975c). A Canada at Elmhurst, Illinois, on 29 July (Kleen & Bush 1972c) was possibly an early fall migrant.

### Fall Migration

The earliest fall migrants have been seen in early August, immature birds and females appearing first (Gault unpublished 1884–1927). A Canada was seen at Chicago on 1 August by F. C. Gates (unpublished 1904) and another on 3 August (Ford et al. 1934). The peak of the Canada warbler's fall migration in northern Illinois is in late August (Fig. 120). The latest dates for the region were 27 September at Orland (Coursen 1947) and 17 October at Rockford (Jones 1895). In central Illinois the Canada warbler has been seen as early as 4 August at Urbana (D. Friedmann unpublished 1976). More often they have been found in mid- or late August, with most occurring in early September (Fig. 120). The latest records were two at Urbana on 6 October (F. Smith unpublished 1906) and one on 11 October at Peoria (Silloway unpublished 1922). In southern Illinois the earliest records were 9 and 11 August, one adult and one immature female collected, respectively, at Mt. Carmel (USNM 60889) and Mermet (INHS WCA2). Relatively few are found in southern Illinois, most of them in the first 2 weeks of September (Fig. 120). The latest records for the region were 1 and 5 October in the St. Louis area (Widmann 1907, Wilhelm 1957).

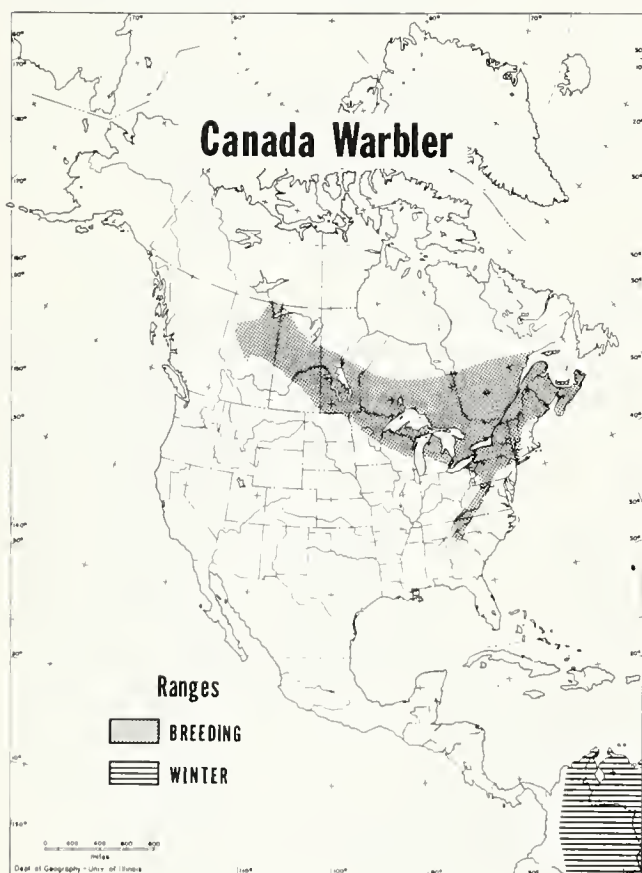


Fig. 119. General distribution of the Canada warbler.

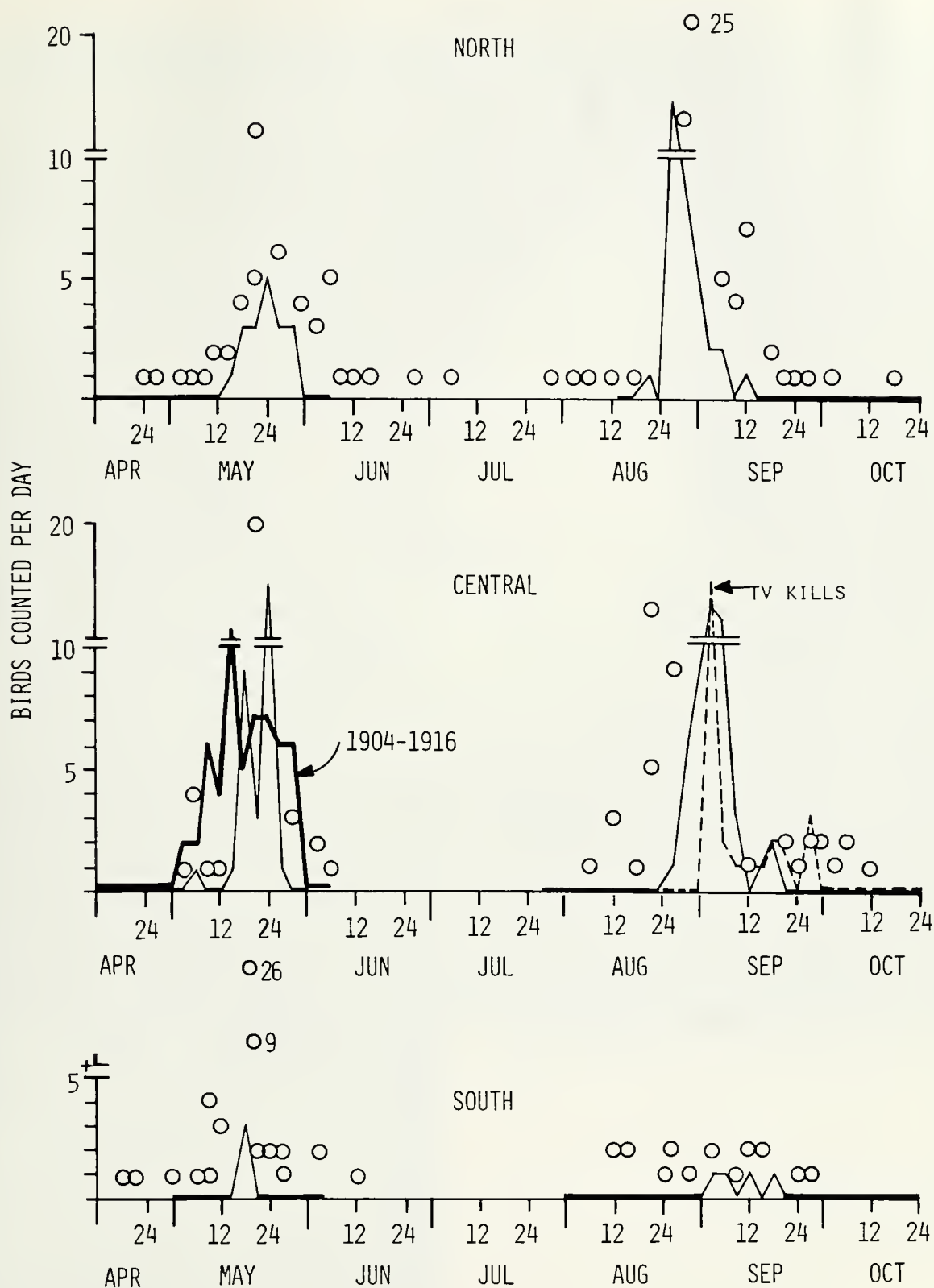


Fig. 120. — Migration seasons of the Canada warbler in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. The dash line shows numbers killed at television towers during fall migration in central Illinois. The heavy line (central spring) indicates numbers found by F. Smith et al. at Urbana.

TABLE 44. — Population densities of Canada warblers in Illinois.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (4-27 May)						
Mature bottomland forest	Piatt (C)	1979-1980	6	123	9.2	4.3
Mature bottomland forest	Johnson (S)	1979-1981	6	128	37.4	8.2
Mature upland forest	Piatt (C)	1979-1981	9	180	1.9	0.4
Mature upland forest	Pope (S)	1979-1981	6	124		0
Forest edge and shrub	Piatt (C)	1979-1981	7	142	6.7	1.4
Forest edge and shrub	Pope (S)	1979-1981	6	114	8.0	2.8
Fall (21 August-22 September)						
Woods (unspecified)	Central	1906-1909		21		1.9
Orchards	South	1908		414		0.1
Mature bottomland forest	Piatt (C)	1979-1980	9	185	32.7	9.8
Mature bottomland forest	Johnson (S)	1979-1981	8	171	7.6	2.4
Mature upland forest	Piatt (C)	1979-1981	12	234	3.0	0.6
Mature upland forest	Pope (S)	1979-1981	7	144		0
Forest edge and shrub	Piatt (C)	1979-1981	13	246	7.1	2.0
Forest edge and shrub	Pope (S)	1979-1981	7	134	2.0	0.6

As in spring, populations of Canadas in fall were highest in bottomland forest and forest edge and shrub, but were consistently low in upland forest (Table 44).

The ratio of the spring-to-fall counts was 1.0 to 1.1 in northern Illinois, 1.0 to 4.9 in central Illinois (1.0 to 3.1 in the census transects), and 2 to 1 in the south (2.8 to 1.0 in the census transects). In central Illinois we saw five times more Canada warblers on the eastern side of the state than on the western side. The age ratio in our small sample of specimens was nine adults to five immatures.

Canada warblers are not common victims at television towers; we have records of only 36 specimens, including 1 in spring (Brewer & Ellis 1958). The pattern of fall dates (31 August-27 September) and numbers of Canadas at the towers was similar to the pattern of field counts (Fig. 120).

### Specimen Data

An adult male Canada warbler killed in May weighed 10.6 g (some fat), and two killed in August-September weighed 10.9 and 11.7 g (some to quite fat). Weights for other fall specimens were: for two immature males, 10.6 and 14.4 g (some to extremely fat); for three adult females, 9.7, 10.2, and 13.4 g (some to very fat); and for two immature females, 10.0 and 11.7 g (some to quite fat).

## AMERICAN REDSTART (*Setophaga ruticilla*)

(Fig. 121, 122 and 123)

### Spring Migration

The earliest reports of the redstart in Illinois were 5 April in the south (George 1968), 15 April in the central region

(Thom 1973), and 6 and 13 April in the north (Gunn & Crocker 1951, Fawks 1967b). Highest numbers have been seen 26 April-21 May in the southern region (13-30 birds per day, though we have even higher counts for June, Fig. 124), 28 April-27 May in the central region (16-200 per day), and 3-30 May in the north (15-50 per day). The highest counts in June in southern Illinois may represent migration to some extent but are mainly the breeding population. The high counts of Smith et al. at Urbana (1904-1925) were similar to



Fig. 121. — American redstart male. Photo taken 8 May in Piatt County, Illinois.



Fig. 122. — American redstart female. Photo taken 12 September at Urbana, Illinois.

our more recent counts (Fig. 124). A count of 200 at Urbana on 8 May represents an unusual concentration because of weather, and high counts of many other species were made on that day (Graber 1962b). The end of the spring migration is obscured by breeding populations throughout the state. Early June records could be either transients or breeding birds almost anywhere in the state, but especially in the north June records could be transients.

Spring populations were highest in bottomland forests and forest-edge and shrub habitat (Table 45), though in central Illinois, where forest habitat is at a premium, upland forest was also heavily used. Spring populations in bot-

tomland forest were about six times higher than June populations in central Illinois, but in the south were only two times higher. (Table 46). Because the spring population is large, redstarts may be found in orchards (Sparks 1905, Du Bois 1909), yards (Schantz 1904a, Du Bois 1909, Fowler 1923, Jung 1925), campuses (Strauch 1917), city parks (Walter & Walter 1904, Schantz 1904b), and cemeteries (Smith 1946), as well as natural forest.

The redstart is a nocturnal migrant, and though many are killed at television towers in fall, there is but one such record for spring—7 May (Brewer & Ellis 1958).

A possible indication of the direction of spring migration

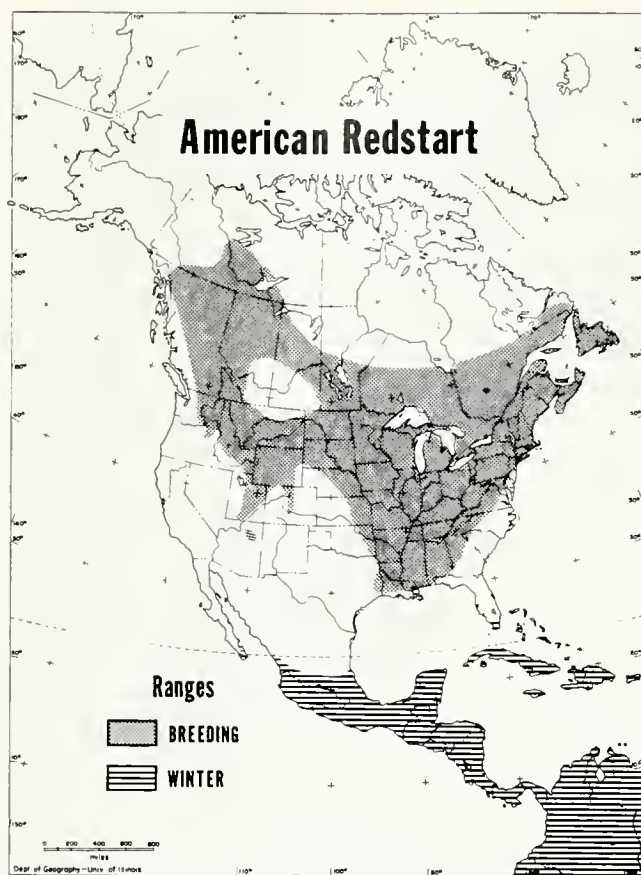


Fig. 123.—General distribution of the American redstart.

TABLE 45.—Population densities of American redstarts in Illinois, spring and fall.

Season and Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha	
					Maximum	Mean
Spring (30 April-27 May)						
Pastures	Champaign (C)	1907		180		0.9
Mature bottomland forest	Piatt (C)	1979-1980	7	144	27.9	14.3
Mature bottomland forest	Johnson (S)	1979-1981	9	189	54.0	8.5
Mature upland forest	Piatt (C)	1979-1981	10	200	32.6	7.5
Mature upland forest	Pope (S)	1979-1981	9	177	18.7	2.7
Forest edge and shrub	Piatt (C)	1979-1981	8	164	34.3	7.4
Forest edge and shrub	Pope (S)	1979-1981	9	175	17.2	2.1
Fall (7 August-3 October)						
Residential	North	1909		17		7.2
Pasture	North	1909		172		2.3
Pasture	Central	1906-1909		289		0.7
Corn	Central	1906-1909		638		0.5
Orchard	North	1909		7		17.4
Orchard	Central	1906-1909		11		14.9
Orchard	South	1908		239		0
Woods (unspecified)	North	1909		10		20.0
Woods (unspecified)	Central	1906-1909		42		49.7
Woods (unspecified)	South	1908-1909		62		1.3
Mature bottomland forest	Piatt (C)	1979-1980	17	304	81.4	24.4
Mature bottomland forest	Johnson (S)	1979-1981	11	235	19.0	6.0
Mature upland forest	Piatt (C)	1979-1981	22	428	95.9	9.4
Mature upland forest	Pope (S)	1979-1981	10	209	1.9	0.2
Forest edge and shrub	Piatt (C)	1979-1981	22	408	47.0	21.7
Forest edge and shrub	Pope (S)	1979-1981	11	212	16.9	3.2

was shown by an adult male redstart banded near Chicago on 17 May 1970 and found dead in southeast Saskatchewan on 23 May 1974, hundreds of miles northwest of the place of banding (Annual banding report, Region 234).

In spring adult males nearly always precede females and young males by a few days (Widmann 1907, Silloway unpublished 1923).

## Breeding

The American redstart has a wide distribution in Canada and the eastern United States (Fig. 122). In Illinois it is found in all regions of the state, especially where there is riparian forest (Fig. 125), and we would expect it to nest in all counties with appropriate habitat. In addition to the records plotted, there are breeding records for Tazewell County, 1889–1898, Winnebago County (Jones 1895), and Putnam County, 1952–1954 (ISM and FMNH oological collections) for which specific localities were not given.

Nesting redstarts have been noted principally in stream-side forests (Nelson 1876, Barnes 1890, Widmann 1907, Hess 1910, Gates 1911, Hodges 1954, Greer 1955). Some of the highest populations in Illinois and adjacent areas have been on wooded islands. Holland (1930) found nine nests on an island, 75 x 300 yards, in the Mississippi River. Hodges (1951) found 93 pairs on Credit Island in the Mississippi River, a density of about 100 birds per 40.5 ha, based on our estimation of forest area on the island.

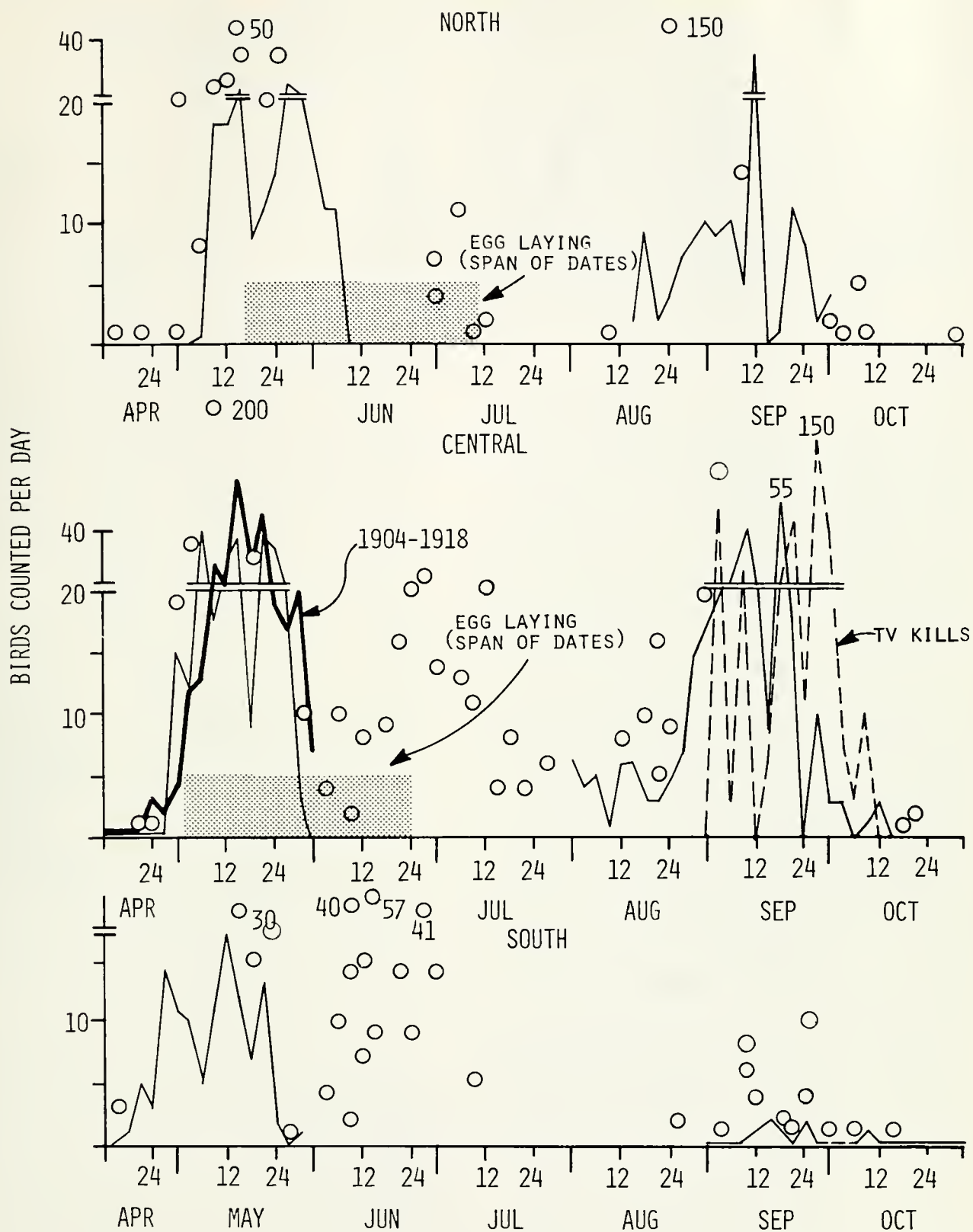


Fig. 124. - Egg-laying and migration seasons of the American redstart in different regions of Illinois (see Fig. 50 for regions). Spring and fall lines show the highest daily count of each 3 days (1967-1970). Hollow circles represent counts made in other years or by other observers. Shaded areas show the span of dates during which eggs have been found. The dash line indicates numbers killed at television towers during fall migration in central Illinois. The heavy line shows spring counts made by F. Smith and his students at Urbana.

TABLE 46. — Breeding population densities of American redstarts in Illinois.

Habitat	County or Region	Year(s)	Number of Censuses	Cumulative Hectares Censused	Birds per 40.5 ha		Reference
					Range	Mean	
Woods (unspecified)	Rock Island (N)	1914-1923	10 years	22	3.7-40.9	24.8	J.J. Schafer unpublished
Second-growth hardwoods	Rock Island (N)	1937-1938	2 years	6	53.0-147.0	100.0	Fawks 1937, 1938
Woods (all types, including edge)	North	1957-1958		72	0 - 1.0	0.6	Graber & Graber 1963
Oak-maple forest	Champaign (C)	1927-1948	16 years	22	0 - 2.0	0.6	Kendeigh 1948
Oak-maple forest	Champaign (C)	1949-1976	28 years	22		0	Kendeigh & Fawver 1949, Kendeigh & Edgington 1977
Virgin floodplain forest	Piatt (C)	1946		20		24.0	Fawver 1947b
Virgin floodplain forest	Sangamon (C)	1948		31		76.0	Snyder et al. 1948
Mature bottomland forest	McLean (C)	1950		25		3.2	Calef 1953b
Grazed bottomland woods	Macon (C)	1955		21		15	Chaniot & Kirby 1955
Bottomland forest	Vermilion (C)	1966		6		64	Karr 1968
Mature bottomland forest	Central	1978-1979		132	0 - 18.0	5.2	This paper
Forest (all types, including edge)	Central	1957-1958		87	5.1- 19.6	11.7	Graber & Graber 1963
Bottomland woods	Richland (S)	1955		7		11.0	Stine 1959
Mature bottomland forest	South	1973-1979	61	1,086	0 - 34.0	5.5	This paper
Forest (all types, including edge)	South	1957-1958		138	1.8- 3.4	2.6	Graber & Graber 1963

Our studies of 10 bottomland forest areas in southern Illinois, 1974-1978, showed the redstart population to be possibly correlated with two plant species—silver maple (*Acer saccharinum*) and swamp holly (*Ilex decidua*). The importance (Y) of silver maple, both as trees over 10 cm DBH ( $r = 0.756$ ,  $P = < 0.01$ ) and as shrub understory ( $r = 0.807$ ,  $P = < 0.01$ ), appeared to be correlated with redstart numbers. The apparent correlation between redstart numbers and the Importance of swamp holly ( $r = 0.780$ ,  $P = < 0.01$ ) is perhaps actually a correlation with wetness of habitat. The holly does not occur over much of the redstart's range, but the distribution of silver maple (Fowells 1965) fairly well matches the southeastern populations of the redstart's range.

Ridgway (1887) noted that redstarts bred sparingly on the outskirts of Mt. Carmel. The species appears fairly tolerant of humans, but we know of no populations in modern residential habitat. We found a good population (18 per 40.5 ha) on the Kankakee River east of Momence in riparian woods in which are a number of cottages. The loss of riparian forest habitat in recent years has surely decreased the overall population of redstarts in Illinois.

Redstart territories have been measured only in central Illinois, where territory size averaged 1.4 acres in Piatt County (Fawver 1947b), and one territory in McLean County was 3.2 acres (Calef 1953b). Allison (1947) suggested that territories in forest edge were slightly larger than those in forest interior at Allerton Park.

Redstart nests have been placed in a variety of woody plants. Records from northern and central Illinois of numbers of nests of various species are: ash (*Fraxinus* sp.) 1, wild cherry (*Prunus* sp.) 1, dogwood (*Cornus* sp.) 1, gooseberry (*Ribes* sp.) 1, elm (*Ulmus* sp.) 14, hackberry (*Celtis occidentalis*) 2, hawthorn (*Crataegus* sp.) 5, hazelnut (*Corylus* sp.) 1, maples (*Acer* spp.) 4, soft maple (*A. saccharinum*) 3, sugar or hard maple (*A. saccharum*) 4, oaks (*Quercus* spp.) 5, white oak (*Q. alba*) 1, bur oak (*Q. macrocarpa*) 1, raspberry (*Rubus* sp.) 2, sycamore (*Platanus occidentalis*) 1, thorn apple (*Pyrus* sp.) 1, and willow (*Salix* sp.) 22. The willow was most often used in central Illinois. The plant chosen is nearly always a sapling or small tree but is sometimes a shrub. The nest is usually fastened firmly in a crotch or cluster of small branchlets.

Data from museum records and the literature show that the average height of 39 nests in northern Illinois was 2.7 m, and of 28 nests in central Illinois, 5.1 m. Eighty percent of the nests in northern Illinois were under 12 feet, but only 50 percent of the nests in central Illinois were this low. The lowest Illinois nest reported was only 38 cm high (FMNH oological collection 13354), and the highest nest was 13.7 m (Holmes 1950). Ridgway (1889) wrote that the height of Illinois redstart nests ranged from 8 to 50 feet (2.4-15.2 m) and Sanborn & Goelitz (1915) found them at 3-40 feet (0.9-12.2 m). We have data on only two nests from southern Illinois, one 6.1 m in a young hackberry and one 7.3 m in a young box-elder.

# American Redstart

## BREEDING RECORDS

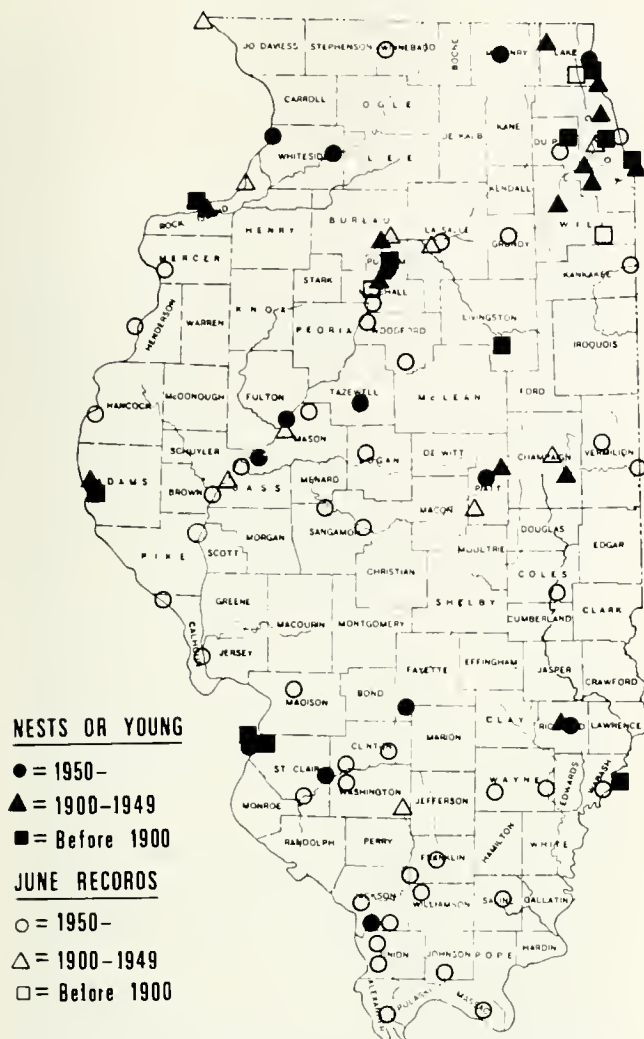


Fig. 125. Breeding records of the American redstart in Illinois.

## Nesting Cycle

The redstart's song is rather weak, a simple "Zee-zee-zee" with definite emphasis on the last note. Fawver (1947a) noted the height of song perches to be 20-40 feet in Piatt County.

The nest is similar to the nest of the yellow warbler—composed of grass and plant down compacted together, and lined with fine grass and feathers (Giddings 1897). A nest with four fresh eggs at Lacon on 19 May (FMNH 13355) implies the start of nest building about 10 May, and a nest with three fresh eggs in Tazewell County on 4 May (ISM oological specimen) implies nest building in late April. The latest egg dates were 10 July in Whiteside County (Thompson 1958) and 21 July (locality not specified, Bent

1953). There are no data on the nesting cycle in southern Illinois.

The eggs are whitish and spotted, especially near the large end, with rusty brown or gray. In a sample of 35 clutches in which incubation had begun, clutch sizes were: 5 eggs, four nests; 4 eggs, 26 nests; 3 eggs, five nests. The data represent old oological collections. There are no recent data on clutch size or any other phase of the breeding biology. The egg collections indicate increasing cowbird parasitism of redstarts. Before 1900 only 7 percent (2 of 27 nests) were parasitized, but after 1900 the rate was 37 percent (15 of 41 nests). More current data are badly needed on all aspects of the breeding biology. Nesting success and productivity have never been measured in any Illinois population.

## Fall Migration

Nolan (1957) noted that cold fronts brought redstarts into the Midwest in July and August, and Brodorb (1928b) reported that redstarts began passing through northeastern Illinois in late July. There are a number of reports of redstart migration in northern Illinois in mid-August (Brodorb 1926a, Boulton & Beecher 1939, Nolan 1956a). In central Illinois redstarts have been seen in early August in places where none were present in June. In the St. Louis area, Widmann (1907) noted the beginning of the fall migration of redstarts in mid-August.

Highest numbers of redstarts in fall have been seen 18 August-21 September in northern Illinois (9-150 birds per day), 16 August-29 September in the central region (10-55 per day), and 10-25 September in the south (8-10 per day). The last redstarts of the season were seen 31 October in the north (Boulton & Pitelka 1939), 21 October and 25 November in the central region (Kleen 1974a), and 9 and 13 October in the south (Hobbs 1931, George 1968). Females and immatures preceded adult males in fall migration. B.T. Gault almost always noted females and immatures in August but no adult males until September in northeastern Illinois.

Redstarts are common victims at television towers. We have records of 537 picked up between 2 September and 12 October.

The ratios of our spring-to-fall counts were 1.5 to 1.0 in northwestern Illinois, 1 to 1 in central Illinois (1.0 to 4.4 in the census transects), and 5.4 to 1.0 in the south (1.1 to 1.0 in the census transects). At Chicago, Dreuth saw redstarts with a ratio of 1.0 in spring to 1.7 in fall (1928-1943). Bennett (1952) saw five times more redstarts at Chicago in fall than we saw in northwestern Illinois. He suggested that individual redstarts tended to linger a week or longer, thus increasing the fall counts. In a sample of 249 redstarts from the towers in fall, only 62 were immature, the hypothetical equivalent of a spring-to-fall ratio of 1.0 to 1.3.

Forbes (1878) provided the only data on the food of redstarts in Illinois. Stomach contents of three specimens (date and locality not given) were one wasp (Ichneumonid), four Lepidoptera (two adults and two caterpillars), one beetle, and one leafhopper. In Piatt County in September we saw a female eat a Flatid planthopper. Wheelock (1905)

referred to redstarts feeding their young by regurgitation though this is probably not the usual practice.

Craigmile (1937) noted the attraction of a redstart to a bird bath in fall.

## Specimen Data

We would expect redstarts from the tower kills to be mainly from northern populations, following the general pattern that most of the tower birds represent northern species or populations (e.g., alder flycatchers more than willow flycatchers, Graber et al. 1974). In our series of 17 female specimens from the towers, only 1 was gray backed, as in the northern form (*tricolora*); it also had very little yellow in the wings, as in that form (Sutton 1967), but was intermediate in size (wing, 57.0 mm) within our series (55.2–62.4 mm; mean, 58.1 mm). A series of eight adult males was uniform in size (wing, 60.2–62.9 mm; mean, 61.6 mm), and though three specimens definitely had small wing spots, they were not short winged. There is insufficient evidence to consider the Illinois specimens as more than one population. No series of Illinois breeding birds (presumably *S.r. ruticilla*) exists so far as we know.

The range of gross weights of redstarts killed 9 September–12 October was, for 67 adult males, 7.4–9.4 g (mean = 8.70, SE = 0.08); for 24 immature males, 7.2–10.4 g (mean = 8.70, SE = 0.15); for 61 adult females, 7.3–10.0 g (mean = 8.24, SE = 0.67); and for 36 immature females, 7.1–9.6 g (mean = 8.25, SE = 0.11). Most of the specimens were only moderately fat (2–3 on a scale of 0–5), and few were very fat, in contrast to most of the fall warblers. Organ weights of redstarts were given by Hancock (1888a), and Graber & Graber (1962, 1965).

## LITERATURE CITED

- ABBOTT, C.E. 1942. Some aspects of spring warbler migration. *Wilson Bulletin* 54(1):17–20.
- \_\_\_\_\_, A. REUSS, K. BARTEL, and F. LABAHAN. 1933. List of birds observed in the vicinity of Blue Island and Orland Park, Illinois, 1933. *Oologist* 50(11):142–143.
- ABBOTT, G.A. 1915. Abbott's collection of North American warblers' eggs. *Oologist* 32(8):129–130.
- ALLEN, J.A. 1879. Nest and eggs of the cerulean warbler. *Nuttall Ornithological Society Bulletin* 4:25.
- ALLISON, D.G. 1947. Bird populations of forest and forest edge in central Illinois. M.S. Thesis. University of Illinois. 87 p.
- AMBATS, I. 1980. 722. Lisle Arboretum, Ill. *American Birds* 34(4):528.
- AMERICAN ORNITHOLOGISTS' UNION. 1957. Check-list of North American birds. 5th ed. and supplements. American Ornithologists' Union, Baltimore, Maryland.
- AMMANN, G.A. 1939. Swainson's warbler in Illinois. *Wilson Bulletin* 51(3):185–186.
- ANDERSON, R.A. 1962. Summer survey. *Bluebird* 29(3):19–23.
- \_\_\_\_\_. 1964a. Observations from southern Illinois. *Audubon Bulletin* 129:18.
- \_\_\_\_\_. 1964b. A ten year study of changing bird population in St. Louis County. *Bluebird* 31(4):3–5.
- \_\_\_\_\_. 1968. Spring report for St. Louis. *Audubon Bulletin* 147:27–28.
- \_\_\_\_\_. 1971. Bird survey. *Bluebird* 38(1):2–4.
- \_\_\_\_\_. 1972. Fall survey—Aug. 15–Nov. 30, 1971. *Bluebird* 39(1):5–7.
- \_\_\_\_\_. 1973. Fall survey—Aug. 16–Nov. 30, 1972. *Bluebird* 40(1):6–9.
- \_\_\_\_\_. 1974. Fall survey—Aug. 1 to Nov. 30. *Bluebird* 41(1):2–4.
- \_\_\_\_\_, and P.E. BAUER. 1968. A guide to finding birds in the St. Louis area. Webster Groves Nature Study Society. 44 p.
- ANDERSON, R.M. 1907. The birds of Iowa. Davenport Academy of Sciences Proceedings 11:125–417.
- BAIRD, S.F., T.M. BREWER, and R. RIDGWAY. 1874. A history of North American birds. Land birds. Vol. 1. Little, Brown, and Company, Boston. 596 p.
- BALCH, L. 1970. Field notes: two waves of migrants. *Audubon Bulletin* 156:22.
- \_\_\_\_\_. 1971–1972. Audubon's warbler in Chicago. *Audubon Bulletin* 160:17.
- \_\_\_\_\_. 1978. Waterthrush identification. *Illinois Audubon Bulletin* 184:21–24.
- \_\_\_\_\_, L. BINFORD, C. CLARK, H. BLUME, J. ROSENBAUM, and B. TWEIT. 1972. Other late fall sightings. *Audubon Bulletin* 162:20.
- BALDA, R.P. 1963. Breeding populations of birds of the upland forest and forest-edge in central Illinois. M.S. Thesis. University of Illinois. 81 p.
- BALDWIN, A.G. 1941. Autumn days afield. *Audubon Bulletin* 40:6–8.
- \_\_\_\_\_. 1943. On the trail of the chat. *Audubon Bulletin* 47:5–8.
- BARNES, R.M. 1889. Nesting of the prothonotary warbler. *Ornithologist and Oologist* 14(3):37–38.
- \_\_\_\_\_. 1890. List of birds breeding in Marshall Co., Ill. *Ornithologist and Oologist* 15(8):113–116.
- \_\_\_\_\_. 1912. Breeding birds of Marshall Co., Ill. *Oologist* 29(8):325–328.
- \_\_\_\_\_. 1927. A half day on the Illinois River. *Oologist* 44(7):82–86.
- BAROODY, N.J. 1931. Illinois conservation—a project. Chicago Academy of Sciences Program of Activities 2(3):n.p.
- BARTEL, K.E. 1933. New birds for 1932. *Oologist* 50(4):55.
- \_\_\_\_\_. 1935. Six year migration summary. *Oologist* 52(1):11.
- \_\_\_\_\_. 1949. Lisle, Du Page County; Morton Arboretum. *Audubon Bulletin* 69:13.
- \_\_\_\_\_. 1950. Banding activities at Blue Island, Ill. 1949–1950. *Inland Bird Banding News* 22(5):26–27.
- \_\_\_\_\_. 1953. Fiscal year banding report by Karl E. Bartel, Blue Island, Ill. 1952–1953. *Inland Bird Banding News* 25(6):33–34.
- \_\_\_\_\_. 1969. "Albino" white-throated sparrow. *Inland Bird Banding News* 41(3):83.
- \_\_\_\_\_. 1976. My 42 years of bird banding. *Inland Bird Banding News* 48(2):55–65.
- \_\_\_\_\_, and A. REUSS. 1932. Birds of Blue Island, Cook Co., Illinois. *Oologist* 49(10):112–113.
- BEECHER, W.J. 1937. Meadows, marsh and oak-hickory island. *Bird-Lore* 39(5):374–375.
- \_\_\_\_\_. 1942. Nesting birds and the vegetation substrate. Chicago Ornithological Society. 69 p.
- BENNETT, H.R. 1952. Fall migration of birds at Chicago. *Wilson Bulletin* 64(4):197–220.
- BENT, A.C. 1953. Life histories of North America wood warblers. U.S. National Museum Bulletin 203. 734 p.
- BERGER, A.J. 1958. The golden-winged-blue-winged warbler complex in Michigan and the Great Lakes area. *Jack-Pine Warbler* 36(2):37–73.
- BIRKENHOLZ, D.E. 1975. The summer birds of Goose Lake Prairie Nature Preserve. Chicago Academy of Sciences Natural History Miscellanea 193. 11 p.
- \_\_\_\_\_. 1977a. 40. Oak-hickory-maple forest. *American Birds* 31(1):43.
- \_\_\_\_\_. 1977b. 161. Orchard grass-tall fescue meadow. *American Birds* 31(1):88–89.
- \_\_\_\_\_. 1978a. Oak-hickory-maple forest. *American Birds* 32(1):66.
- \_\_\_\_\_. 1978b. 176. Orchard grass-tall fescue meadow. *American Birds* 32(1):121.

- \_\_\_\_\_. 1979a. 34. Oak-hickory-maple forest. American Birds 33(1):65.
- \_\_\_\_\_. 1979b. 191. Orchard grass-tall fescue meadow. American Birds 33(1):109.
- \_\_\_\_\_. 1980. 33. Oak-hickory-maple forest. American Birds 34(1):52.
- BJORKLUND, R.G., and J.R. DETERS. 1972. An annotated checklist of the birds of Mason State Forest. Peoria Academy of Science Proceedings 5:20-24.
- BLACKWELDER, E. 1899. A note on Kirtland's warbler (*Dendroica kirtlandi*). Auk 16(4):359-360.
- BLAKE, E.R. 1941. Chicago region. Audubon Magazine 43(2):228-230.
- \_\_\_\_\_, and E.T. SMITH. 1941. Chicago region. Audubon Magazine 43(6):570-572.
- \_\_\_\_\_, and \_\_\_\_\_. 1942. Chicago region. Audubon Magazine 44(2):9 (Supplement).
- BODENSTEN, A.J. 1939. Old time collectors. Oologist 56(3):26-31.
- BOHLEN, H.D. 1971. First record in Illinois of Audubon warbler (*Dendroica auduboni*-Townsend). Audubon Bulletin 158:26.
- \_\_\_\_\_. 1976. Black-throated gray warbler in Illinois. Audubon Bulletin 176:27.
- \_\_\_\_\_. 1978. An annotated check-list of the birds of Illinois. Illinois State Museum Popular Sciences Series 9. Illinois State Museum, Springfield. 156 p.
- \_\_\_\_\_. Winter 1978-1979. Overmigration. A method of range expansion? Living Museum 41(1):13.
- \_\_\_\_\_, and V. KLEEN. A method for aging orange-crowned warblers in fall. Bird-Banding 47(4):365.
- BOULTON, R., and W.J. BEECHER. 1939. Chicago region. Bird-Lore 41(5):8 (Supplement).
- \_\_\_\_\_, and \_\_\_\_\_. 1940. Chicago region. Bird-Lore 42(3):305-306 (Supplement).
- \_\_\_\_\_, and E. BLAKE. 1936. Chicago region. Bird-Lore 38(4):309-310.
- \_\_\_\_\_, and F.A. PITELKA. 1937a. Chicago region. Bird-Lore 39(5):396-397.
- \_\_\_\_\_, and \_\_\_\_\_. 1937b. Chicago region. Bird-Lore 39(6):473-474.
- \_\_\_\_\_, and \_\_\_\_\_. 1938a. Chicago region. Bird-Lore 40(2):153-154.
- \_\_\_\_\_, and \_\_\_\_\_. 1938b. Chicago region. Bird-Lore 40(4):290-291.
- \_\_\_\_\_, and \_\_\_\_\_. 1938c. Chicago region. Bird-Lore 40(6):464-465.
- \_\_\_\_\_, and \_\_\_\_\_. 1939. Chicago region. Bird-Lore 41(1):57-58.
- BOYD, E.B. 1969. Sight record of black-throated gray warbler. Audubon Bulletin 149:13.
- BREWER, R. 1955. Size of home range in eight bird species in a southern Illinois swamp-thicket. Wilson Bulletin 67(2):140-141.
- \_\_\_\_\_. 1958a. Some corrections to "A distributional check list of the birds of Illinois." Audubon Bulletin 106:9.
- \_\_\_\_\_. 1958b. Breeding-bird populations of strip-mined land in Perry Co., Ill. Ecology 39(3):543-545.
- \_\_\_\_\_, and J.A. ELLIS. 1958. An analysis of migrating birds killed at a television tower in east-central Illinois, September 1955-May 1957. Auk 75(4):400-414.
- \_\_\_\_\_, and W. HARDY. 1950. 18. Swamp and thicket. Audubon Field Notes 4(6):303.
- BREWSTER, W. 1878a. Descriptions of the first plumage in various species of North American birds. Nuttall Ornithological Club Bulletin 3(1):15-23.
- \_\_\_\_\_. 1878b. Descriptions of the first plumage in various species of North American birds. Nuttall Ornithological Club Bulletin 3(2):56-64.
- \_\_\_\_\_. 1878c. Nesting of the large-billed water-thrush (*Siurus motacilla* [Vieill.] Bp.). Nuttall Ornithological Club Bulletin 3(3):133-135.
- \_\_\_\_\_. 1878d. The prothonotary warbler (*Protonotaria citrea*). Nuttall Ornithological Club Bulletin 3(4):153-162.
- \_\_\_\_\_. 1885. Swainson's warbler. Auk 2(1):65-80.
- \_\_\_\_\_. 1896. Descriptions of a new warbler and a new song sparrow. Auk 13(1):44-47.
- BRIDDKORB, P. 1926a. Chicago region. Bird-Lore 28(5):347-348.
- \_\_\_\_\_. 1926b. Chicago region. Bird-Lore 28(6):407-408.
- \_\_\_\_\_. 1928a. Chicago region. Bird-Lore 30(4):275.
- \_\_\_\_\_. 1928b. Chicago region. Bird-Lore 30(5):341.
- \_\_\_\_\_. 1929. Summer notes from southern Illinois. Auk 46(3):398-399.
- BROOKS, E. 1928. Yellow warblers and a cowbird. Bird-Lore 30(3):183-185.
- BROWN, B., and J. SANDERS. 1968. 472. Chicago Urban, Ill. Audubon Field Notes 22(2):268.
- BROWN, W.H. 1961. General notes reports. Iowa Bird Life 31(4):85-88.
- \_\_\_\_\_. 1964. Field reports. Iowa Bird Life 34(4):97-101.
- \_\_\_\_\_. 1965. Field reports. Iowa Bird Life 35(3):86-90.
- \_\_\_\_\_. 1966. Field reports. Iowa Bird Life 36(1):17-24.
- \_\_\_\_\_. 1968. Field reports. Iowa Bird Life 38(3):88-90.
- \_\_\_\_\_. 1974. Field reports. Iowa Bird Life 44(4):100-104.
- \_\_\_\_\_. 1975. Field reports. Iowa Bird Life 45(3):92-95.
- BURSEWICZ, J. 1961. Bird studies at Robert W. Allerton Park, central Illinois. M.S. Thesis. University of Illinois. 65 p.
- BUSH, L. 1955. 318. Crab Orchard Wildlife Refuge, Carterville, Ill. Audubon Field Notes 9(2):170.
- BUTLER, A.W. 1898. Birds of Indiana. Pages 515-1187 in 22nd Annual Report of the Department of Geology and Natural Resources of Indiana for 1897. [Indiana Academy of Sciences Proceedings for 1908.]
- \_\_\_\_\_, and A.S. HYDE. 1929. Easter birds of Little Egypt. Wilson Bulletin 41(1):31-38.
- CALEF, R.T. 1953a. Ecological analysis of the flora and vertebrate fauna of Funk Forest Natural Area, McLean Co., Ill. M.S. Thesis. University of Illinois. 85 p.
- \_\_\_\_\_. 1953b. Avian populations of the Funk Forest Natural Area in McLean County, Illinois. Illinois State Academy of Science Transactions 46:240-257.
- CHANLOT, G.E., JR. 1960. 362. Decatur, Ill. Audubon Field Notes 14(2):203.
- \_\_\_\_\_, and R. KIRBY. 1955. 4. Grazed stream bottomland. Audubon Field Notes 9(6):413.
- CLARK, C.T., and M.M. NICE. William Dreuth's study of bird migration in Lincoln Park, Chicago. Chicago Academy of Sciences Special Publication 8. 43 p.
- COALE, H.K. 1912. *Dendroica aestiva* captured by a spider. Auk 29(1):105.
- COFFIN, L.V. 1909. Blue-winged and prairie warblers near Chicago. Bird-Lore 11(4):177.
- "Collector." 1895. The prothonotary warbler. Nidologist 2(5):69.
- COMFORT, J.E. 1942. St. Louis bird club walks successful. Bluebird 9(6):35.
- \_\_\_\_\_. 1950. St. Louis area. Bluebird 17(11):n.p.
- \_\_\_\_\_. 1951. St. Louis area. Bluebird 18(4):n.p.
- \_\_\_\_\_. 1952. St. Louis area. Bluebird 19(6):n.p.
- \_\_\_\_\_. 1953. St. Louis notes. Bluebird 20(6):n.p.
- \_\_\_\_\_. 1954a. St. Louis area. Bluebird 21(5):n.p.
- \_\_\_\_\_. 1954b. St. Louis area birding. Bluebird 21(10):n.p.
- \_\_\_\_\_. 1961. St. Louis. Bluebird 28(3):22.
- COOKE, W.W. 1883. Mississippi valley migration. Ornithologist and Oologist 8:33-34, 73-75.
- \_\_\_\_\_. 1884. Migration in the Mississippi valley. Ornithologist and Oologist 9(10):117-118.
- \_\_\_\_\_. 1885. Bird migration in the Mississippi valley. Winter birds of southern Illinois. Forest and Stream 23(23):444-445.
- \_\_\_\_\_. 1888. Report on bird migration in the Mississippi valley in the years 1884 and 1885. U.S. Department of Agriculture, Division of Economic Ornithology Bulletin 2. 313 p.
- \_\_\_\_\_. 1904. Distribution and migration of North American warblers. U.S. Department of Agriculture Biological Survey Bulletin 18. 142 p.
- \_\_\_\_\_. 1905a. The migration of warblers. Bird-Lore 7(5):237-239.

- \_\_\_\_\_. 1905b. The migration of warblers. *Bird-Lore* 7(6): 275-278.
- \_\_\_\_\_, and O. WIDMANN. 1883. Bird migration in the Mississippi valley. *American Field* 20:513-514, 536-537, 584-585, 610.
- COURSEN, C.B. 1947. Birds of the Orland Wildlife Refuge. *Turtlex News* (Supplement). 30 p.
- COURTNEY, J.C. 1917. Spring census and migration record. *Audubon Bulletin*, Spring: 49.
- CRAIGMILE, E. 1904. A summer porch list at Hinsdale, Ill. *Wilson Bulletin* 16(3):105-107.
- \_\_\_\_\_. 1937. A bird bath. *Audubon Bulletin* 27:34-35.
- CRAMP, L. 1922. Birds near Chicago. *Bird-Lore* 24(5):272-273.
- CUNNINGHAM, J.W. 1943. Missouri region. *Audubon Magazine* 45(6):8-9.
- CURRIER, E.S. 1895. The hooded warbler. *Iowa Ornithologist* 1(3):67-70.
- DAVIE, O. 1898. Nests and eggs of North American birds. 5th ed. David McKay, Philadelphia. 509 p.
- DILLON, S.T. 1971. Additional avian species seen at McGraw Wildlife Foundation. *Audubon Bulletin* 159:18-20.
- DU BOIS, A.D. 1909. Birds of a city yard. *Oologist* 26(3):39-40.
- \_\_\_\_\_. 1918. An annotated list of the birds observed from May to July in central Logan County, Illinois. *Oologist* 35(11):143-146.
- DU MONT, P.A. 1930. The distribution westward of *Seiurus noveboracensis noveboracensis*. *Auk* 47(1):91-93.
- \_\_\_\_\_. 1936. Old nesting records of rare birds in Iowa. *Oologist* 53(1):8-10.
- \_\_\_\_\_. 1947. Middle-western region. *Audubon Field Notes* 1(4):154-156.
- \_\_\_\_\_, and E.T. SMITH. 1945. Middlewestern region. *Audubon Magazine* 47(5):48-50 (Supplement).
- \_\_\_\_\_, and \_\_\_\_\_. 1946a. Middlewestern region. *Audubon Magazine* 48(1):7-8 (Supplement).
- \_\_\_\_\_, and \_\_\_\_\_. 1946b. Middlewestern region. *Audubon Magazine* 48(4):112-113.
- \_\_\_\_\_, and \_\_\_\_\_. 1946c. Middlewestern prairie region. *Audubon Magazine* 48(5):123-124 (Supplement).
- DUNN, J.O. 1895. Notes on some birds of northeastern Illinois. *Auk* 12(4):393-395.
- EATON, D.H. 1878. List of birds in Peotone [Illinois] and vicinity. *Forest and Stream* 11(3):47.
- EDDLEMAN, W.R. 1978. Selection and management of Swainson's warbler habitat. M.S. Thesis. University of Missouri. 75 p.
- \_\_\_\_\_, K.E. EVANS, and W.H. ELDER. 1980. Habitat characteristics and management of Swainson's warbler in southern Illinois. *Wildlife Society Bulletin* 8:228-233.
- EIFERT, V.S. Birds in your back yard. *Illinois State Museum Popular Science Series* 2. 238 p.
- EIFRIG, C.W.G. 1919. Notes on birds of the Chicago area and its immediate vicinity. *Auk* 36(4):513-524.
- \_\_\_\_\_. 1922. A mild winter and its effect on the migration of birds at Chicago. *Wilson Bulletin* 34(2):90-94.
- \_\_\_\_\_. 1937. The changing status of birds as regards their abundance. *Illinois State Academy of Science Transactions* 30(2):295-297.
- EISEMAN, R.M., and M.C. SHANK. 1962. Birds of the Chicago Navy Pier area. *Audubon Bulletin* 122:1-11.
- EISENMANN, E., chairman. 1973. Thirty-second supplement to the American Ornithologists' Union check-list of North American birds. *Auk* 90(2):411-419.
- FARWELL, E.D. 1919. Bird observations near Chicago. (Privately printed, Chicago). 188 p.
- FAWKS, E. 1936. Warblers of Rock Island County in 1935. *Audubon Bulletin* 26:40-41.
- \_\_\_\_\_. 1937. Second-growth hardwood. *Bird-Lore* 39(5):380.
- \_\_\_\_\_. 1938. Second-growth hardwood. *Bird-Lore* 40(5):359.
- \_\_\_\_\_. 1966a. Field notes — March, 1966. *Audubon Bulletin* 137:3-5.
- \_\_\_\_\_. 1966b. Field notes — June 1966. *Audubon Bulletin* 138:6-8.
- \_\_\_\_\_. 1966c. Field notes — September 1966. *Audubon Bulletin* 139:22-23.
- \_\_\_\_\_. 1966d. Field notes — December 1966. *Audubon Bulletin* 140:6-7.
- \_\_\_\_\_. 1967a. Field notes — March 1967. *Audubon Bulletin* 141:12-13.
- \_\_\_\_\_. 1967b. Field notes. *Audubon Bulletin* 143:17-21.
- \_\_\_\_\_. 1967c. Field notes. *Audubon Bulletin* 144:16-19.
- \_\_\_\_\_. 1968a. Field notes. *Audubon Bulletin* 145:14-16.
- \_\_\_\_\_. 1968b. Field notes. *Audubon Bulletin* 148:18-20.
- \_\_\_\_\_. 1969a. Field notes. *Audubon Bulletin* 149:12-15.
- \_\_\_\_\_. 1969b. Field notes. *Audubon Bulletin* 151:15-16.
- \_\_\_\_\_. 1969c. Field notes. *Audubon Bulletin* 152:19.
- \_\_\_\_\_. 1970a. Field notes. *Audubon Bulletin* 153:16-19.
- \_\_\_\_\_. 1970b. Field notes. *Audubon Bulletin* 155:26-27.
- \_\_\_\_\_. 1971a. Field notes. *Audubon Bulletin* 157:27-28.
- \_\_\_\_\_. 1971b. Field notes. *Audubon Bulletin* 158:23-24.
- \_\_\_\_\_. 1971-1972. Field notes. *Audubon Bulletin* 160:16-17.
- \_\_\_\_\_. 1973a. Field notes. *Audubon Bulletin* 164:38-43.
- \_\_\_\_\_. 1973b. Field notes. *Audubon Bulletin* 166:23-26.
- \_\_\_\_\_, and P. PETERSEN, JR. 1961. A field list of birds of the Tri-city region. *Tri-city Bird Club, Davenport, Iowa*. 40 p.
- FAWVER, B.J. 1947a. The bird and mammal population of an Illinois flood plain forest. M.S. Thesis. University of Illinois. 51 p.
- \_\_\_\_\_. 1947b. Bird population of an Illinois flood plain forest. *Illinois State Academy of Science Transactions* 40: 178-189.
- FEENEY, T.J. 1950. Townsend's warbler at Davenport. *Iowa Bird Life* 20(3):61.
- FERRY, J.F. 1907a. Winter bird notes from extreme southern Illinois. *Auk* 24(3):281-286.
- \_\_\_\_\_. 1907b. Further notes from extreme southern Illinois. *Auk*. 24(4):430-435.
- \_\_\_\_\_. 1908. The spring migration of 1907 in the vicinity of Chicago. *Wilson Bulletin* 20(1):27-40.
- FINDLEY, C.H. 1944. A new state record. *Bluebird* 11(3):13-14.
- \_\_\_\_\_. 1949. Trip to Horseshoe Lake. *Bluebird* 16(1):n.p.
- FINLEY, C.W. 1917. Birds of the campus (Western Illinois State). *Normal School Quarterly* 30:1-28.
- FORBES, S.A. 1878. The food of birds. *Illinois Horticultural Society Transactions* 23:140-145.
- \_\_\_\_\_. 1881. The ornithological balance-wheel. *Illinois Horticultural Society Transactions* 26:120-131.
- \_\_\_\_\_. 1883. The regulative action of birds upon insect oscillations. *Illinois State Laboratory of Natural History Bulletin* 1(6):1-32.
- \_\_\_\_\_. 1907. An ornithological cross-section of Illinois in autumn. *Illinois State Laboratory of Natural History Bulletin* 7(9):305-335.
- \_\_\_\_\_, and A.O. GROSS. 1922. The numbers and local distribution in summer of Illinois land birds of the open country. *Illinois State Natural History Survey Bulletin* 14(6):187-218.
- \_\_\_\_\_, and \_\_\_\_\_. 1923. On the numbers and local distribution of Illinois land birds of the open country in winter, spring, and fall. *Illinois State Natural History Survey Bulletin* 14(10): 397-453.
- FORD, E.R. 1914. Nesting of the blue-winged warbler in northern Illinois. *Wilson Bulletin* 26(2):105.
- \_\_\_\_\_. 1931. Recollections of bird life in Chicago 40 years ago. *Chicago Academy of Sciences Program of Activities* 2(2):n.p.
- \_\_\_\_\_. 1939. Bird houses. *Chicago Academy of Sciences Leaflet* 3. n.p.
- \_\_\_\_\_. 1956. Birds of the Chicago region. *Chicago Academy of Sciences Special Publication* 12. 117 p.
- \_\_\_\_\_, C.C. SANBORN, and C.B. COURSEN. 1934. Birds of the Chicago region. *Chicago Academy of Sciences Program of Activities* 5(2-3):17-76.
- FOWELLS, H.A. 1965. Silvics of forest trees of the United States. U.S. Department of Agriculture, Forest Service. *Agriculture Handbook* 271. Washington, D.C. 762 p.
- FOWLER, G. 1923. Birds in busy Chicago. *Bird-Lore* 25(5):315.
- FRANKS, E.C., and W. MARTIN. 1967. 6. Oak-hickory forest. *Audubon Field Notes* 21(6):615.

- FREEMAN, F.J. 1950a. Back roads are rewarding. Audubon Bulletin 76:13-15.
- . 1950b. Display of ovenbirds, *Seiurus aurocapillus*. Auk 67(4):521.
- . 1951. A virgin prairie area: Custer Park. Audubon Bulletin 79:2-7.
- FRIEDMANN, H. 1963. Host relations of the parasitic cowbirds. United States National Museum Bulletin 233. 276 p.
- FRISBEY, R.M., JR. 1892. The prothonotary warbler. Oologist 9(18):213.
- FUNK, J., and M. FUNK. 1976. 625. Beverly, Ill. American Birds 30(2):425-426.
- , and ———. 1980. 699. Beverly, Ill. American Birds 34(4):523-524.
- GARDINER, L.F. 1959. Illinois field notes—1959. Audubon Bulletin 110:6.
- GASTMAN, E.A. 1886. Birds killed by electric light towers at Decatur, Illinois. American Naturalist 20(11):981.
- GATES, F.C. 1911. Summer bird life in the vicinity of Havana, Illinois, in its relation to the prominent plant associations. Wilson Bulletin 23(1):1-27.
- GAULT, B.F. 1892. The chestnut-sided warbler nesting in Missouri. Auk 9(4):396.
- . 1894. Kirtland's warbler in northeastern Illinois. Auk 11(3):258.
- . 1901a. A late September horizon at Cairo, Ill. Wilson Bulletin 13(3):65-68.
- . 1901b. April and May bird-life at Glen Ellyn (near Chicago), Illinois. Bird-Lore 3(2):65-67.
- . 1901c. June and July bird-life at Glen Ellyn (near Chicago), Illinois. Bird-Lore 3(3):102-104.
- . 1901d. August and September bird-life at Glen Ellyn (near Chicago), Illinois. Bird-Lore 3(5):166-168.
- . 1901e. October and November bird-life at Glen Ellyn (near Chicago), Illinois. Bird-Lore 3(5):168-170.
- . [1922]. Check list of the birds of Illinois. Illinois Audubon Society, Chicago. 80 p.
- GEORGE, W.G. 1968. Check list of birds of southern Illinois, 1968. Southern Illinois University, Carbondale. Mimeographed. 28 p.
- . 1969. The current status of certain bird species in southern Illinois. Audubon Bulletin 150:12-15.
- . 1971. Vanished and endangered birds of Illinois: A new 'black list' and 'red list'. Audubon Bulletin 158:2-11.
- . 1972. Breeding status of the purple gallinule, brown creeper, and Swainson's warbler in Illinois. Wilson Bulletin 84(2):208-210.
- GIDDINGS, H.J. 1897. Notes on the warblers of Jackson Co. Iowa Ornithologist 3(1):7-9.
- GIFFORD, C.E., and E.P. ODUM. 1965. Bioenergetics of lipid deposition in the bobolink, a trans-equatorial migrant. Condor 67(3):383-403.
- GOELITZ, W.A. 1915. Large sets of 1915. Oologist 32(9):147-148.
- . 1917. 1916 list of Illinois nests. Oologist 34(5):87.
- GOWER, C. 1933. Horse-shoe Lake. Audubon Bulletin 23:31-33.
- GRABER, J.W., and R.R. GRABER. 1976. Environmental evaluations using birds and their habitats. Illinois Natural History Survey Biological Notes 97. 40 p.
- , and ———. 1979. Severe winter weather and bird populations in southern Illinois. Wilson Bulletin 91(1):88-103.
- , and E.L. KIRK. 1977. Illinois birds: Picidae. Illinois Natural History Survey Biological Notes 102. 73 p.
- , and ———. 1979. Illinois Birds: Sylviidae. Illinois Natural History Survey Biological Notes 110. 22 p.
- GRABER, R.R. 1962a. Middlewestern prairie region. Audubon Field Notes 16(1):35-37, 41-43.
- . 1962b. Middlewestern prairie region. Audubon Field Notes 16(4):413, 417-420.
- . 1968. Nocturnal migration in Illinois—different points of view. Wilson Bulletin 80(1):36-71.
- , and J.W. GRABER. 1962. Weight characteristics of birds killed in nocturnal migration. Wilson Bulletin 74(1):74-88.
- , and ———. 1963. A comparative study of bird populations in Illinois, 1906-1909 and 1956-1958. Illinois Natural History Survey Bulletin 28(3):383-528.
- , and ———. 1965. Variation in avian brain weights with special reference to age. Condor 67(4):300-318.
- , and E.L. KIRK. 1974. Illinois birds: Tyrannidae. Illinois Natural History Survey Biological Notes 86. 56 p.
- GREER, T.R. 1955. Rambling notes. Audubon Bulletin 95:11-12.
- GRISCOM, L. 1942. The changing seasons. Audubon Magazine 44(4):252-253.
- GROSS, A.O. 1908. Swainson's warbler (*Helinaia swainsoni*). Auk 25(2):225.
- GUNN, W.W.H., and A.M. CROCKER. 1951. Analysis of unusual bird migration in North America during the storm of April 4-7, 1947. Auk 68(2):139-163.
- HALL, G.A. 1979. Hybridization between mourning and MacGillivray's warblers. Bird-Banding 50(2):101-107.
- HANCOCK, J.L. 1888a. The relative weight of the brain to the body in birds. American Naturalist 22(258):537-539.
- . 1888b. The northern range of *Oporornis formosa* in Illinois. Auk 5(1):210.
- HANN, H.W. 1937. Life history of the oven-bird in southern Michigan. Wilson Bulletin 49(3):145-237.
- . 1948. Longevity of the ovenbird. Bird-Banding 19(1):5-12.
- HANSELMAN, S. 1963-1964. The warbler and vireo migration in the St. Louis area. Bluebird 30(4):9-12.
- HARDY, J.W. 1955. Records of Swainson's warbler in southern Illinois. Wilson Bulletin 67(1):60.
- HARLOW, J.E. 1923. Night singing of the yellow-breasted chat. Oologist 40(12):202.
- HARRIS, T.G. 1947. Cape Girardeau birds. Bluebird 14(1):n.p.
- . 1948. Cape Girardeau census. Bluebird 15(2):n.p.
- HENSLEY, M.M. 1948. Studies of the breeding bird population of the forest-edge in Robt. W. Allerton Park, central Illinois. M.S. Thesis. University of Illinois. 76 p.
- HESS, I.E. 1902. My first oven-bird's nest. Oologist 19(11):165.
- . 1910. One hundred breeding birds of an Illinois ten-mile radius. Auk 27(1):19-32.
- . 1914. Making good as a bird man. Oologist 31(9):166-168.
- HEYER, P.L. 1963. Tower fatalities. Bluebird 30(1):7.
- HOBBS, R.L. 1931. St. Louis region. Bird-Lore 33(6):412-413.
- . 1932. St. Louis region. Bird-Lore 34(3):212-213.
- HODGES, J. 1949. The vireos and warblers in the Mississippi Valley. Iowa Bird Life 19(3):47-49.
- . 1950. Contributions to the ornithology of the upper Mississippi Valley. Part 1. An unpublished list by J.H. Paarmann on the birds of Davenport, Iowa, and vicinity. Iowa Academy of Science Proceedings 57:457-459.
- . 1951. The breeding birds of Credit Island. Iowa Bird Life 21(3):50-51.
- . 1954. The Burtis H. Wilson journals. Iowa Bird Life 24(2):34-38.
- HOGER, R. 1964. Field notes — fall and winter 1963. Audubon Bulletin 129:6.
- HOLCOMBE, C.E. 1929. 75 ovenbirds. Inland Bird Banding News 1(2):14-15.
- . 1930. 106 ovenbirds. Inland Bird Banding News 2(3-4):5.
- . 1938. Illinois. Inland Bird Banding News 10(3):8.
- HOLLAND, H.M. 1930. Warblers at Lacon. Oologist 47(9):112.
- HOLLINGER, A. 1916. Jacksonville Audubon Bulletin. Spring: 41-42.
- HOLMES, E.B. 1950. A comparison of the breeding-bird populations of floodplain forest, upland forest, and forest-edge in central Illinois. M.S. Thesis. University of Illinois. 94 p.
- HOMOYA, M. 1975. 613. Crab Orchard National Wildlife Refuge, Ill. American Birds 29(2):411.
- . 1976. 636. Crab Orchard National Wildlife Refuge, Ill. American Birds 30(2):429.
- HOPKINS, E.M. 1974a. 42. Poorly drained mixed oak forest. American Birds 28(6):1008.

- \_\_\_\_\_. 1974b. 104. Maintained invaded grassland. American Birds 28(6):1033-1034.
- \_\_\_\_\_. 1978. 41. Poorly drained mixed oak forest. American Birds 32(1):67.
- \_\_\_\_\_. 1980. 697. Willow Slough-Iroquois Preserves, Ind.-Ill. American Birds 34(4):523.
- HUBBARD, J.P. 1970. Geographic variation in the *Dendroica coronata* complex. Wilson Bulletin 82(4):355-369.
- HUDSON, J.E. 1968. Breeding birds of forest edge and flood plain forest areas in central Illinois. M.S. Thesis. University of Illinois. 99 p.
- HURTER, J. 1884. List of birds. Ornithologist and Oologist 9(7):85-86.
- JENCKS, F.T. 1882. Large-billed waterthrush. Ornithologist and Oologist 7(5):114-115.
- JOHNSON, L.G. 1950. Yellow warbler nesting notes. Audubon Bulletin 74:1-2.
- \_\_\_\_\_, and T. ELLIS. 1974. Retrap of migrant birds. Inland Bird Banding News 46(2):67.
- JOHNSON, R.W. 1936. Bird migration at Dubuque. Iowa Bird Life 6(1):8-9.
- \_\_\_\_\_. 1942. Warblers of the Dubuque region. Iowa Bird Life 12(4):56-59.
- JOHNSTON, V.R. 1947. Breeding birds of the forest edge in Illinois. Condor 49(2):45-53.
- JONES, L. 1895. Record of the work of the Wilson chapter for 1893 and 1894 on the Mniotiltidae. Wilson Bulletin 7(4):1-20.
- JONES, S.P. 1935a. St. Louis region. Bird-Lore 37(3):227-228.
- \_\_\_\_\_. 1935b. St. Louis region. Bird-Lore 37(6):470.
- \_\_\_\_\_. 1938. St. Louis region. Bird-Lore 40(6):465-466.
- JUNG, C.S. 1925. Chicago region. Bird-Lore 27(6):410-411.
- JURICA, E., V. LAKETEK, and J. SPODEN. 1960. Lisle, Illinois—Return data 1959. Inland Bird Banding News 32(3):33.
- \_\_\_\_\_, and \_\_\_\_\_. 1963. Banding returns for 1962. Inland Bird Banding News 35(3):58-60.
- KARR, J.R. 1968. Habitat and avian diversity on strip-mined land in east-central Illinois. Condor 70(4):348-357.
- KENDEIGH, S.C. 1944. Measurement of bird populations. Ecological Monographs 14(1):67-106.
- \_\_\_\_\_. 1948. 10. Oak-maple forest and edge. Audubon Field Notes 2(6):232-233.
- \_\_\_\_\_. 1953. 285. Urbana-Champaign, Ill. Audubon Field Notes 7(2):138-139.
- \_\_\_\_\_. 1968. 491. Urbana-Champaign, Ill. Audubon Field Notes 22(2):275.
- \_\_\_\_\_. 1977. 680. Urbana-Champaign, Ill. American Birds 31(4):691.
- \_\_\_\_\_, and R.J. CLEMENS. 1970. 35. Oak-maple forest and edge. Audubon Field Notes 24(6):762.
- \_\_\_\_\_, and J.M. EDGINGTON. 1977. 41. Oak-maple forest and edge. American Birds 31(1):43-44.
- \_\_\_\_\_, and B.J. FAWVER. 1949. 13. Oak-maple forest and forest-edge. Audubon Field Notes 3(6):262.
- KLEEN, V.M. 1972. A travelling Wilson's warbler. Inland Bird Banding News 44(6):235.
- \_\_\_\_\_. 1973. The density and territory size of breeding prothonotary warblers (*Prothonotaria citrea*) in southern Illinois. M.A. Thesis. Southern Illinois University, Carbondale. 43 p.
- \_\_\_\_\_. 1974a. Middlewestern prairie region. American Birds 28(1):58-63.
- \_\_\_\_\_. 1974b. Middlewestern prairie region. American Birds 28(4):807-810.
- \_\_\_\_\_. 1974c. Middlewestern prairie region. American Birds 28(5):908-910.
- \_\_\_\_\_. 1974-1975. Field notes. Breeding season. Illinois Audubon Bulletin 171:16-18.
- \_\_\_\_\_. 1975a. Middlewestern prairie region. American Birds 29(1):64-68.
- \_\_\_\_\_. 1975b. Middlewestern prairie region. American Birds 29(3):696-700.
- \_\_\_\_\_. 1975c. Middlewestern prairie region. American Birds 29(4):858-862.
- \_\_\_\_\_. 1975d. Field notes. Winter season. Illinois Audubon Bulletin 173:19-22.
- \_\_\_\_\_. 1975e. Field notes. Spring migration. Illinois Audubon Bulletin 174:28-38.
- \_\_\_\_\_. 1976a. Middlewestern prairie region. American Birds 30(1):77-82.
- \_\_\_\_\_. 1976b. Middlewestern prairie region. American Birds 30(3):724-728.
- \_\_\_\_\_. 1976c. Middlewestern prairie region. American Birds 30(4):846-850.
- \_\_\_\_\_. 1976d. Field notes. Fall migration. Illinois Audubon Bulletin 176:28-36.
- \_\_\_\_\_. 1976e. Field notes. Winter season. Illinois Audubon Bulletin 177:25-29.
- \_\_\_\_\_. 1976f. Field notes. Spring migration. Illinois Audubon Bulletin 178:25-35.
- \_\_\_\_\_. 1976-1977. Field notes. Illinois Audubon Bulletin 179:34-40.
- \_\_\_\_\_. 1977a. Middlewestern prairie edge. American Birds 31(2):182-186.
- \_\_\_\_\_. 1977b. Middlewestern prairie region. American Birds 31(3):336-339.
- \_\_\_\_\_. 1977c. Middlewestern prairie region. American Birds 31(5):1006-1010.
- \_\_\_\_\_. 1977d. Middlewestern prairie region. American Birds 31(6):1146-1150.
- \_\_\_\_\_. 1977e. Field notes. Spring migration. Illinois Audubon Bulletin 182:38-47.
- \_\_\_\_\_. 1977-1978. Field notes. Breeding season. Illinois Audubon Bulletin 183:30-37.
- \_\_\_\_\_. 1978a. Middlewestern prairie region. American Birds 32(5):1012-1017.
- \_\_\_\_\_. 1978b. Field notes. Fall migration. Illinois Audubon Bulletin 184:40-51.
- \_\_\_\_\_. 1978c. Field notes. Spring (1978) migration. Illinois Audubon Bulletin 186:27-39.
- \_\_\_\_\_. 1978-1979. Field notes. Breeding season. Illinois Audubon Bulletin 187:27-35.
- \_\_\_\_\_. 1979a. Middlewestern prairie region. American Birds 33(2):181-185.
- \_\_\_\_\_. 1979b. Middlewestern prairie region. American Birds 33(5):775-778.
- \_\_\_\_\_. 1979c. Middlewestern prairie region. American Birds 33(6):866-869.
- \_\_\_\_\_. 1979d. Field notes. Fall migration. Illinois Audubon Bulletin 188:39-52.
- \_\_\_\_\_. 1979e. Field notes. Spring migration. Illinois Audubon Bulletin 190:23-35.
- \_\_\_\_\_. 1979-1980. Field notes. Breeding season. Illinois Audubon Bulletin 191:25-34.
- \_\_\_\_\_. 1980a. Field notes, 1979. Fall migration. Illinois Audubon Bulletin 192:24-36.
- \_\_\_\_\_. 1980b. Field notes. Winter season. Illinois Audubon Bulletin 193:25-30.
- \_\_\_\_\_. 1980c. Middlewestern prairie region. American Birds 34(2):166-169.
- \_\_\_\_\_. 1980d. Middlewestern prairie region. American Birds 34(3):277-279.
- \_\_\_\_\_. 1980e. Field notes. Spring migration. Illinois Audubon Bulletin 194:23-36.
- \_\_\_\_\_. 1980-1981. Field notes. Breeding season. Illinois Audubon Bulletin 195:34-47.
- \_\_\_\_\_. 1981a. Field notes. Fall migration. Illinois Audubon Bulletin 196:36-52.
- \_\_\_\_\_. 1981b. Field notes. Spring migration. Illinois Audubon Bulletin 198:36-57.
- \_\_\_\_\_, and L. BUSH. 1971. Middlewestern prairie region. American Birds 25(4):750-753.
- \_\_\_\_\_, and \_\_\_\_\_. 1972a. Middlewestern prairie region. American Birds 26(3):610-614.

- \_\_\_\_\_, and \_\_\_\_\_. 1972b. Spring migration. Middlewestern prairie region. *American Birds* 26(4):765-769.
- \_\_\_\_\_, and \_\_\_\_\_. 1972c. Middlewestern prairie region. *American Birds* 26(5):864-867.
- \_\_\_\_\_, and \_\_\_\_\_. 1973a. Middlewestern prairie region. *American Birds* 27(1):66-70.
- \_\_\_\_\_, and \_\_\_\_\_. 1973b. Middlewestern prairie region. *American Birds* 27(3):622-625.
- \_\_\_\_\_, and \_\_\_\_\_. 1973c. Middlewestern prairie region. *American Birds* 27(4):777-781.
- \_\_\_\_\_, and \_\_\_\_\_. 1973d. Middlewestern prairie region. *American Birds* 27(5):874-878.
- KUMLIEN, L. and N. HOLLISTER. 1951. The birds of Wisconsin. Revised ed. Wisconsin Society for Ornithology, Madison. 122 p.
- LAFORCE, E.F. 1939. The prothonotary warbler nests at Burlington. *Iowa Bird Life* 9(3):36-37.
- LANYON, W.E. and J. BULL. 1967. Identification of Connecticut, mourning, and MacGillivray's warblers. *Bird-Banding* 38(3):187-194.
- LAWHON, F.R. 1967. Winter survey—Dec. 1 through Feb. 28. *Bluebird* 34(1):20-24.
- LEVY, S. 1964. Unusual records for Illinois migrants. *Audubon Bulletin* 129:17.
- LEWIS, G.P. 1923a. Chicago region. *Bird-Lore* 25(1):49-50.
- \_\_\_\_\_. 1923b. Chicago region. *Bird-Lore* 25(2):133-134.
- \_\_\_\_\_. 1923c. Chicago region. *Bird-Lore* 25(5):326.
- \_\_\_\_\_. 1924. Chicago region. *Bird-Lore* 26(4):268-270.
- LINKLETTER, J. 1975. 105. Disturbed mixed prairie. *American Birds* 29(6):1121-1122.
- \_\_\_\_\_. 1977. 93. Disturbed mixed prairie. *American Birds* 31(1):63-64.
- \_\_\_\_\_, and F. WOOLEY. 1978. 82. Disturbed mixed prairie. *American Birds* 32(1):81.
- LONG, M.A. 1928. Rare bird visitors at Rockford. *Audubon Bulletin* 19:44-46.
- LOUCKS, W.E. 1891. List of birds found breeding in the vicinity of Peoria, Illinois. *Oologist* 8(11):224-226.
- \_\_\_\_\_. 1893. The golden swamp warbler. *Oologist* 10(1):19-20.
- \_\_\_\_\_. 1894. The life history and distribution of the prothonotary warbler in Illinois. Illinois State Laboratory of Natural History Bulletin 4(3):10-35.
- MADDING, W.R., and W. MCCLAIN. 1977a. 146. Cattail marsh I. 147. Cattail marsh II. *American Birds* 31(1):84.
- \_\_\_\_\_, and \_\_\_\_\_. 1977b. 160. Grass-edge meadow. *American Birds* 31(1):88.
- MARVEL, C.S. 1948. Unusual feeding behavior of a Cape May warbler. *Auk* 65(4):599.
- MAYFIELD, H. 1948. Middlewestern prairie region. *Audubon Field Notes* 2(5):208-209.
- \_\_\_\_\_. 1949a. Middlewestern prairie region. *Audubon Field Notes* 3(4):210-211.
- \_\_\_\_\_. 1949b. Middlewestern prairie region. *Audubon Field Notes* 3(5):237-238, 240.
- \_\_\_\_\_. 1950a. Middlewestern prairie region. *Audubon Field Notes* 4(4):243-245.
- \_\_\_\_\_. 1950b. Middlewestern prairie region. *Audubon Field Notes* 4(5):278-279.
- \_\_\_\_\_. 1951. Middlewestern prairie region. *Audubon Field Notes* 5(5):292.
- \_\_\_\_\_. 1960. The Kirtland's warbler. *Cranbrook Institute of Science Bulletin* 40. 241 p.
- MEANLEY, B. 1971. Natural history of the Swainson's warbler. North American Fauna Series No. 69. U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. U.S. Government Printing Office, Washington, D.C. 90 p.
- MENGEL, R.M. 1965. The birds of Kentucky. American Ornithologists' Union Ornithological Monographs 3. 581 p.
- MILLER, D.E., and W.B. MILLER. 1972. 54. Suburban woodlot. *American Birds* 26(3):686-687.
- MILLER, T. 1980. 702. Calumet City-Sandridge, Ill.-Ind. *American Birds* 34(4):524.
- MILLS, C. 1980. 695. Western Gibson County, Indiana. *American Birds* 34(4):522-523.
- MILOSEVICH, J., and J. OLSON. 1981. Nesting Canada warblers in Joliet. *Illinois Audubon Bulletin* 197:23-26.
- MOHLENBROCK, R.H., and D.M. LADD. 1978. Distribution of Illinois vascular plants. Southern Illinois University Press, Carbondale. 281 p.
- MOORE, G.E. 1947. Briefs. *Bluebird* 14(7):n.p.
- MORRISON, M.D. 1978. 39. Upland deciduous forest. *American Birds* 32(1):66-67.
- \_\_\_\_\_, and B. PETERJOHN. 1977. 42. Upland deciduous forest. *American Birds* 31(1):44.
- MORRISSEY, T., E.C. GREER, and T.J. FEENEY. 1954. Unusual records from the Davenport area during 1953. *Iowa Bird Life* 24(1):19-20.
- MOYER, J.W. 1933. Bird life along the Kankakee. *Wilson Bulletin* 45(3):136-138.
- MOYER, L.B. 1908. Song of Kirtland's warblers. *Bird-Lore* 10:264.
- MUMFORD, R.E. 1959a. Middlewestern prairie region. *Audubon Field Notes* 13(4):373-376.
- \_\_\_\_\_. 1959b. Middlewestern prairie region. *Audubon Field Notes* 13(5):433-434.
- \_\_\_\_\_. 1960a. Middlewestern prairie region. *Audubon Field Notes* 14(1):38-41.
- \_\_\_\_\_. 1960b. Middlewestern prairie region. *Audubon Field Notes* 14(3):312-314.
- \_\_\_\_\_. 1960c. Middlewestern prairie region. *Audubon Field Notes* 14(4):390-392.
- \_\_\_\_\_. 1960d. Middlewestern prairie region. *Audubon Field Notes* 14(5):452-454.
- MUNDT, A.H. 1883. Oological and ornithological. *Ornithologist and Oologist* 8(2):9-10.
- MURRAY, G., JR., and F.B. GILL. 1976. Behavioral interactions of blue-winged and golden-winged warblers. *Wilson Bulletin* 88(2):231-254.
- MUSSELMAN, T.E. 1921. The birds of Illinois. Illinois State Historical Society Journal 14. 75 p.
- \_\_\_\_\_. 1932. The 1931 season at Quincy. *Audubon Bulletin* 22:48-51.
- \_\_\_\_\_. 1933. Quincy nature diary for 1932. *Audubon Bulletin* 23:50-54.
- \_\_\_\_\_. 1936. 1935 nature diary. *Audubon Bulletin* 26:24-29.
- \_\_\_\_\_. 1937. 1936 nature diary. *Audubon Bulletin* 27:36-44.
- \_\_\_\_\_. 1939. Bird notes at Quincy, 1938. *Audubon Bulletin* 29:14-15.
- \_\_\_\_\_. 1945. Did you know? *Audubon Bulletin* 56:5-6.
- NEHRLING, H. 1880. Beitrage zur ornithologie des nordlichen Illinois. *Journal fur Ornithologie* 28:408-418.
- NELSON, E.W. 1876. Additions to the avifauna of Illinois with notes on other species of Illinois birds. *Nuttall Ornithological Club Bulletin* 1(2):39-44.
- \_\_\_\_\_. 1876-1877. Birds of north-eastern Illinois. *Essex Institute Bulletin* 8(9-12):90-155.
- \_\_\_\_\_. 1877. Notes upon birds observed in southern Illinois, between July 17 and September 8, 1875. *Essex Institute Bulletin* 9:32-65.
- NICE, M.M. 1930. A study of a nesting of black-throated blue warblers. *Auk* 47(3):338-345.
- NISBET, I.C.T. 1970. Autumn migration of the blackpoll warbler: evidence for long flight provided by regional survey. *Bird-Banding* 41(3):207-240.
- NOLAN, V. 1952. Middlewestern prairie region. *Audubon Field Notes* 6(5):284-285.
- \_\_\_\_\_. 1953. Middlewestern prairie region. *Audubon Field Notes* 7(5):310-312.
- \_\_\_\_\_. 1956a. Middlewestern prairie region. *Audubon Field Notes* 10(1):27-29.
- \_\_\_\_\_. 1956b. Middlewestern prairie region. *Audubon Field Notes* 10(3):254-256.
- \_\_\_\_\_. 1956c. Middlewestern prairie region. *Audubon Field Notes* 10(5):386-387.

- \_\_\_\_\_. 1957. Middlewestern prairie region. Audubon Field Notes 11(1):28-30.
- \_\_\_\_\_. 1958. Middlewestern prairie region. Audubon Field Notes 12(5):415-417.
- \_\_\_\_\_. 1978. Ecology and behavior of the prairie warbler *Dendroica discolor*. American Ornithologists' Union Ornithological Monographs 26. Washington, D.C. 595 p.
- NORRIS, J.P. 1889. [Editor's note]. Ornithologist and Oologist 14(3):38-39.
- \_\_\_\_\_. 1890a. A series of eggs of the golden-winged warbler. Ornithologist and Oologist 15(2):21-22.
- \_\_\_\_\_. 1890b. A series of eggs of the prothonotary warbler. Ornithologist and Oologist 15(12):177-182.
- PARKES, K.C. 1951. The genetics of the golden-winged and blue-winged warbler complex. Wilson Bulletin 63:5-15.
- \_\_\_\_\_. 1954. Notes on some birds of the Adirondack and Catskill mountains, New York. Carnegie Museum Annals 33(8):149-178.
- PEARSON, R.W. 1962. A population study of forest-edge birds in central Illinois. M.S. Thesis. University of Illinois. 60 p.
- PERE MARQUETTE NATURE LEAGUE. 1942. Pere Marquette State Park, Grafton, Ill. Audubon Magazine 44(1):50 (Supplement).
- PETERJOHN, B.C. 1981. Middlewestern prairie region. American Birds 35(3):304-307.
- PETERSEN, P.C., JR. 1959. Brewster's warbler at Davenport. Iowa Bird Life 29(4):99.
- \_\_\_\_\_. 1963a. Middlewestern prairie region. Audubon Field Notes 17(1):36-37.
- \_\_\_\_\_. 1963b. Middlewestern prairie region. Audubon Field Notes 17(4):407-409.
- \_\_\_\_\_. 1964a. Middlewestern prairie region. Audubon Field Notes 18(1):42-44.
- \_\_\_\_\_. 1964b. Middlewestern prairie region. Audubon Field Notes 18(3):360.
- \_\_\_\_\_. 1964c. Middlewestern prairie region. Audubon Field Notes 18(4):454-456.
- \_\_\_\_\_. 1964d. Middlewestern prairie region. Audubon Field Notes 18(5):511-512.
- \_\_\_\_\_. 1965a. Middlewestern prairie region. Audubon Field Notes 19(1):44-46.
- \_\_\_\_\_. 1965b. Middlewestern prairie region. Audubon Field Notes 19(5):551-552.
- \_\_\_\_\_. 1966a. Middlewestern prairie region. Audubon Field Notes 20(3):429-431.
- \_\_\_\_\_. 1966b. Middlewestern prairie region. Audubon Field Notes 20(5):574-575.
- \_\_\_\_\_. 1967. Middlewestern prairie region. Audubon Field Notes 21(5):577-578.
- \_\_\_\_\_. 1968a. Middlewestern prairie region. Audubon Field Notes 22(1):48-50.
- \_\_\_\_\_. 1968b. Middlewestern prairie region. Audubon Field Notes 22(5):612-614.
- \_\_\_\_\_. 1969. Middlewestern prairie region. Audubon Field Notes 23(1):64-65.
- \_\_\_\_\_. 1970a. Middlewestern prairie region. Audubon Field Notes 24(1):54-55.
- \_\_\_\_\_. 1970b. Middlewestern prairie region. Audubon Field Notes 24(5):689-691.
- \_\_\_\_\_. 1972. Wintering yellowbreasted chat at Davenport. Iowa Bird Life 42(1):26.
- PITCHER, E.B. 1974. 39. Black oak and sassafras woods. American Birds 28(6):1007.
- \_\_\_\_\_. 1975. 37. Black oak-sassafras woods. American Birds 29(6):1096.
- \_\_\_\_\_. 1977. 43. Black oak-sassafras woods. American Birds 31(1):44.
- \_\_\_\_\_. 1978. 40. Black oak-sassafras woods. American Birds 32(1):67.
- \_\_\_\_\_. 1979. 35. Black oak-sassafras woods. American Birds 33(1):65.
- PHILCKA, F.A. 1935. Sight records of the horned grebe and mourning warbler. Chicago Academy of Sciences Program of Activities 6(4):85-87.
- \_\_\_\_\_. 1938. Brewster's warbler in the Chicago region. Auk 55(3):540-542.
- \_\_\_\_\_. 1939a. Flight song of the blue-winged warbler. Auk 56(2):340-341.
- \_\_\_\_\_. 1939b. Hybrid *Vermivora* in the Chicago region. Auk 56(3):340.
- \_\_\_\_\_. 1939c. Mourning warbler nesting in the Chicago region. Auk 56(4):481.
- \_\_\_\_\_. 1940. Nashville warbler breeding in northeastern Illinois. Auk 57(1):115-116.
- POLDERBOER, E.B. 1949. The use of common bull thistle as a nesting plant by songbirds. Iowa Bird Life 19(4):71-72.
- POLING, O.C. 1887. Prothonotary warbler in western Illinois. Ornithologist and Oologist 12(10):160-161.
- \_\_\_\_\_. 1889. A list of birds in whose nests the cowbird's eggs have been found. Ornithologist and Oologist 14(9):133-134.
- \_\_\_\_\_. 1890. Further notes on the cowbird with remarks on the nesting of the prothonotary warbler at Quincy, Illinois. Ornithologist and Oologist 15(6):92.
- PRINCEN, L.H. 1969. Unusual bird sightings in central Illinois during 1968. Peoria Academy of Science Proceedings 2:20-23.
- \_\_\_\_\_. 1979. Unusual bird sightings in central Illinois during 1977 and 1978. Peoria Academy of Science Proceedings 11:21-32.
- PUESCHEL, P. 1942. A four course dinner. Audubon Bulletin 42:11-12.
- RAVELING, D.G. 1965. Geographic variation and measurements of Tennessee warblers killed at a TV tower. Bird-Banding 36(2):89-101.
- \_\_\_\_\_. and D.W. WARNER. 1978. Geographic variation of yellow warblers killed at a TV tower. Auk 95(1):73-79.
- RAYMOND, C.E. 1916. Mid-May bird census, 1916. Wilson Bulletin 28(2):83.
- REESE, R.W. 1949. 1. Comparison of forest-edge bird populations in Robert W. Allerton Park, central Illinois 1946, 1947, 1948. M.S. Thesis. University of Illinois. 42 p.
- REUSS, A. 1953. Banding notes from Alfred Reuss. Inland Bird Banding News 25(2):11.
- RICE, L.A. 1946. Studies on deciduous forest animal populations during a two-year period with differences in rainfall. American Midland Naturalist 35(1):153-171.
- RIDGWAY, R. 1874a. The lower Wabash valley, considered in its relation to faunal districts of the eastern region of North America. Boston Society of Natural History Proceedings 16:304-332.
- \_\_\_\_\_. 1874b. Catalogue of the birds ascertained to occur in Illinois. Lyceum of Natural History of New York Annals 10:364-394.
- \_\_\_\_\_. 1874c. On local variations in the notes and nesting habits of birds. American Naturalist 8(4):197-201.
- \_\_\_\_\_. 1876. On geographical variation in *Dendroica palmarum*. Nuttall Ornithological Club Bulletin 1(4):81-87.
- \_\_\_\_\_. 1878. Notes on birds observed at Mount Carmel, southern Illinois, in the spring of 1878. Nuttall Ornithological Club Bulletin 3(4):162-166.
- \_\_\_\_\_. 1881. A revised catalogue of the birds ascertained to occur in Illinois. Illinois State Laboratory of Natural History Bulletin 1(4):163-208.
- \_\_\_\_\_. 1882. Notes on some of the birds observed near Wheatland, Knox Co., Indiana in the spring of 1881. Nuttall Ornithological Club Bulletin 7(1):15-23.
- \_\_\_\_\_. 1887. List of birds found breeding within corporate limits of Mt. Carmel, Illinois. Ridgway Ornithological Club Bulletin 2:26-35.
- \_\_\_\_\_. 1889. The ornithology of Illinois. Vol. 1. Illinois State Laboratory of Natural History. Reprinted 1913. Pantagraph Printing and Stationery Company, Bloomington, Illinois. 520 p. + 32 plates.
- \_\_\_\_\_. 1914. Bird-life in southern Illinois. 1. Bird Haven. Bird-Lore 16(6):409-420.
- \_\_\_\_\_. 1915a. Bird-life in southern Illinois. Bird-Lore 17(2):91-103.
- \_\_\_\_\_. 1915b. Bird-life in southern Illinois. Bird-Lore 17(3):191-198.

- RIES, D.T., and F.G. WERNER. 1946. Checklist of the birds of Starved Rock State Park and surrounding territory. Illinois State Academy of Science Transactions 39:135-142.
- RIIS, P.B. 1921. Rockford. Audubon Bulletin, Spring:40-41.
- ROBERTS, G., JR. 1918-1919. Mid-winter field notes. Audubon Bulletin 1918-1919:41-42.
- . 1923. An Illinois yard. Bird-Lore 25(6):392.
- ROBERTSON, M.J. 1959. Analysis of breeding bird populations at Allerton Park, central Illinois, 1946-1955. M.S. Thesis. University of Illinois. 114 p.
- ROBERTSON, W. 1941a. 9. Swampy prairie. Audubon Magazine 43(5):485.
- . 1941b. 33. Cut-over upland forest with pond. Audubon Magazine 43(5):496-497.
- . 1942a. 5. Swampy prairie. Audubon Magazine 44(5):18-19 (Supplement).
- . 1942b. 22. Cut-over upland oak-hickory forest with pond. Audubon Magazine 44(5):27 (Supplement).
- . 1944a. 5. Swampy prairie. Audubon Magazine 46(5):16 (Supplement).
- . 1944b. 14. Upland oak-hickory forest with pond. Audubon Magazine 46(5):19 (Supplement).
- , and D. SNYDER. 1948. 11. Cut-over upland oak-hickory forest. Audubon Field Notes 2(6):233.
- ROSENBAUM, G. 1976. Bird finding. The Skokie lagoons. Cook County. Illinois Audubon Bulletin 177:17.
- ROTH, R.R. 1967. An analysis of avian succession on upland sites in Illinois. M.S. Thesis. University of Illinois. 106 p.
- RUDOLPH, P.D. 1916-1917. The yellow warbler's nest. Audubon Bulletin 1916-1917:35.
- SANBORN, C.C. 1911. Notes from northern Illinois. Oologist 28(11):180.
- . 1921a. The season. Chicago region. Bird-Lore 23(3):145-146.
- . 1921b. The season. Chicago region. Bird-Lore 23(4):203-204.
- . 1921c. The season. Chicago region. Bird-Lore 23(5):251-252.
- . 1921d. The season. Chicago region. Bird-Lore 23(6):308-309.
- . 1922a. Recent notes from an old collecting ground in northeastern Illinois. Auk 39(3):367-373.
- . 1922b. The season. Chicago region. Bird-Lore 24(4):222-223.
- . 1934. Chicago region. Bird-Lore 36(5):311.
- , and W.A. GOELITZ. 1915. A two-year nesting record in Lake County, Illinois. Wilson Bulletin 27(4):434-448.
- SANDERS, J. 1968. 480. Maple Park-Mooseheart, Ill. Audubon Field Notes 22(2):271.
- . 1975. 610. Chicago Urban, Ill. American Birds 29(2):410.
- . 1976. 633. Chicago Urban, Ill. American Birds 30(2):428.
- . 1980. 707. Chicago Urban, Ill. American Birds 34(4):525.
- SAUSAMAN, W.A. 1957. 323. Springfield, Ill. Audubon Field Notes 11(2):171.
- SCHAFER, J.J. 1917-1918. The fall migration. Audubon Bulletin, Winter:40-43.
- SCHANTZ, O.M. 1904a. Morton Park, Ill. May 8. Wilson Bulletin 16(2):39-42.
- . 1904b. A door-yard list from Morton Park, Ill. Wilson Bulletin 16(2):57-59.
- . 1912. Prothonotary warblers (*Protonotaria citrea*) nesting at Riverside, Illinois. Wilson Bulletin 24(4):165-167.
- . 1921. Bird geography in the Cook County forest preserves. Audubon Bulletin, Fall:9.
- . 1927. What warblers do for us. Audubon Bulletin 18:10-14.
- SCHRANTZ, F.G. 1943. Nest life of the eastern yellow warbler. Auk 60(3):367-387.
- SCHWAGER, G.M. 1961. Forest edge breeding-bird populations at Allerton Park, central Illinois, 1946-1960. M.S. Thesis. University of Illinois. 86 p.
- SEETS, J.W., and H.D. BOHLEN. 1977. Comparative mortality of birds at television towers in central Illinois. Wilson Bulletin 89(3):422-433.
- SHORT, L.L. 1963. Hybridization in the wood warblers *Vermivora pinus* and *V. chrysoptera*. Pages 147-160 in 13th International Ornithological Congress Proceedings. Vol. 1.
- SHORT, W. 1938. St. Louis, Mo. Bluebird 5(10):97-98.
- SILLOWAY, P.M. 1895. The prothonotary warbler in dry weather. Oologist 12(6):105-108.
- SMITH, E.T. 1941a. Chicago region. Audubon Magazine 43(4):392-393.
- . 1941b. Chicago region. Audubon Magazine 43(5):472-473.
- . 1942a. Chicago region. Audubon Magazine 44(4):8-9 (Supplement).
- . 1942b. Chicago region. Audubon Magazine 44(5):8 (Supplement).
- , and P.A. DUMONT. 1944a. Middlewestern region. Audubon Magazine 46(4):104-106 (Supplement).
- , and ———. 1944b. Middle-western region. Audubon Magazine 46(5):6-8 (Supplement).
- , and ———. 1945a. Middle-western region. Audubon Magazine 47(1):6-7 (Supplement).
- , and ———. 1945b. Middlewestern region. Audubon Magazine 47(4):34-37 (Supplement).
- SMITH, F. 1921. Illinois birds as travelers. Illinois Arbor and Bird Days Circular 1921:21-29.
- . 1930. Records of spring migration of birds at Urbana, Illinois, 1903-1922. Illinois State Natural History Survey Bulletin 19(2):105-117.
- SMITH, H.M. 1950. Notes on the birds of the Chicago region. Auk 67(1):109-110.
- SMITH, H.R. 1946. Spring migration of warblers in Chicago region. Audubon Bulletin 57:1-8.
- SMITH, J.L. 1920. The yellow-breasted chat. Audubon Bulletin, Fall 1920:22-23.
- SMITH, P.W., JR. 1888. Nesting of the Nashville warbler in Fulton County, Illinois. Bay State Oologist 1:44.
- . 1893. Nesting of the cerulean warbler. Ornithologist and Oologist 18(1):5-6.
- SNYDER, D., C. BONNEY, and W.B. ROBERTSON. 1948. 15. Deciduous flood-plain forest. Audubon Field Notes 2(6):237.
- SPARKS, M.E. 1905. Birds vs. street cars. Wilson Bulletin 17(2):44-47.
- STEVENSON, H.M. 1972. The recent history of Bachman's warbler. Wilson Bulletin 84(3):344-347.
- STINE, P.M. 1949. 28. Shrubby field and forest edge. Audubon Field Notes 3(6):271.
- . 1959. Changes in the breeding birds of Bird Haven Sanctuary over a period of forty-five years. Wilson Bulletin 71(4):372-380.
- STODDARD, H.L. 1921. Female bay-breasted warbler in male plumage. Auk. 38(1):117.
- STRAUCH, L. 1917. Birds in the vicinity of Carthage, Illinois. Spring 1917. Carthage College Bulletin 3(11):n.p.
- STRODE, W.S. 1916. The prothonotary warbler. Oologist 33(6):107-110.
- . 1918. Some bird characteristics. Illinois State Academy of Science Transactions 11:182-186.
- STRUTHERS, K. 1980. The I.A.S. 1979 Christmas bird count. Illinois Audubon Bulletin 192:12-20.
- STUTESMAN, P. 1968. 489. Shelbyville Reservoir area, Ill. Audubon Field Notes 22(2):274.
- SUTTON, G.M. 1967. Oklahoma birds. University of Oklahoma Press, Norman. 674 p.
- SWAN, M.M. 1977. Bird finding. Lorado Taft Field Campus, Ogle County. Audubon Bulletin 180:21-22.
- SWINK, F. 1976. A finding list of the birds of the Morton Arboretum. Revised ed. Morton Arboretum Booklet 1. 483 p.

- TAYLOR, W.K. 1976. Migration of the common yellowthroat with an emphasis on Florida. *Bird Banding* 47(4):319-332.
- TESSEN, D.D. 1980. Western Great Lakes region. *American Birds* 34(6):898.
- THOM, R.H. 1968. 468. Bird Haven Sanctuary, Ill. *Audubon Field Notes* 22(2):267.
- . 1973. Notes on the birds of Hidden Springs State Forest. *Audubon Bulletin* 166:33-40.
- THOMPSON, C.F., and V. NOLAN, JR. 1973. Population biology of the yellow-breasted chat (*Icteria virens* L.) in southern Indiana. *Ecological Monographs* 43(2):145-171.
- THOMPSON, M.D. 1958. The 1959 [= 1958] breeding bird census. *Audubon Bulletin* 108:5-11.
- . 1960. 1959 nesting report. *Audubon Bulletin* 115:7-13.
- , and O. ROBINSON. 1963. Illinois nesting records—1962. *Audubon Bulletin* 126:7-15.
- TUTTLE, H.E. 1918. Notes on the nesting of the Nashville warbler. *Bird-Lore* 20(4):269-272.
- TWOMEY, A.C. 1945. The bird population of elm-maple forest with special reference to aspection, territorialism and coactions. *Ecological Monographs* 15(2):173-205.
- VAN DUZEN, E. 1920. Notes from Rockford. *Audubon Bulletin* Fall:24.
- VAN HORN, D.H. 1952. Breeding-bird populations of flood plain and upland forests in central Illinois. M.S. Thesis. University of Illinois. 78 p.
- WADE, S. 1916. Mid-May bird census, 1916. *Wilson Bulletin* 28(2):82.
- WALKINSHAW, L.H. 1953. Life-history of the prothonotary warbler. *Wilson Bulletin* 65(3):152-168.
- WALTER, H.E., and A.H. WALTER. 1904. Wild birds in city parks. A.W. Mumford, Chicago. 40 p.
- WANDELL, W.N. 1948. Agricultural and wildlife values of habitat improvement plantings on the Illinois black prairie. *North American Wildlife Conference Transactions* 13:256-270.
- WASSON, I.B. 1957. Effect of cold spring of 1956 in Chicago area. *Audubon Magazine* 59(1):4.
- WESTCOTT, C. 1970. 488. Barrington, Ill. *Audubon Field Notes* 24(2):305-306.
- WHELOCK, I.G. 1905. Regurgitative feeding of nestlings. *Auk* 22(1):54-71.
- WHITE, J.S. 1930. Chicago region. *Bird-Lore* 32(3):210-212.
- WIDMANN, O. 1885. Note on the capture of *Coturniculus lecontei* and *Dendroica kirtlandi* within the city limits of St. Louis, Mo. *Auk* 2(4):381-382.
- . 1895. Swainson's warbler an inhabitant of the swampy woods of southeastern Missouri. *Auk* 12(2):112-117.
- . 1897a. The myrtle warbler, *Dendroica coronata*, in Missouri in summer. *Osprey* 2(3):40.
- . 1897b. The summer home of Bachman's warbler no longer unknown. *Auk* 14(3):305-309.
- . 1898. Bachman's warbler in summer. *Osprey* 3(1):13.
- . 1907. A preliminary catalog of the birds of Missouri. Academy of Science of St. Louis Transactions 17(1). 288 p.
- . 1922. Extracts from the diary of Otto Widmann. St. Louis Academy of Science Transactions 24(8):1-77.
- WILHELM, E.J., JR. [1957]. Birds of the St. Louis area. St. Louis Audubon Society. 40 p.
- WILKOSKI, W. 1924. A wanderer's bird notes. *Oologist* 41(5):47.
- WILLIAMS, Z.A. 1975. Three-year study of bird life at Wildlife Prairie Park, Peoria, Illinois. Peoria Academy of Science Proceedings 8:9-15.
- WILLSON, M.F. 1974. Avian community organization and habitat structure. *Ecology* 55(5):1017-1027.
- WILSON, B.H. 1904. An all day bird study. *Wilson Bulletin* 16(2):51-52.
- . 1906. The birds of Scott County, Iowa. *Wilson Bulletin* 18(1):1-11.
- . 1912. Red-letter days in the country. *Oologist* 29(5):281-285.
- WOODRUFF, F.M. 1907. The birds of the Chicago area. Chicago Academy of Sciences Natural History Survey Bulletin 6. 221 p.
- WRIGHT, E.G. 1926. Spring birds of a city park. *Oologist* 43(2):28.
- WUESTENFELD, H. 1977. Bird finding. Pere Marquette State Park. Jersey County. Illinois Audubon Bulletin 182:25-26.
- YEAGER, L.E. 1949. Effect of permanent flooding in a river-bottom timber area. Illinois Natural History Survey Bulletin 25(2):33-65.