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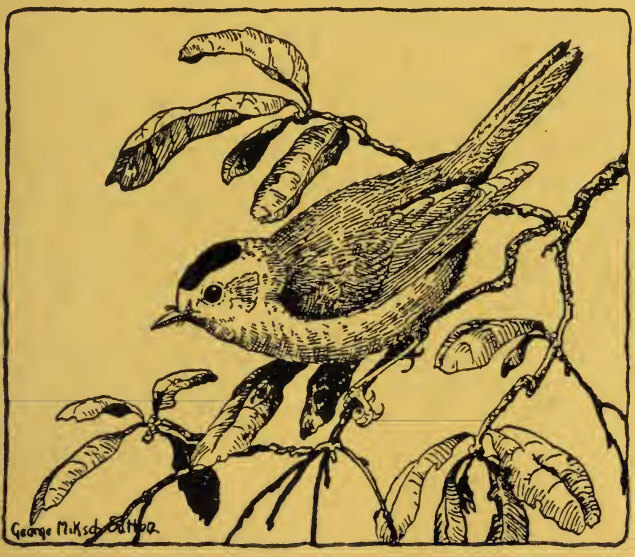

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THE WILSON BULLETIN

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PLUMBEOUS KITE
(Ictinea plumbea)

Adult female taken along the Rio Sabinas, near Gomez Farias, southwestern Tamaulipas, Mexico, on April 18, 1941. From a field sketch in water-color by George Miksch Sutton.

(About one-third life-size)

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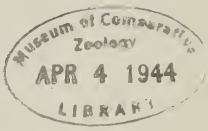

THE KITES OF THE GENUS ICTINIA

BY GEORGE MIKSCH SUTTON

ARE the Mississippi Kite and Plumbeous Kite distinct species, or are they geographical races of the same bird? Twenty years ago, when I first compared specimens of the two forms, I was so impressed with certain differences between them that it did not occur to me to question the judgment of those who had accorded them full specific rank. At that time I had not seen either in life, had not examined either eggs or young birds, and did not know enough about taxonomy to be concerned with the validity of such phylogenetic concepts as might be embodied in, or proclaimed by, their scientific names.

Today I am much better acquainted with these two kites. I have spent weeks on end with the former in western Oklahoma (Sutton, 1939:41–53) and have encountered the latter briefly in southwestern Tamaulipas, at the northern edge of its range (Sutton and Pettingill, 1942:8). I have handled the skins in several of our museums and am convinced that neither form has a single morphological character wholly its own. I have made a point of observing both birds critically in life, have heard their cries, noted carefully the colors of their fleshy parts, painted them from freshly killed specimens, skinned them, and examined their stomach contents. All this, together with what I have learned from the literature concerning the distribution and nesting habits of the Plumbeous Kite, convinces me that the two birds are conspecific. In the following paper I propose to show why I consider them thus closely related.

In disposition and behavior they are alike. They are mild to the point of docility much of the time though capable of becoming pugnacious when their nests or young are threatened. They may perch for an hour at a stretch in the very top of a tree but are more likely, especially on a hot day, to seek a shady spot on a lower branch. Their flight is buoyant, easy, and graceful. As they soar about, their widespread tails veer this way and that.

I have not had opportunity to compare their cries directly, but the shrill whistles of Plumbeous Kites that I heard in Tamaulipas seemed to me the precise counterpart of the *phee-phew* I had so often heard from the Mississippi Kites in Oklahoma.

Both birds feed chiefly on large insects, many of which they capture on the wing. Freshly killed specimens have the same peculiar, sweetish, slightly offensive odor, probably that of insects they have eaten. Too, they usually have a soiled patch in the middle of the under tail coverts—evidence of the habit of tucking moist, partly eaten prey snugly up against the tail as they fly.

As for their nidification, I can say nothing concerning the Plumbeous Kite from personal observation. The nest is described as "a collection of rather coarse twigs" built with "but little care" and placed thirty to forty feet up in a mangrove (Dickey and van Rossem, 1938: 108); as a "small, rather formless" structure "of sticks placed in the main crotch of a tree about twenty feet from the ground" (Chapman, 1894:70); and as "composed of small sticks . . . lined with leaves and fibrous material, and placed toward the end of a branch of a *Ceiba* at 50 to 60 feet" (Belcher and Smooker, 1934:589). It must, therefore, be very much like that of its northward ranging relative. The Mississippi Kite nests "in tall trees" (Chapman, 1932:216) when it inhabits a heavily forested region. So, apparently, does the Plumbeous Kite. Chubb (1916:274–275) quotes Schomburgk to the effect that the latter form "builds its nest of twigs in tall trees that are quite impossible to climb."

The eggs of the two forms seem to be very similar. They are white or very pale bluish white, unmarked save for nest stains. Three Plumbeous Kite eggs described by Belcher and Smooker (1934:589) measured 40 x 33, 41.25 x 35.5, and 41 x 35 mm., while the average for 29 Mississippi Kite eggs measured by Bendire (1892:179) was 41 x 34 mm. (extremes: 39 x 32—44.5 x 36.5). However, the egg of the Plumbeous Kite figured by Oates (1902: plate 14) is much more spherical than the egg of the Mississippi Kite figured by Bendire (1892: plate 5); the former is "oval," the latter, "short ovate" (Ridgway, 1886: plate 16). The Mississippi Kite lays one to three eggs, usually two. So few Plumbeous Kite nests have been discovered that it is hard to say what the average set may number. A nest reported from El Salvador held a complete set of one egg (Dickey and van Rossem, 1939:108). One nest found in Trinidad held one egg, another held two (Belcher and Smooker, 1934:589). A nest in "South Guyana" (= mainland of Brazil near the island of Maracá) held one young bird (Goeldi, 1897:150). Wolfe (1938:6) records a single egg from Brazil, and a set of two from Paraguay.

As for the natal down, I have not yet seen a specimen nor found a description of the newly hatched Plumbeous Kite, but a young one "about a week old" is said to have been "of white color" (Goeldi, 1897: 150). The newly hatched Mississippi Kite is snow white with a dull gray facial mask and a very faint wash of brown on the nape, back, and upper side of the wings (Sutton, 1939:48).

I have not had opportunity to compare skeletons of the two birds, but both have short, scutellate tarsi and rather short toes; well proportioned, pointed wings with the two outermost primaries notched; round nostrils; broad, roundish head; and compact body.

If, then, these two kites are so much alike, how do they differ? The Plumbeous Kite is darker than the Mississippi Kite, generally speaking. Its principal diagnostic marks are the white barring of the tail and the reddish brown patch on the primaries. These are usually thought to be specific characters. But are they? Let us consider all the so-called 'species characters' one by one.

1. *White barring of tail.* In adult plumage the tail of the Plumbeous Kite is always barred with white. At first glance this appears to be a strong species character, but careful examination of any large series of Mississippi Kites reveals the presence of white tail-barring (see Amer. Mus. Nat. Hist. Nos. 80643 and 470055) and gray tail-barring (see Univ. Mich. Mus. Zool. No. 57265 and G. M. Sutton No. 2315) in some breeding, and probably fully adult birds, as well as in a good many subadult birds. It is normal in birds under a year old; it is fairly common in the first breeding plumage (perhaps because of delayed molt); and its presence is evidence of morphological overlap.

2. *Red-brown wing-patch.* Most (probably all) adult Plumbeous Kites have a more or less extensive rufous patch on the primaries. Some young Plumbeous Kites also have it. But some young Plumbeous Kites do not have it, and most adult Mississippi Kites have a suggestion of it, so here again we have morphological overlap.

3. *White tipping of secondaries.* I have yet to find an adult Plumbeous Kite with white-tipped secondaries, but I have examined enough Mississippi Kites to know that some adults have little or no white tipping, and that those individuals which have the character most strongly developed also have the most extensive concealed white markings on the wing coverts and scapulars; hence I regard the concealed white markings that are occasionally found on the back and wings of the Plumbeous Kite as further evidence of morphological overlap.

4. *Shape of tail.* The tail usually is truncate in the Plumbeous Kite, furcate in the Mississippi Kite. But at least four specimens in the American Museum's series of about fifty adult Plumbeous Kites have more or less furcate tails (the character is especially marked in a male, No. 121448, collected March 13, 1913, at Villavicencio, Colombia); and some Mississippi Kites have truncate tails (see Amer. Mus. Nat. Hist. No. 470055), so there is at least occasional morphological overlap in tail-shape.

5. *Proportions of wing and tail.* In the Plumbeous Kite the tail is less than half as long as the wing. I encountered no exception to this rule in a series of 42 specimens I measured and carefully checked at the American Museum. But in one specimen (a female, No. 73597) the

tail-length was 49.7 per cent that of the wing-length, and in five other specimens it was at least 48 per cent. In the Mississippi Kite, on the other hand, the tail is said to be more than half as long as the wing, but in the American Museum's series of 13 adults there are two in which the tail-length is only 49.5 per cent that of the wing-length, and there are four others in which it is very little more than 50 per cent (50.5, 50.9, 51.4, and 51.6 per cent). In other words there is actual morphological overlap here too.

6. *Color of fleshy parts.* Adult Plumbeous Kites are much brighter footed than adult Mississippi Kites in life, but there is enough yellow, orange, or orange-red on the tarsi, and sometimes the toes, of the latter to indicate that this brightness-of-foot character also is common to the two forms. The eyes are a beautiful deep red in both. The supraorbital shield and cere are without bright color in both, though the mouth-corners sometimes have a touch of red-orange.

7. *Immature plumage.* In the immature plumage we again find a difference in intensity, the Plumbeous Kite being more sharply black and white, especially below, and sometimes having an extensive red-brown wing-patch. From above, the two forms are scarcely distinguishable in this plumage; but the Mississippi Kite has much more concealed white on the scapulars and wing coverts—a fact that becomes instantly apparent with parting or lifting of the plumage. The Mississippi Kite is less heavily streaked, and therefore whiter, on the chin; more broadly streaked throughout the breast and belly; and the streaking is brown rather than dark gray. But in this plumage, as well as in the adult, there is no character strictly peculiar to one form or the other.

At no point does the breeding range of the Plumbeous Kite touch that of the Mississippi Kite though the latter is believed to have nested as far south as the mouth of the Rio Grande within recent times (May, 1935:17). I feel certain that the Plumbeous Kite nests nowhere more than a few miles north of Gomez Farias, Tamaulipas, where our party found it in the spring of 1941, and the southern limits of the Mississippi Kite's present-day breeding range (central Texas, southern Louisiana and extreme northwestern Florida) are far to the northward of this tropical valley. In winter there may be occasional overlapping, for some Mississippi Kites move southward into the range of the other bird (Peters, 1931:201).

How did the Mississippi Kite, this northward ranging relative of the Plumbeous Kite, become isolated? Did some storm of vast proportions carry its progenitors northward en masse, transferring them to a wooded country in which they established themselves in a single season? Or did these progenitors move slowly northward, only to become isolated because the dry country of northern Tamaulipas and southern Texas proved not to be adequate to their needs? Probably not. More plausible is the guess that before the ice-age the range of *Ictinia* was continuous from Florida westward along the Gulf Coast to Mexico;

that the southward moving ice sheet separated eastern birds from western; and that since the retreating of the ice the birds of the "Florida pocket" (that is, the Mississippi Kites of today) have been gradually moving westward and southward toward the western birds (that is, the Plumbeous Kites). The present day range of many reptiles and other animals suggests that some such explanation may well be the most accurate (see Mayr, 1942:177).

The Mississippi Kite now occupies a nesting range very distinct from that of the Plumbeous Kite. There is no area in which the two forms intergrade, no area in which one "approaches" the other. Only rarely do we come upon a specimen which might actually be called the former by one systematist, the latter by another. The Mississippi Kite is, in other words, a very distinct race or subspecies. But the similarities between it and its relative to the south are far more important than the dissimilarities—this is the point of my discussion. Giving the two birds the same species name will call attention to, and accent, the closeness of their relationship. Only through 'lumping' of this sort will scientific names serve to show the kinship of United States birds with those of lands far beyond our own borders.

If the above suggestion be adopted, our Mississippi Kite may well be thought of, if not actually called, the Mississippi Plumbeous Kite. How such a name would please Audubon, for Audubon, believing that his rival, Wilson, had merely re-described Gmelin's *Falco plumbeus*, relegated *Falco misisippiensis* to the synonymy of that species!

Another race of *Ictinia plumbea* has been described—*Ictinia plumbea vagans* Miller and Griscom (1921:5); but it seems to be generally conceded that Central American birds are not sufficiently different for recognition as a distinct race (see, for example, Dickey and van Rossem, 1938:107).

The races of *Ictinia plumbea* may, therefore, be listed as follows:

Ictinia plumbea plumbea (Gmelin)
Falco plumbeus Gmelin, Syst. Nat., 1, pt. 1, 1788, p. 283 (Cayenne, ex Latham)

Ictinia plumbea misisippiensis (Wilson)
Falco misisippiensis Wilson, Amer. Ornith., 3, 1811, p. 80, pl. 25, fig. 1 (below Natchez, Mississippi)

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American Museum of Natural History, New York City

BONAPARTE'S GULL ON THE NIAGARA RIVER AND EASTERN LAKE ERIE

BY CLARK S. BEARDSLEE

THE Niagara River forms an important part of the fly-way of the Bonaparte's Gull (*Larus philadelphia*) on both the spring and fall migration flights. Since the river offers open water and adequate food at every season, and particularly since it acts as a bottle neck in the overland route between the Atlantic and the species' breeding grounds, it affords a rare opportunity to observe these gulls in large numbers.

My interest in the Bonaparte's Gull was aroused immediately after my moving to Buffalo in the spring of 1921, and my study of their habits during the succeeding years has brought out some points which seem worth recording. The present paper deals only with group movements, dates of molting, and variant plumages, as observable on the Niagara River and eastern Lake Erie.

March. Insofar as western New York is concerned, a calendar of the Bonaparte's Gull properly starts with the month of March. The arrival of the earliest migrants varies somewhat with the weather, but a few gulls usually appear soon after March 20, and more follow during the last days of the month. These early flocks are normally composed entirely of adults in winter plumage.

April. Early in the month Bonaparte's Gulls become abundant. These migrants are adults, and the assumption of the black hood is approximately coincident with their arrival. The dates on which winter- and nuptial-plumage birds are present in equal numbers—in other words, the dates for the height of the prenuptial molt—average April 11, the earliest being April 6 (1939) and the latest April 17 (1935). Individual birds may occasionally be found in full nuptial plumage as early as April 2. It is impossible to determine when the most tardy individuals assume the hood, for in very rare instances it is not assumed at all. In an average year, 10 per cent of the gulls will have the black hood on April 7, and 90 per cent ten days later, indicating that the complete process in the individual is a matter of a few days only, and almost certainly requires less than a week. Immature birds are uncommon throughout the month, although I have noted a slight increase in their numbers during the last week of April in several years when the weather was mild. They appear to be entirely in winter plumage at this season. No signs of molting in immatures is visible to the field observer in western New York during April, the dark feathers about the head being acquired, if at all, after the middle of May (see below).

May. Most of the adults leave our waters during the first half of May, large numbers often congregating in flocks preparatory to the flight to their breeding grounds. I have seen flocks of several thousand birds on numerous occasions during the first week of May, and once (May 3, 1930) observed a single flock of more than 10,000 adults floating down the Ontario side of the river a short distance above the falls. Coincident with the adults' departure, the immatures begin to arrive in some numbers. There are always a good many present soon after May 1, but they ordinarily do not reach their peak of abundance until the middle of the month, by which time there are generally several hundred immatures on the river. They remain here for a much shorter period than the adults. Although arriving in our waters about a month later than the older birds, they follow them northward fairly closely, and by the month's end are usually scarce.

June. Occasional adults may be encountered after June 1, but they are rare, and I have never seen one after the first week. Immatures are more often seen, but in a normal year they are not present in numbers, and after mid-month only the few individuals which summer here can be found.

July. Only summering immatures are found here during the first half of July. During the third week, the earliest adults (still in nuptial plumage) return from their breeding grounds. They are in small groups easily overlooked, but I have seen them once (1943) as early as July 15 and several times almost as early. Their numbers are gradually augmented during the remainder of the month, but I have never found as many as 100 in a flock until early August.

August. The complete postnuptial molt of the adult, all stages of which are observable here, takes place in August. After the first few days of the month, Bonaparte's Gulls are abundant on the Niagara River, particularly off Bird Island from the International Bridge up to a point opposite the northern portion of the Buffalo sewage disposal property. The immense flocks which often congregate in that area afford an ideal opportunity for estimating relative numbers of the different plumages accurately. Individual adults exhibiting signs of molt about the head[1] may be seen as early as August 5, and by August 15 the molt is usually at its height. The date for the height of the molt is somewhat variable (earliest, August 13, 1930; latest, August 20, 1940). The flocks are composed predominantly of adults, with immatures (second-year birds and juveniles) averaging perhaps 10 per cent. Sometimes in early August one encounters flocks of a thousand or more gulls, all adults; but the large mid-August flocks may contain as high as 15 per cent second-year birds and a few (maximum 5 per cent) juveniles. The second-year birds have a later and slower molt than the adults. In the course of this molt they assume adult plumage

[1] The molt starts on the forehead and chin and works back, but proceeds most rapidly over the crown.

for the first time. We therefore find that during August all of the adults and many of the second-year birds are changing to an identical plumage. For this reason the decreasing proportion of birds in immature plumage during the latter half of the month does not indicate that the second-year birds are leaving for the south. By the month's end only one or two gulls in the black-headed plumage can be found among a flock of two thousand birds, although two or three per cent still show a slight trace of the hood. Birds in immature plumage (mainly second-year birds) now compose only six or seven per cent of the total, though still present in numbers sufficient to impress the observer with the fact that their molt, as a group, is much more prolonged than that of the adults.

September. After the first of September, adults in the black-headed plumage are very rare, my latest date being September 3 (1940). By that time about two per cent of the gulls still exhibit signs of incomplete molt, and about five per cent are in immature plumage. This five per cent diminishes gradually throughout the month as the molt proceeds. During September Bonaparte's Gulls are more locally concentrated than at other seasons of the year. They feed almost exclusively off Bird Island and in a number of favored haunts along the Canadian shores of Lake Erie and the upper Niagara River. Usually hundreds or even thousands may be found in each of these areas, whereas on many trips to Dunkirk, Erie (Pennsylvania), and Niagara Falls during September I have seen not a single individual, or only one or two very small groups. I have found several hundred birds present at the Falls and at Dunkirk in September, but only rarely. A considerable number of the gulls leave late in the month.

October. Bonaparte's Gulls are less common throughout October than they are in either the preceding or the succeeding months. It is actually unusual to find any at Niagara Falls, and even at Bird Island their numbers are much reduced. In 1933 there were never more than three or four individuals off Bird Island during the entire month. Admittedly 1933 was abnormal, but even during an average October the flocks of Bonaparte's Gulls encountered on the upper Niagara River, from Buffalo to the Falls, are comparatively small. They are composed mainly of adults, but a few birds in immature plumage can usually be noted. Since a bird of the previous year that has not yet molted, and a bird of the year that has assumed the first winter plumage, are practically identical in appearance, it is difficult in the fall to recognize and classify the immatures. I believe, however, that any bird of the previous year has assumed adult plumage by the first of October. This seems reasonable, for whereas their molt is more extended than that of the adult, it may be expected to be complete one month after the adults have all molted. Acting on this assumption, I conclude that the few immatures which are present after October 1 are birds of the year. Their numbers are very small.

November. The second phase of the fall migration occurs in November, the date of its maximum intensity varying with the weather. In general it takes the form of a southward drift which gradually augments the population already present. I have found flocks of a thousand or more in some years as early as November 10, any period of subnormal temperature during the month seeming to bring a few hundred more individuals southward. This November movement is, however, subject to considerable variation from year to year, and some years there appears to be no concentration at any time during the month. An example was the year 1933. In fourteen days of observing during November of that year, the largest number seen was 150, found off Bird Island on November 13. On November 10 and 17, however, I saw only two individuals there; on five trips down the river to Niagara Falls I saw Bonaparte's Gulls only twice, and ten was the maximum observed. November is the best time to look for birds of the year. As stated above, a very few usually appear in August, but if there is any concentration of them at all, it occurs during the first half of November. Even at this season their numbers are not large. Such a flock as I saw November 3, 1941, containing 150 gulls, of which 125 were birds of the year, is very unusual. That particular flock grew to a total of 800 birds by November 10 and 11, and then contained 160 birds of the year, the largest number I ever saw in the fall. The young birds do not tarry long. After November 20 it is difficult to find more than one or two in even the largest flocks, which are now over 99 per cent adults. When we consider that many thousands of Bonaparte's Gulls use the Niagara River as part of their migration route in the fall, the scarcity of juveniles is striking. I estimate that more than 15,000 adults and second-year birds pass through here each fall, yet I seriously doubt that juveniles have ever been represented by as many as three per cent of that number in any one of the more than twenty years during which I have studied them. An interesting conclusion emerges: the juveniles migrate southward over a different route.

December. This is the month of the third phase of the fall migration, which begins with the advent of severe cold weather. Usually the first cold snap occurs between the first and tenth of December, and brings the gulls to the Niagara frontier in flocks of several thousand birds. If the cold spell is of short duration, many of the gulls linger for a time, and considerable numbers are here at Christmas, or even later. If the period of cold is prolonged, however, the gulls continue southward. In 1940, near zero temperature was recorded on December 1, and on December 2 and 3 there were 2,000 gulls off Bird Island. On December 4 the extreme cold showed no sign of abating, and had covered the canal behind Bird Island with ice. On that day not a Bonaparte's Gull was to be found on the upper river. As the cold continued, I observed 100 gulls at Niagara Falls on December 5, and on the following day, 80 were off Bird Island. This number was increased

to 200 by December 10, but even though higher temperatures prevailed, the flocks thereafter were small and scattered. It is always both interesting and instructive to study the effect of December weather on the gull population, but just as a thirty-day period of weather never duplicates itself, so the size of the gull population is variable from year to year. The December flocks are normally composed entirely of adults, but an occasional immature may be noted.

January. Usually Bonaparte's Gulls are entirely absent during most or all of January. Often a few linger into the early days of the month; less frequently large numbers are still present (for example, a flock of 1,600 was observed January 1, 1931, at Bridgeburg, Ontario). Generally it is difficult or impossible to locate any Bonaparte's Gulls here after the first week of January. In 1931, I found 30 along the Canadian shore of the river on January 22, and in 1932 and 1937, they were here throughout the month, 200 being counted January 31, 1937, on a trip along the Canadian shore of Lake Erie as far as Port Colborne. Normally these January flocks are composed entirely of adult birds. In the exceptionally mild winter of 1932, however, there were not only large flocks present (1000, for example, on January 22 at Dunkirk), but each flock contained several immature birds.

February. In only two years have I seen Bonaparte's Gulls here in the month of February: in 1937, when I observed a few on February 1 and 2; and in the mild winter of 1932, when groups of from 60 to 350 were present at various points from Dunkirk to Niagara Falls, not only through February, but also throughout March until the spring migrants arrived.

Notes on Plumage

Bonaparte's Gulls reach maturity more quickly than the Herring (*Larus argentatus*) and Ring-billed (*L. delawarensis*) Gulls,[2] which are also abundant here. Furthermore, there is less variation in plumage between individuals of the same age group. Certain differences can be noted, however.

1. First nuptial plumage. Dwight stated (1901:57) that in the first prenuptial molt "the deep plumbeous hood is partly, and probably in many birds fully acquired," and later (1925:308): "an imperfect cap of dull grayish black is assumed, sometimes more advanced." This suggests that these gulls in their first nuptial plumage always exhibit at least a partial hood. But in the field, where an observer can examine over a period of years thousands of young gulls in spring, I believe that the individual with even a partial hood will be found to be exceptional. Immatures displaying the full hood are rare—I have seen only two. Regarding the time of molt, Dwight stated that the first prenuptial molt takes place "during March and April on the Atlantic

[2] Herring Gulls have a four-year plumage cycle, Ring-billed Gulls a three-year cycle, Bonaparte's Gulls a two-year cycle (Dwight, 1920:268).

coast" (1901:57), "late winter" (1920:266), and "April and May" (1925:308). As stated above, I have seen no signs of molting in immatures until May.

2. Winter plumage. After the postnuptial molt, band-headed individuals are rather common. In these birds the usual winter dress is modified by a band of gray extending up over the top of the head from eye to eye, usually accompanied by a similar streak joining the dark ear patches. The intensity of these bands varies greatly, from faint gray to a gray so dark that it appears black, but even when faint, the posterior band is quite noticeable when the bird is facing away from the observer. On November 10, 1941, I observed a bird of the year with both bands present, though rather faint, and with the entire back of the neck brownish-gray. This latter is a vestige of the juvenal plumage. Band-headed individuals may be found among both adults and immatures in their winter plumage. When seen in early April it might be mistakenly supposed to be an indication of the incidence of the prenuptial molt, but I have observed this plumage not only through early winter, but also on March 4, 1932 (in both adults and immatures).

Summary

A study was made of the group movements, dates of molting, and variant plumages of Bonaparte's Gulls on the Niagara River and eastern Lake Erie from the spring of 1921 to 1943.

The adults arrive in late March and early April, leave during May, return in late July and August, and depart in September, October, and November.

The young of the previous year arrive in May, drift northward in late May and early June, and probably compose a large portion of the great November and December flocks.

Juveniles are surprisingly rare in fall, and it seems necessary to conclude that they follow a different route southward.

Dates of prenuptial and postnuptial molts are given.

The band-headed plumage of adults and immatures is described.

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THE PRESENT STATUS OF THE AMERICAN EIDER ON THE MAINE COAST*

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THE long, irregular coast line of Maine, with its numerous bays, coves, and harbors, is dotted with islands. There are more than 400 that range in size from 1,100 to 16,000 acres (H. E. Dunnack, 1920:39); more than 1,300 smaller islands that support a substantial growth of trees and vegetation; and so many islets and ledges that no one has ever attempted to count them. Numbers of sea birds have taken advantage of the excellent nesting sites and the isolation provided by many of the islands, especially those that lie well out to sea.

Figure 1. A group of adult American Eiders: five males (two in nuptial plumage), and four females. Kent Island, New Brunswick, June 17, 1932.

In recent years sea birds have greatly increased in numbers along the Maine coast. Some, like the Double-crested Cormorant (*Phalacrocorax auritus auritus*) and the Great Black-backed Gull (*Larus marinus*), have also greatly extended their ranges, and the Herring Gull (*Larus argentatus smithsonianus*), which, at the turn of the century, was threatened with extermination as a breeding bird on the Maine coast, has increased with protection to such an extent that the U. S. Fish and Wildlife Service has been forced to undertake measures of

* Contribution Number 10, Bowdoin-Kent Island Scientific Station, Kent Island, Bay of Fundy, New Brunswick, Canada.

control. The Black-backed Gull is becoming so abundant and is so destructive to the eggs and young of other sea birds, especially to those of the Eider, that similar control may prove advisable.

This paper will deal primarily with the American Eider (*Somateria mollissima dresseri*), which, like the Herring Gull, was at a very low ebb of its existence on our coast 40 years ago, when William Dutcher (1904:147) wrote: "The American Eider . . . . is yearly becoming more rare owing to the fact that almost every set of eggs that is laid is at once taken by some fisherman." Dutcher (p. 152) also quotes Arthur H. Norton: "Though this bird [the Eider], within the memory of the present generation . . . . bred from the western side of Penobscot Bay . . . . east to Machias Bay, it is now reduced to the small number breeding in Jericho Bay and a colony on Old Man Island." A year later Norton wrote of the Eider: "Maine is the only state in the Union in which it breeds, and while twenty-five years ago it occupied no less than fifteen of our islands and ledges to breed upon, it has been gradually reduced to the very verge of disappearance as a breeding bird"; and in 1907: "There are probably no Eiders breeding on the coast of Maine, except those at Old Man's Island" (Norton, 1905:78; 1907:325).

The year 1907 marks the low point for this species along the Maine coast. When Old Man Island was leased to the National Association of Audubon Societies (now the National Audubon Society), and Fred E. Small appointed warden in 1907, Small reported that there were only "two Eider Ducks breeding" on the island (Bowdish, 1909:124). But through the foresight of the National Audubon Society, the Eider was able to re-establish itself. By 1910 there was a substantial increase in the number of Eiders breeding on Old Man Island. From there they spread southwestward, and by 1911 Swain (1911:58) found a dozen nests on islands near Isle Au Haut, and in 1915 A. H. Norton (1915:501) reported that Eiders were again breeding on the islands in Jericho Bay.

Norton and Allen (1931:591) in their thorough inspection of the sea bird colonies on the Maine coast from June 23 to July 14, 1931, reported counting 165 adults, 25 broods, and 27 nests. In an unpublished report submitted to the National Audubon Society, they list Old Man Island, White Ledge, West Penobscot Egg Rock, Mouse Island, Robinson's Rock, and Calderwood Island as Eider nesting localities (see also Berolzheimer, 1932:21). Thus the Eiders slowly increased their numbers and regained much of their former nesting area in the course of 25 years.

During the past three years (1941–1943) I have visited the more important sea bird colonies as a Collaborator serving with the U. S. Fish and Wildlife Service,[1] and have supplemented these trips with

[1] I wish to thank the officials of the Fish and Wildlife Service for the opportunity offered to record the increase and present distribution of the Eider and other sea birds.

independent visits to other islands. The chief objective of the Fish and Wildlife Service representatives was to visit the larger Herring Gull colonies for the control of that species; hence visits to Eider Duck colonies were incidental. However, the records are sufficient to indicate the present trend of the population and the fact that the Eider is again firmly established as a breeding bird on the coast of Maine. Each year the trips were taken during the last two weeks of May and the first three weeks of June and extended from the Isles of Shoals, near the Maine-New Hampshire state boundary to the most northeastern sections of the Maine coast. I have found Eider nests on 31 islands, and I saw adult Eiders in the vicinity of 14 others, where they were probably nesting but where the duties of the gull control project did not permit time to land.

The nesting range has now extended as far southwestward as Mark Island in Casco Bay, and a summering pair has been recorded as far south as Massachusetts (Walsh, 1933:93). The large flocks of Eiders, some of them containing two or three hundred individuals, seen all the way from the mouth of the Kennebeck River to the Bay of Fundy, are

Figure 2. Female American Eider on nest. Kent Island, New Brunswick. June 24, 1932.

another indication of the increasing abundance of this splendid sea duck. The present population of nesting Eiders on the Maine coast probably exceeds 2,000 pairs, as contrasted with the two birds known to be breeding there in 1907.

The comeback of the Eider is apparently due to several factors: first, the protection and educational program initiated by the National Audubon Society; second, the law prohibiting spring shooting; and third, the recent pronounced decrease in egg collecting. The third, a development due to the war, is perhaps the most important. The armed services and various war industries have taken many of the persons who, in spite of the laws prohibiting it, frequently visited the islands to gather Eider eggs, which are highly prized as food (Knight, 1895:388).

The increase in Eiders is not peculiar to the coast of Maine but has been noted in other sections of the breeding range, for example, on the islands in the Bay of Fundy, New Brunswick—notably on Kent Island, the site of the Bowdoin Scientific Station. Brownson (1908:75) reported that there were only about a dozen pairs of Eider Ducks breeding at Three Islands (a group of which Kent Island is a member). With protection the colony on Kent Island had increased to 300 pairs by 1937 (Gross, 1938). By the summer of 1943, the Eiders had invaded every part of the two-mile island, and according to the warden, Ernest Joy, there are now a thousand pairs nesting there. This island presents a splendid example of what may be accomplished by establishing guarded reservations. From this Eider metropolis the Eiders have invaded many of the islands of the Grand Manan archipelago.

Space does not permit giving an account of each of the 31 Maine islands where Eiders were found nesting, but 9 of them have been selected because of their larger population, because of their geographical location, or because they represent typical conditions and trends of the present day Eider population. A complete list of the 31 islands is given at the end of this paper.

Most of the islands inhabited by the Eiders are very small, some of them only a few acres in area. Most of them are occupied by other sea birds, such as gulls, cormorants and guillemots. None is inhabited by man.

Old Man Island. 44° 37.2′ N., 67° 14.2′ W.

Old Man Island, the most northeastern of our sea bird colonies, is located three miles southwest of Cutler, and overlooks Grand Manan Channel to the east. It is a high rugged island, about 12 acres in area, with precipitous rocky shores. It is divided into several parts by deep straight-walled chasms. The top is covered with a reddish-brown peaty soil which 20 years ago supported a large number of spruce trees. Today most of these are dead; some are still standing, but the majority have been blown down by the storms of recent years and form a tangled network of stumps, fallen trunks and broken limbs. In the open spaces

there are luxuriant growths of grass, weeds, vines, wild parsnips, and other plants, which provide concealed nesting sites for the Eiders.

In 1907, as previously stated, there were but two Eiders nesting on the island, which were the only nesting birds of this species known on the coast of Maine at that time. Early in June, 1913, Frank A. Brown (1913:217) found a nest with one egg. On July 24 and 25, 1931, Allen and Norton (MS) found four nests with three to four eggs each. When we visited the island on June 6, 1943, we counted 83 adults

Figure 3. Nest of American Eider. Grass Ledge, Maine. June 8, 1941.

swimming around the island. In the course of the gull-control work nine nests were discovered: one with three eggs; four with four eggs each; three with five eggs each; and one empty. All of these nests were located among the grass and weeds of the open spaces, and I have no doubt a greater number were hidden in the tangle of fallen spruces. Judging from the number of adults seen, there are probably 25 pairs breeding there today. The Eiders are now well established on the island in spite of the fact that it also has a large nesting population of Cormorants and Herring Gulls and eight pairs of Black-backed Gulls.

In going along the coast from Old Man Island to the southwestward we saw flock after flock of Eiders, many of them comprising more than

50, and a few more than 200, individuals. We also found the birds nesting on six islands between Old Man Island and Penobscot Bay. A systematic search would probably reveal many more nesting Eiders along this stretch of coast line, which is dotted with hundreds of islands.

Grass Ledge. 44° 13.1′ N., 68° 51′ W.

A most significant fact concerning the present status of the Eider Duck is the large number which are again breeding on the numerous islands of the Penobscot Bay region. I have visited 23 islands in the bay (Matinicus, Vinal Haven, Castine and Rockland quadrangles) which are now occupied by nesting Eiders. Of these, Grass Ledge has the largest number of nesting birds. It is located in upper Penobscot Bay about 2½ miles north of North Haven and midway between Compass and Scrag islands. It should not be confused with another Grass Ledge (also inhabited by Eiders) lying 3 miles to the southeastward, in the same quadrangle. The Grass Ledge under consideration is two islets separated, except at very low tides, by a narrow channel. It has the rocky shore line characteristic of all of the islands of this region. The central portion of the northern and larger member is comparatively level and is thickly covered with grass, weeds, and other herbaceous plants. There are no trees or shrubs, and there is little to commend it as a nesting place; yet in recent years its few acres have provided a breeding ground for one of the largest colonies of Eiders on the Maine coast. There are more nests per acre here than in any of the numerous colonies I have visited in the Maritime Provinces or on the Labrador coast.

Allen and Norton (MS) made no mention of Eiders nesting on Grass Ledge when they visited this region in 1931, and I have discovered no published record of Eiders nesting there in recent times prior to my visit in 1933. I was informed by fishermen, however, that the birds were breeding there in 1932. When I arrived June 7, 1933, there was already a well-established colony of 94 nests, of which 72 contained one to six eggs and one contained four young. Young had left 14 nests, and in 7 nests the eggs had been broken and the contents eaten—probably by the Black-backed Gulls which were also nesting on the island. From one point on the island I counted 80 female and 12 male Eiders in nuptial plumage. There were also 13 females with broods comprising a total of 55 young, ranging from downy young just out of the nest to others about a week or 10 days old.

When he visited the island in July, 1936, Bryan W. Barker (1941: 65) found that all of the young had hatched—only traces of down remained to indicate the nests; on May 30, 1941, he found 45 nests with one to eight eggs each. When I visited the island on June 8 of the same year I found a total of 89 nests, of which 62 contained one to eight eggs each. Young had left 19 nests, and in 8 nests the eggs were broken and the contents eaten.

I saw 63 adults, 56 females and 7 males, swimming near the island. There were also 3 females, with 12 young in their combined broods. We found two dead adult Eiders, but there was nothing to indicate the cause of their death. A pair of Herring Gulls and two pairs of Black-backed Gulls were nesting on the island, and as we approached we noted four Crows (*Corvus brachyrhynchos*) that may have been responsible in part for the broken eggs found in eight of the nests. The gull nests were destroyed by Mr. White, the Federal warden, to discourage these birds from nesting on the island.

On June 10, 1942, we arrived at a time when the eggs in seven nests had just hatched or were in process of hatching. There were 86 nests with one to seven eggs each, and 27 empty nests. We found six dead adult Eiders with their flesh eaten away, possibly by a mink. As in previous years, a pair of Black-backed Gulls were nesting on the island. The Federal warden destroyed the nest and killed the three young that it contained.

On June 3, 1943, just a week earlier in the season than our visit of the previous year, we found 123 nests: 115 contained one to six eggs each; one nest was empty; young had left one nest; and in six nests the eggs had been punctured and partially eaten—probably by gulls, since we saw neither Crows nor Ravens on this island during our 1942 and 1943 visits. In spite of the efforts of previous years to discourage the Black-backed Gulls from nesting on Grass Ledge there were two of their nests, containing three young each. The warden took more drastic action this year, and not only destroyed their nests and young but also shot three of the adults because there is little room for competition on this little islet already over-crowded with nesting Eiders.

The ten-year history of the Eider colony on Grass Ledge shows a very slow but steady increase from 94 nests in 1933 to 123 nests in 1943. Undoubtedly many of the Eiders reared on Grass Ledge have served to stock some of the neighboring islands.

Compass Island. 44° 12.9′ N., 68° 52′ W.

Compass Island is also in upper Penobscot Bay, less than a mile southwest of Grass Ledge. It has an area of about 20 acres, and the eastern part is covered with a number of large spruces, oaks, birches, and other hardwood trees which provide nesting sites for two pairs of Ravens (*Corvus corax*) and a pair of Ospreys (*Pandion haliaetus*). Bordering the growth of large trees is a thick tangle of shrubs and briar thickets. About three fourths of the area of the island is covered with grass, which supports a flock of about 20 sheep and provides nesting sites for 800 Herring Gulls and 18 pairs of Black-backed Gulls. The Eiders nest in the thicker, taller grass and briar patches, and among the shrubbery and spruces.

The first record I have of Eiders nesting on Compass Island is June 8, 1941, when we found five nests containing two to five eggs each.

Swimming near the shore were 3 females with a total of 11 young that appeared to be about 10 days old.

The next year, on June 10, 1942, there were two nests with four eggs each and two nests with five eggs each; young had left three nests, and the eggs had been punctured or broken in four nests—probably by the Ravens and Black-backed Gulls. We found two gull nests which contained Eider eggs. One contained three gull eggs and one Eider egg, and the other, two gull eggs and two Eider eggs. The eggs in the two gull nests were being incubated by Eider females. The occurrence of Eider eggs in gull nests is not rare and may be expected on any island where the two species are nesting in proximity. Often it is the Eider that takes possession of the nest and incubates the eggs, though on Kent Island, New Brunswick, there were cases in which the gull retained possession of the nest after the Eider eggs were deposited (Gross, 1938: 390; see also Barker, 1938:137). In addition to the nests, we noted two broods of young in the water off the island.

On June 3, 1943, we found a greater population of Eiders, but unfortunately there was even a larger percentage of nests in which the eggs had been wholly or partially eaten. There were also the bones of three adult Eiders.

In 1943 we found 40 nests: 13 contained two to five eggs each, and one contained four young; young had left three nests, and in 22 nests the eggs were punctured or broken. There was one Herring Gull nest with two Eider eggs and two Gull eggs. Eiders have increased greatly on this island during the past three years. However, the destruction of the eggs in so many nests does not make one feel optimistic for the future of the Compass Island colony. On no other island we visited on the Maine coast was there such a wholesale destruction of Eider eggs.

Downfall Island. 44° 10.9′ N., 68° 48.5′ W.

Downfall is a small island lying east of the northern part of North Haven. In this vicinity Sheep, Dagger, Burnt, Oak, Grass Ledge, Spoon, and Sloop islands also have their quotas of nesting Eiders. Most of these islands had a few nesting Eiders when I first visited the region in the years 1933 and 1934. All of them have maintained, and some have greatly increased their numbers of nesting birds, especially during the past three years.

Downfall, though smaller than the others, has been selected as a good example of an average-sized Eider colony, and the increase in its Eider population during the past three years is typical of the recent trend on the majority of the Eider islands. It is without trees or shrubs, but there are numerous patches of tall grass, luxuriant weeds, and umbelliferous plants. In addition to the Eiders there are a colony of about 200 Herring Gulls, 5 pairs of Black-backed Gulls, and an Osprey, which nests each year on one of the protruding headlands. The results of the

nest counts made during the first part of June of each of the past three years are presented in the following table.

NESTS OF THE EIDER DUCK ON DOWNFALL ISLAND

	1941 June 8	1942 June 10	1943 June 3
Nests with eggs (1 to 7*)	7	23	37
Nests with young	1	3	1
Empty nests	1	-	1
Nests with eggs destroyed	-	-	5
Gull nests with Eider eggs	-	-	2
Total	9	26	46

* One nest found in 1942 contained the exceptionally large number of nine eggs, probably laid by two females.

As the Eiders increased in numbers their nesting sites approached more closely those of the gulls, and in 1943 this resulted in five nests being destroyed by the gulls. In the same year two gull nests were found to contain Eider eggs.

Barred and Colt Head Islands, 44° 16′ N., 68° 50′ W.

Barred Island and nearby Colt Head Island are north of the Penobscot Bay Islands previously mentioned. They are situated about four miles east of Dark Harbor, South Islesboro Island (which separates East and West Penobscot Bays). There are two parts to Barred Island; on the western and larger section there is a thick growth of spruce, but the greater part of its area is grown up in a tangled mass of gooseberry, raspberry, and rose bushes and briars interspersed with small areas of rank weeks and grass. These conditions provide excellent, well-protected nesting sites for the Eiders. When we visited Barred Island for the first time, on June 8, 1941, we saw 25 Eiders swimming offshore, and on the island we found two nests with five eggs each. One of the nests was located in the briars, and the other was concealed under the lower spreading branches of a large spruce tree.

On June 9, 1942, we located nine nests: three with three eggs each; two with four eggs each, and four with five eggs each. On June 3, 1943, as we approached the island, we saw 50 Eiders, one third of them males. In the thick growth of briars we found 13 nests, all of them in good condition. One of the nests contained three eggs; five had four eggs each; five had five eggs each; one had six eggs and one had seven eggs. The type of nesting cover gives excellent protection from enemies such as Ravens, Crows, and Black-backed Gulls, all of which nest on or near the island. The nests are so well concealed that all we found were located only by flushing the incubating females as we walked through the tangle of briars. Because of the large number of adults seen in the vicinity, it is probable that a systematic search of Barred Island would reveal double the number of nests we found.

On nearby Colt Head Island we found one nest in 1941, 7 nests with eggs in 1942, and 13 nests (with two to five eggs each) in 1943.

Fisherman's Island. 44° 2.4′ N., 69° 2.4′ W.

Fisherman's Island is located on the western side of Penobscot Bay about 3½ miles south of Owl's Head Light, which marks the entrance to Rockland Harbor, and 3 miles east of Ash Point. It is a rather high island with knolls well covered with grass, and the lower depressions grown up with patches of weeds and red raspberry vines. There are no trees or shrubs.

There were no Eiders nesting on Fisherman's Island when I visited it in 1935. Our first record of nesting Eiders was made on June 8, 1941, when we found one nest containing four eggs, and one nest with one egg and four freshly hatched young.

On June 1, 1943, we found seven nests: one with two eggs; one with three eggs; one with four eggs; and four with five eggs each. There were 28 adult Eiders, including 13 males, swimming along the eastern shore; and on the opposite side, one male and five females. Some of the nests were in rather open situations, and it is remarkable that, though there is a large colony of Herring Gulls and 25 pairs of Black-backed Gulls on the island, not a nest had been disturbed.

This is another illustration of how the habits of a species such as the Black-backed Gull may vary among the individuals of different island populations. There is also a prosperous colony of 265 pairs of Double-crested Cormorants nesting on the rocky outcroppings of the higher portion of the island.

No Man's Land. 43° 53′ N., 68° 52.2′ W.

No Man's Land Island is a member of the Matinicus group off Penobscot Bay. It is a fairly large island with many bold outcroppings of rock. Fallen spruce trees produce conditions somewhat resembling those on Old Man Island. In the lower levels between the rocks there are thick growths of grass and weeds.

On June 14, 1941, four adult Eiders were seen in the vicinity of the island, but no nests were discovered that year. On June 8, 1942, there were four nests: two with four eggs, and two with five eggs, each.

On June 11, 1943, we found 15 nests. Twelve contained three to five eggs each; one nest had five freshly hatched young and one egg; and there were two gull nests with Eider eggs. One gull nest contained an Eider egg and a gull egg, the other two Eider eggs and one gull egg. We saw 12 adults, including 4 males, swimming near shore.

Mark Island. 43° 42.4′ N., 69° 54′ W.

During the past three years, especially during 1943, many flocks of Eiders were seen among the islands along the coast southwest of Penobscot Bay. There were indications that they were nesting in the

Breeding Localities of the Eider Duck on the Maine Coast, 1941–1943*

QUADRANGLE	ISLAND	LOCATION
Cutler		
	Old Man Island	44° 37.2′ N., 67° 14.2′ W.
Machias		
	Double Shot Island	44° 36.5′ N., 67° 16′ W.
	Green Island	44° 33.8′ N., 67° 26.8′ W.
Columbia Falls		
	Ballast Island	44° 33.7′ N., 67° 33.2′ W.
Deer Isle		
	Shabby Island	44° 10′ N., 68° 33.5′ W.
	Great Spoon Island	44° 2.5′ N., 68° 33.5′ W.
	Little Spoon Island	44° 2.5′ N., 68° 34.4′ W.
Castine		
	Green Ledge	44° 17.5′ N., 68° 49.7′ W.
	Barred Island	44° 16′ N., 68° 50′ W.
	Colt Head Island	44° 15.6′ N., 68° 50.5′ W.
Vinal Haven		
	Horse Head Island	44° 15′ N., 68° 51′ W.
	Grass Ledge	44° 13.1′ N., 68° 51′ W.
	Compass Island	44° 12.9′ N., 68° 52′ W.
	Sloop Island	44° 12.4′ N., 68° 48.9′ W.
	Spoon Ledge	44° 12.1′ N., 68° 49.6′ W.
	Mouse Island	44° 12′ N., 68° 56.5′ W.
	Grass Ledge	44° 11.8′ N., 68° 47.8′ W.
	Oak Island	44° 11.8′ N., 68° 49.2′ W.
	Burnt Island	44° 11.3′ N., 68° 49′ W.
	Goose Island	44° 11.1′ N., 68° 57′ W.
	East Goose Rock	44° 11′ N., 68° 58.7′ W.
	Dagger Island	44° 11′ N., 68° 48.3′ W.
	Downfall Island	44° 10.9′ N., 68° 48.5′ W.
	Sheep Island	44° 10.8′ N., 68° 47.8′ W.
	Robinson's Rock	44° 9.6′ N., 68° 58.6′ W.
	Widow's Island	44° 7.8′ N., 68° 49.9′ W.
	Otter Island	44° 0.5′ N., 68° 48′ W.
Matinicus		
	No Man's Land Island	43° 53′ N., 68° 52.2′ W.
Rockland		
	Fisherman's Island	44° 2.4′ N., 69° 2.4′ W.
	Otter Island	44° 1.4′ N., 69° 4.2′ W.
Small Point		
	Mark Island	43° 42.4′ N., 69° 54′ W.

* Arranged in order, beginning with the most northeasterly and proceeding southwestward, according to the quadrangles or sheets of the U. S. Geological Survey. The nine islands discussed in the text are in boldface.

region (in particular on some of the islands of Tenant's Harbor and Muscongus Bay), though we found no nesting Eiders on the islands we visited. The probability that the Eiders have now extended their nesting range to this region was greatly strengthened by the finding of an Eider's nest on Mark Island even further to the westward, in Casco Bay.

Mark Island is one of the outer islands in the eastern part of the bay. The interior of the island is heavily timbered with spruces and hardwoods—chiefly beeches and maples. There is a colony of about a hundred pairs of Black-crowned Night Herons (*Nycticorax nycticorax*

hoactli), and a considerable number of nests of the Great Blue Heron (*Ardea herodias herodias*). About 200 Herring Gulls nest on the rim of the island between the timber and the rocky shores.

I was unable to go to Mark Island in 1943, but Jay Gashwiler of the U. S. Fish and Wildlife Service and his assistant, Allen Morgan, found an Eider's nest with four eggs when they visited the island on June 14, 1943. The nest was located on the southwestern quarter of the island about 75 feet from the water. It was well concealed in some shrubbery at the edge of the timber, and there were no gulls nesting near it. No other Eiders were seen on Mark Island nor were any others seen in Casco Bay.

This nest constitutes not only the first record of the Eider nesting on Mark Island but, as far as I have been able to determine, also the most southwestern record of nesting Eiders on the Atlantic coast.

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A STUDY OF THE CARDINAL IN TENNESSEE [1]

BY AMELIA R. LASKEY

DURING the years 1931 to 1943 I made a study of the Cardinal (*Richmondena cardinalis*) in the Nashville, Tennessee area, banding a total of 1,621 birds, and gathering data on habits through the year, nesting, seasonal movements, weights, longevity, and abnormalities. A number of individuals were color-banded, and detailed observations made on two distinctively banded pairs.

Song

The first songs of immature Cardinals are very soft warblings, totally unlike adult song: these "indefinite" warblings are called "ancestral," "primitive," or "tribal" by various authorities (Nice, 1943:42). I have records for four young Cardinals singing in August, two wild birds and two hand-raised, free-flying females. One of the latter began warbling at three weeks of age, the other at four weeks. One of the wild birds (probably a female) appeared to be about a month old; the other, a male nearly two months old, used some adult phrases in his lengthy warbling performance. "Reddie," one of the hand-raised females, added two adult songs to her warbling in early October, when she was slightly over two months old (Laskey, 1937:68). By late January and February her songs were indistinguishable from those of adults.

Jesse M. Shaver gave me the following notes on the song of the adult: "Cardinals have a great many songs, at least 16 common ones. There is a good deal of difference in the singing of individual male Cardinals. There are times when the female seems to sing more softly than the male [See Ganier, 1941:1], but this is not always or even usually the case. I think it would be wise to say that there is no more difference between the song of the male and the female than between different males. The female begins her song much later in spring than is the case with the male. After nesting begins, her song is quite different from that of the male and is often uttered on the nest. Always the male comes to her after the song and often feeds her. The female also sings when she wishes copulation to take place. The male responds to this song by appearing and copulating with her. At other times the female sings and the male sings in answer but the male does not appear."

In 1942, from June 28 through most of July, I kept a record of songs and variations heard from Cardinals about my home and in Warner Parks, using phonetic syllables to designate each song as it sounded to me. There were 28 different songs of two to six syllables each.

[1] To Mrs. Margaret M. Nice and to J. Van Tyne, I wish to express appreciation for their suggestions and editing during the preparation of this material.

The songs of the two sexes seem to me to be alike, but the male's singing season is longer than that of the female. In Tennessee, his clear ringing whistles are heard in January and February, sometimes when snow is still on the ground, whereas female song usually starts in March, when Cardinal song is heard on all sides. "Reddie" sang in December and January, but she spent much of her time indoors during the cold weather, which apparently advanced her singing period to some extent. Shaver and Roberts (1933:118) mention a female that sang in mid-February while she was being courted. There is considerable singing during July and August, when the bird is so well concealed in the foliage that sex identification is difficult. But in most cases where identification was certain, the singers were males. In August, 1943, a female sang a few songs as she perched in a tree near her nest, which at that time contained two young, eight days old. Although I have records of Cardinal song for every month of the year in Tennessee, there are very few for November and December—in some years I heard no Cardinal singing at all during these months. In Oklahoma, Nice (1927:103) found the Cardinal's season of full song began in early February and extended to late July.

Adult birds may sing an almost inaudible song ("whisper" singing) during the months of courtship and mating, January to April. This type of song is mentioned by Shaver and Roberts (1933:118) as part of courtship behavior in January and in April. In February (Laskey, 1935:1), as a mated pair investigated nest sites outside our windows, I heard very soft songs, described in my notes as "woit-woit," "de-ar," and "almost inaudible trills." Nice (1927:101) heard the whisper song in September.

There is considerable antiphonal singing between a pair during courtship as well as during nesting. At my home a male sang from a tree, and the female answered, as she incubated or brooded in the nest 150 feet away. Apparently the songs were signals between the pair, for her songs often preceded a flight from the nest to meet the male 15 or more feet away, where he fed her.

During April, May, June, and July, I have heard Cardinal songs in the night (Laskey, 1935:2). They have never been lengthy, like the night performance of the Mockingbird, but merely a few repetitions of "tu-er" or similar sounds heard in the daytime repertory. Because Cardinals like to roost about the house or garage, usually on service wires under eaves, in porches, or in foundation shrub plantings, it is particularly easy to hear these short songs on many successive nights.

Shaver and Roberts (1933:118) described song and courtship of a pair of Cardinals (involving the female cited above), which sang against each other from mid-February until nesting time, the male repeating songs after the female, changing usually as she did, often singing in unison with her. This the authors consider part of courtship, with "protective value for the territory in warning other Cardinals that it was

occupied." They describe the type of behavior common in March and April, when singing in both sexes is accompanied by swaying of the body with neck elongated and crest raised. Another courtship ceremony is sometimes followed by coition. "The male . . . with his crest, neck and body extended and singing very rapidly . . . may step sideways down the limb to the female. During this time he appears fairly to slide down. Arriving at the female, he may put some food into her mouth" (p. 119). Song was a "queer gurgling attempt" as the male flew after the female following one such ceremony. When coition followed, the female then sang a "weird" song as she walked sideways down a limb and away from the male (April 24). This pair had a nest soon afterward and the first egg was laid May 2.

Territory and Dominance

Courtship pursuits begin soon after the reappearance of full song early in the year. On mild sunny days of late February, there is considerable evidence of the beginning of territorial activity. Males sing from rather high perches in trees about a hundred yards apart. There are many pursuits at low elevations when males pursue males, and females fly after females. Sometimes three males fly in single file, but usually only two individuals of a sex are involved in these rather leisurely flights.

The groups and loose flocks, formed during fall and winter, disband gradually as males choose territory and obtain mates. (Generally these groups have been fairly even in sex ratio, but occasionally the proportion of males is somewhat greater; in December, 1943, the flock at my home had an unusually large proportion of males, 10 to 2; February 1, there were 6 of each sex in the flock.) Occasionally a mixed group may still be found feeding together in mid-March, but by late March, most of them are settled on territories with only occasional intrusions by unmated individuals.

Cardinals do not defend territory so pugnaciously as Mockingbirds, for example, do, but there is some mild fighting in spring. A mated male will fly at an intruder of his own sex; a mated female will chase another female, but each is usually tolerant of the opposite sex, never becoming an ally of its mate against the intruder. At my home, in the spring of 1935, an unmated male frequently trespassed on the territory of the "Old Pair" (mated since 1933) to court the female, but the mated male always drove him back to his own side of the lot. In April of another season, a female arrived and began singing as she perched about 20 feet up in a tree near our house. Immediately a mated pair flew to the tree, and that female flew at the singer, causing her to stop singing and leave, with the mated female in pursuit. In March and April, 1937, a female several times drove another from the vicinity of her nest while the male showed no animosity (Laskey, 1937:68). I have observed Mockingbirds

and Bluebirds in this same type of territorial defense. Brooks (Christy, 1942:185), however, reports a female Cardinal who during the breeding season was "often intolerant" of the presence of a male at the feeding shelf.

"Shadow-boxing" is occasionally practised by Cardinals of both sexes. An individual will fight its own reflection in a window pane for long periods on many successive days while the mate perches quietly in a nearby tree. W. R. Reed (1938:17) reports a female in east Tennessee flying at its reflection during January; she was sometimes accompanied by a male "which behaved as a bystander." In Nashville, a male spent much time in March dashing at his own image in a window while the female watched. Harry Yeatman (1936:22), of Columbia, Tennessee, reports a male that in winter drove all Cardinals from his territory and spent many hours in the day fighting his reflection in the upper windows of the house.

Cardinals, in Tennessee, are only mildly belligerent, and one seldom sees a fight involving them. Towhees, in my experience, fight oftener among themselves over food in winter, and Chipping Sparrows fight more desperately over territory in spring, than Cardinals do. However, in October, 1943, I saw two male Cardinals fly at each other, striking beaks as they came together three or four times. Again in December, a male ran at other males, striking one with his beak.

In my feeding program, food is widely scattered on the ground, hence the behavior would not exactly parallel that on a feeding shelf, where the food is concentrated in a small space. At her feeding shelf in Oklahoma, Mrs. Nice (1927:102; letter) found some of the males much more despotic than those which came to her shelf in Ohio. In all cases, the winter males dominated the females, but in Ohio she found the despotism mild. She tells me that "females in Ohio showed more animosity towards each other in connection with the feeding shelf than did males toward each other or toward the females. . . . In Oklahoma all males drove Harris Sparrows; some males drove all smaller birds. All gave way before Mockingbirds and a Robin." In winter, I find some Cardinals of both sexes drive off House Sparrows but usually ignore smaller birds (See also Maurice Brooks, quoted by Christy, 1942:185). They are sometimes dominated by Towhees, by Mockingbirds, and by Blue Jays.

The female of a pair tends to follow her mate after the breeding season and through the winter, but in autumn, males become mildly dominant when feeding, keeping the females in the background by running at them. The male of the Old Pair might run at his mate of three seasons if she came too close during November and December, and she remained a yard or so behind him as they fed on the lawn (See also Maurice Brooks, quoted by Christy, 1942:185). He was not seen feeding her until March, but in January and February, he permitted her to feed within a few inches of him.

Feeding of the female by the male, a common occurrence in March and April, is sometimes observed in January and February (Ganier, 1941:1), but usually starts in March. In 1936, Ganier's (1937:15) Cardinal, then 13 years of age, started feeding his mate in February. The female assumes the begging posture, quivering both wings like a juvenile bird. In the section on the nesting of "Y" and "B" in this paper, more details are given on the begging of a color-banded female. Feeding of the female gradually ceases as the young need attention and the male is occupied with them.

Nests and Nesting

Cardinals usually begin laying in April. A. F. Ganier (1941:2) states that his earliest record around Nashville is a completed set of 3 eggs on April 3, but I have five records of eggs laid in March, four of them from 1938, when a period of spring weather occurred unusually early. In 1935, three eggs were being incubated April 1; in 1938, a set of three was being incubated March 28 and three broods of two, one, and two, were banded on April 16, 18, 19, respectively, when they were at least five days old—indicating that egg laying started in March.

The nesting season may extend into August and September. I have 13 records of young still in the nest during those months. In addition, I have trapped from late September to December 14 a number of unbanded immatures whose beaks were still dark, an indication that they were August or September nestlings, since the beak assumes the red color of the adult in 65 to 80 days (though a dark tip about a millimeter in width is sometimes retained in the upper mandible for several months). On October 6, 1941, a young Cardinal three to four weeks old was still being fed in Centennial Park by the mother.

Since 1932 I have found a total of 103 Cardinal nests in the Nashville area. As nest sites, Cardinals choose young evergreens of many varieties; privet hedges; many species of vines, including rose and honeysuckle; shrubbery; and saplings of hackberry, elm, hawthorn, and locust. I have found them from 2½ to 12 feet from the ground, but 4 to 5 feet is the usual height. Shaver and Roberts (1930:167) report one 8 inches, and two 15 feet, from the ground. Most nests are concealed in forks of twigs and small branches or in mats of vine stems, but one at my home was built upon a platform of twigs which I had placed in a privet shrub where the pair had tried to anchor material in unsuitable forks. Another was built on the ledge of a lattice fence between poultry wire with nothing for concealment. Alfred Clebsch (1943:38) found one in Clarksville, Tennessee, in a rustic building behind some lattice work. Among 103 nests studied by Shaver and Roberts (1930: 160), two atypical sites were found which lacked the usual foliage concealment; one was placed on the north side of a house, and the other against the trunk of a honey locust tree on the branching thorns below the limbs. They cite one photographed by Harry Vaughn, of Nashville,

in April, 1921, which was placed on a dirt shelf among tree roots in a gully. E. Copeland (1936:83) describes a Cardinal nest built in a feeding shelf outside a second-story window.

Nests are composed most commonly of weed stems, small pliable twigs, strips of bark, grasses, vines, and rootlets, with leaves and paper interwoven. They are bowl-shaped, some compactly built and well-lined, others very flimsy with scarcely any lining.

I observed the building of three nests from the start; one was begun April 6, 1931, completed April 10, first egg laid April 16; one started April 1, 1934, was completed April 4, first egg laid April 9; another, started April 7, 1937, was completed by April 16 (perhaps earlier), and contained its first egg on April 22. The male assisted in building one nest; the females built the other two without help. Sometimes the male attends his mate as she flies back and forth with material. Ganier (1941:1) states the male sometimes brings material which the female takes from him. Sutton (1941:274) states that "Crousty" built her first nest in late June, 1937, when she was less than 11 months old. She built it by herself while the male sang and fed her. "The nest was a good one, neat, compact, well lined." She had been hand raised and released in the spring at Ithaca, New York, where she and her mate, a wild bird, were the only two Cardinals in the countryside. Shaver and Roberts (1930:163) also state nest building is usually by the female with the male sometimes accompanying her or singing in a nearby tree, but they observed two nests where the male assisted in building.

Shaver and Roberts (p. 157) report that a pair may build five nests in a season, though usually not more than four broods are reared successfully. In 1934, at my home, the Old Pair started nest building on April 1, and that season had four nests, three of which were successful; six young were raised. In 1935, the same female again had four nests, with three successful. The first brood of two left the nest April 22; the second nest was robbed. About that time, the male of the pair, now mated for three seasons, disappeared, and the female mated with the green-banded male ("G") that had occupied the other half of the lot, had courted her in spring, and had been chased back by her mate. She remained in her old territory where she and "G" had one nestling leave on June 11 and two on July 30. Her nesting routine had not been affected by the loss of her old mate and the acquisition of a new one in mid-season, for she raised that season five young from three successful nests in four attempts. A sixth nestling was killed by a Blue Jay the day its nest mate was fledged. (Laskey, 1935:62.)

The number of eggs in a set is commonly three, but in Oklahoma, Mrs. Nice (1931:173) found that among 36 nests with at least three eggs, 28 per cent had more than the usual complement: nine had four eggs, and one had five. Ganier (1941:2) states that around Nashville about one in 30 nests has four eggs and that late in the season a full complement may be two eggs. Christy (1942:182), in Pennsylvania,

in four nests studied, found one with four eggs. Excluding nests found with less than three eggs or young, which may or may not have been complete sets, I have records for 35 nests during the years 1937 to 1943. Of these, three had four eggs each (8.5 per cent).

In 1943 a set of three was completed April 16; incubating had started with the set still intact at 8:15 A.M. on the following day, but at 5 P.M. one pierced egg was found on the ground about four and a half feet away. A pair of Cowbirds had been lurking in a tree above the nest, but none of their eggs appeared in the nest, and no further depredations occurred there. In Johnson City, Tennessee, Robert B. Lyle (Woodring, 1932:38) found the first Cowbird eggs he had recorded from that area in April, 1932, in a nest of the Cardinal which contained three of its own and two eggs of the Cowbird. H. C.Monk (1936:33), when compiling a list of species parasitized by Cowbirds in the Nashville area over a period of 19 years, stated: "Local students have examined thousands of Cardinal nests with only one Cowbird record, indicating how very rarely this species is parasitised." This scarcity of records might be taken as evidence that the Cowbird is a rare breeder in Tennessee, as reported by Ganier (1933:39), but I have records for 1938 to 1942 of nine Cardinal nests with one Cowbird egg in each. In 1942, among 16 nests of this species, four in April and one in June were parasitized and contained less than the usual complement of Cardinal eggs. Previously I had found Cowbird eggs in two sets of three eggs and in one set of four eggs.

In one nest which I observed, the Cowbird egg hatched a day ahead of the single Cardinal egg, but both nestlings were taken by a predator. In another nest, the two Cardinal eggs and the Cowbird egg hatched on the same day. The Cardinals left at 9 days, but the Cowbird remained in the nest until 11 days old.

Incubation of eggs and brooding of young is by the female exclusively. In August, 1941, after I had removed two nestlings from a nest eight feet up in a privet hedge, the female hopped into the empty nest and sat in it, as if brooding, during the entire time the nestlings were being banded nearby. She was not deterred by the presence of the ladder or of the people.

I found incubation periods of 12 and 13 days, computed from the date of laying of the last egg, when incubation starts. Mrs. Nice (1931: 173) reports 12 days for nests in Oklahoma. The young may leave the nest at 7 to 11 days of age, but usually at 9 to 10 days.

During incubation, the male feeds the female, usually when she is off the nest. He brings food to the nest for nestlings and often assumes full charge of the fledglings when the female begins a new nest. He feeds the young until the next brood is hatched; then he repulses the older birds by flying at them with scolding notes. The last brood of the season is often divided between the pair for attention.

Although a large part of the food of adult Cardinals consists of

seeds and wild fruits, the nestlings are fed exclusively on insects. A hand raised Cardinal began to pick up food after 13 days out of the nest; another began after 20 days, at that time readily eating a corn-ear worm, first crushing the head, and passing it back and forth in its mouth a few times, before swallowing it head first. Cracking sunflower seeds was not successfully accomplished by "Reddie" until she was nine weeks old.

One hand-raised Cardinal dropped a pellet in the cage when brought indoors overnight at five to six weeks of age. The pellet was 15 mm. long, 8 mm. at its widest and tapering to a point, consisting of husks and seeds of millet. Among my hand-raised fledglings of other species, pellets were dropped by the Crow, Orchard Oriole, Mockingbird, and Bluebird.

Cardinals are not particularly fond of bathing, but "Reddie" (Laskey, 1937:68) bathed indoors occasionally; and on March 1, she took a prolonged bath, getting her plumage very wet, in a tiny gutter outdoors, with temperature around freezing and a light snow falling. One year in January, I observed Cardinals and Juncos bathing in small puddles formed by the melting snow. Christy (1942:177, note) states Cardinals are seldom seen at the bird bath; Mrs. Nice (1942: 187) says she has seen females bathe fairly often but knows of only one record for a male.

Nest of Y and B

In April, 1937, considerable data were accumulated from a nest of a resident color-banded pair built in the privet shrub by the house. The female, "Y," was banded in January, 1936, and was last trapped in June, 1939. Her mate, "B," was banded April 5, 1936, and was last seen in August, 1937. The nest was built six feet up, almost opposite a breakfast room window and under a high kitchen window.

Nest building started April 7; all material was brought in and placed by the female. Her mate followed her closely but was not seen assisting. The nest was complete by April 16 or earlier. That day the female was found in the nest at 7 A.M. (C.S.T.) but did not lay the first egg until April 22; the set of 3 was completed April 24, when incubation started. Fearing she might desert, I made no lengthy observations during incubation, but some notes were taken from spasmodic watching, as follows: April 26, "Female sings frequently, rather loudly, while incubating. Male sings from a distance of 150 feet. Songs alternate as if in answer." April 28, "Loud singing by female several times today, apparently to attract the male, for he answers. Her calls came shortly before she went off the nest. Male always met her at some distance from the nest. At several observations, she came back to nest, looked into it, left for short periods of a minute or so before settling." May 23, 6:25 A.M., "Male came to the nest with a moth. From perch on a twig

beside the nest, he passed it to the female, who left nest with it, flying to driveway curb 15 feet away to eat it. Male remained, hopping on twigs, looking into the nest while making soft clucking sounds. Female returned in five minutes, 'chipping.' She settled on eggs briefly, left, and returned immediately to incubate. Loud songs were given by her at 6:40, 6:45, 6:50 A.M. She flew off for 5 minutes at 7:15. She sang again at 7:35 A.M. The various Cardinal songs were used." May 4 (drizzling rain), 8:04 A.M., "Male called 'Woit, woit' several times. Female answered with same calls but fewer in number. Performance repeated.—8:16, Female off for 3 minutes, returning with 'chips,' leaving again before settling.—9:25 A.M., Off. Met male on driveway. Back in 2 minutes, looked at nest, flew off. Repeated, 'chipping' entire time. Settled at 9:35."

On May 7, the first nestling was hatched by 6:30 A.M. and the other two by 8 A.M. (13 days incubation). Young were seen raising heads within a half hour after hatching. Twice the female was noted eating egg shells; she turned and crushed the halves in her beak before swallowing. Apparently none was carried away. Observations were made during the nine days of nest care in periods irregular in length, and at varying hours of the day; yet they give a picture of the progressive phases of nest life. The first morning, the female alone fed the young, although during her short periods away from the nest the male may have given her food elsewhere. That afternoon he brought food to the nest, which he fed to the young in the absence of the female, but when she was at the nest she tended to monopolize this part of the care and begged the food from the male. Twice he passed it to her for feeding, but later in the day he ignored her begging and fed the young himself. On the second day (May 8) during mid-day observations, he brought food five times, and offered it to the young, but it apparently was unsuitable; some of it he ate himself and some the female swallowed. On May 10 (young three days old) both parents were kept so busy feeding that their visits alternated, each feeding in turn. May 11 the female was again seen begging the food from her mate. He gave it to her once but the other times ignored her. After that day no begging by the female was seen.

To feed the nestlings, the female perched on the nest rim, but the male was never seen on the nest. He always fed the nestlings from twigs adjacent to the nest. During the first days each parent announced its coming with the typical Cardinal "chip," but from the afternoon of May 11, when the nestlings were four days old, the parents were usually silent; the young had then become alert and were ready for the food at the arrival of a parent. On May 14, when the young were seven days old, their chattering food call was first heard. Each time a parent arrived in the shrub, the young stretched high in the nest and chattered. On May 15 they preened their breast- and wing-feathers. The entire body quivered in their eagerness for food from the parent.

At 7 A.M., May 16 (at nine days old), one was perching in the nest shrub, and by 8:30, the other two had joined it. During that day the parents spent much time in a nearby silver maple, where, from the low-sweeping branches, they obviously coaxed the young, trying to lure them away from the nest site. There were many trips from tree to shrub and back to tree, punctuated with "chips." Only a relatively few of these trips included feedings. At one time the female faced the young from the tree, singing "tu-er" repeatedly, changing to "de-ar bird," and back to "tu-er" again. Finally by 4:30 P.M. all three young had left the nest shrub; they were unable to fly, but they made their way across the front of the house, some 60 feet, to the privet shrub at the other side, where they spent the night. On June 10, the male was feeding three apparently full-sized immatures at the rear of the house; June 15 they were seen following him but not fed. June 19 and 25, one of the brood, a male, was taken in a banding trap near the house.

The nesting activities of the pair were not followed the rest of the season, but on July 23, the male was feeding a large immature of their final brood of the season. August 5, these adults were not far apart, the father feeding a dark-billed female and the mother followed by the immature male. Both these young had been caught in banding traps before this date, proving that they were already foraging to some extent for themselves. August 15, the adult male was busily repulsing two begging young by running at them, flipping his wings, and giving the short "pfitt, pfitt" scolding notes as they followed him with fluttering wings and jingling begging chatter.

In 16½ hours of observation of three young from hatching to the day before nest-leaving, the female fed the young 56 times, the male 45. In 6¼ hours during the first two days, the young were fed 3.3 times an hour; in 5½ hours during the next two days, 8 times an hour; in 3 hours on the fifth day, only 3 times an hour (this low figure being correlated with showery weather and much brooding), while in 1⅔ hours during the last two days, they were fed 11 times an hour. During the observation periods, the female brooded about two-thirds of the time during the first two days, about one-third during the next two, two-thirds on the showery fifth day and none at all after that during the daytime. The female gave the young their last feeding on the second day at 6:30 P.M. (C.S.T.) and on the third day at 6:53 P.M.; on both these evenings she settled for the night immediately after the feeding. On the third day she fed the young at 6:53 and settled at 6:55. On the seventh day she settled at 7:50.

Harvey (1903:56) says the parents feed the young insects at first by "regurgitation." My observations furnish no evidence to that effect; the insect food brought was often very tiny, but it obviously was carried in the mouth or beak and rolled many times in the beak before being fed to the nestlings.

Both parents cleaned the nest, but the female displayed more concern by waiting and searching for fecal sacs. She swallowed some until the fifth day and the male ate some until the fourth day; after that all were carried off.

Individual Range of Cardinals

A total of 1,621 Cardinals were banded at my home and in Nashville, and at several sub-stations (operated with the help of friends) [2] between September, 1931, and August, 1943. The records from these 12 years of systematic banding indicate that the Cardinal is not only a permanent resident species in the Nashville, Tennessee area, but also that individuals range no more than a few miles during their lifetime.

Eighty-five individuals, or 5.24 per cent of the total number banded, have been caught or found dead from one to six years after the banding date. Most of these birds were found in the immediate neighborhood of the banding place, and none was found farther than four miles away.

There are numerous records of banded individuals that remained in the same area for several years. Among them are a color-banded pair which remained as resident mates at my home for nearly three years, and a color-banded male that lived there from September, 1937, until killed by an automobile near our driveway in May, 1943. A male banded at my Love Hill sub-station in October, 1934, was caught in the same neighborhood in March, 1940. (Unfortunately, the finder removed the band before releasing the bird, so that further knowledge of this old bird is unobtainable.) In addition, there is the well-known male banded by A. F. Ganier (1937:15) at his home in February, 1924, and seen there regularly until its disappearance in November, 1936.

The greater number of my Cardinals have been banded in autumn and winter. From September into March, groups or loose flocks of from 6 to 25 birds gather at good feeding places. It became apparent during the second year of my banding (1932) and has been noted many times since that, while the total number of individuals in a given flock may remain fairly constant, the flock is not always composed of the same individuals (Laskey, 1934:117; Ganier, 1941:4). Throughout the season unbanded birds continue to arrive, and some banded birds disappear, often returning at some later date or subsequent winter season. These returning Cardinals reappear at irregular intervals. Their movements do not coincide with the rhythmic appearance and disappearance which my banding records have revealed for the Field Sparrow (*Spizella pusilla*), another species which has been considered a permanent resident (Laskey, 1934:172).

Among Cardinals, one plausible explanation of the fall grouping and wandering of a large part of the local population, while certain individuals and pairs remain on their nesting grounds, is that these

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[2] Grateful acknowledgment is made to M. S. Carter, A. F. Ganier, Mrs. E. C. Hicks, A. A. McMurray, M. L. Rippy, Jr., Mrs. E. C. Tompkins, and others.

groups are composed mostly of young birds hatched during the year (though the flocks doubtless also include adult birds that have left their breeding territories for various reasons such as lack of food and shelter). It is difficult in autumn after the molt to distinguish young from adult birds, but I have a few banding records as evidence. Several years ago I was operating sub-station "Shadows" at the home of Mrs. E. C. Hicks, three-quarters of a mile southwest of my home, and found that flocks congregated there each autumn and winter. They were attracted by the supply of hackberries and sunflower seeds, their favorite winter foods, and particularly by a dense canebrake about a tiny creek. Among the banded birds taken there, were some that had been banded as juveniles at their birthplaces. In February, 1933, I caught a male that had been banded in May, 1932, in a nest half a mile east; a female that had been banded in September, 1932, in a nest about two and a half miles north; and one unbanded male whose spotty plumage and short tail feathers indicated he was probably one of a very late 1932 brood. A young male, banded at my home in August, 1933, and retrapped there in September, was trapped at Shadows in November. In late December, 1935, another young male was taken at Shadows that had been banded in the nest of the Old Pair at my home. He had left the nest June 11, 1935. He had remained in our garden until he was at least six weeks old, for he was taken in banding traps July 8, 11, 12, and 13. In January, 1940, another male was trapped at Shadows that had been banded the previous August in immature plumage at my home and retaken there in December, 1939 (and that was again taken there in January, 1944). Therefore the Shadows flock had harbored at least six individuals that are positively identified as young birds, four of which are known to have hatched from one to two and a half miles away. Another young Cardinal with beak still dark was banded at the home of a friend in September, 1935, and was retaken on December 14 at my Love Hill sub-station about a mile from its birthplace.

Among my records are four which give an idea of the short distance traveled between birthplace and breeding area. Male No. 38-210161, banded in the nest at Glendale sub-station May 16, 1938, was trapped at my home station, less than a mile west, on July 7, 1938, February 23, 1939, and July 5, 1939. Female No. 37-240877, banded in the nest at Peabody Campus August 4, 1937, was found injured August 14, 1941, within a half-mile of the campus. Female No. 40-258298, banded in the nest August 6, 1941, was found dead in September, 1942, a quarter of a mile away. Male No. 41-217453, banded in the nest May 7, 1942, was found dead August 13, 1943, three-quarters of a mile southwest.

Dead Cardinals would not be easily overlooked by the public, yet not one of the 1,621 individuals banded in this area since 1931 has been reported except from the neighborhood of my banding stations.

In my experience there is no other bird that attacks the band as the Cardinal does. I have had to replace several tempered aluminum bands

that had been over-lapped by pressure from the beak of the wearer. An extraordinary example of the antipathy of a male toward his band which continued, at least spasmodically, over a period of two years, is described by J. B. Young (1941:197), of Kentucky. Mrs. Nice in Ohio and J. Van Tyne in Michigan each have evidence of at least one banded Cardinal that had removed the band. Although I have notched rectrices of numbers of my banded Cardinals—which would identify the individuals between molting seasons—none has yet been retaken without the band.

Ages of Banded Cardinals

Many of my birds have been retaken between the ages of two and three years but, disregarding those, the record shows that of the 1,135 individuals that at this time (1943) could have had a life span of three or more years, 30 birds, or 2.6 per cent, have lived three to six years. Age 3 years: 7 males, 5 females; age 3½ years: 1 male, 3 females; age 4 years: 3 males, 4 females; age 4½ years: 1 male, 1 female; age 5½ years: 3 males; age 6 years: 2 males.

Scott Hutcheson (1943:40) of Memphis, Tennessee, reports a banded male that nested near his home from 1939 to 1943, when it was found dead, at least five years old. Karl E. Bartel (1942:14), of Blue Island, Illinois, who had banded 73 Cardinals between 1935 and the end of 1941, states (p. 12) that his oldest living Cardinal is at least six years of age. Josselyn Van Tyne (1943:195) records a male in Michigan banded December, 1934, and still alive in August, 1943, at least nine years old. S. P. Baldwin banded an adult male Cardinal March 28, 1921, at Thomasville, Georgia, and captured it there in several successive seasons until February, 1930, when it was at least 10 years old (Lincoln 1933:86). M. S. Mercur (1937:122) had a female Cardinal in her garden in Pittsburgh, Pennsylvania, from the winter of 1927 until August, 1936, when it was found dead, at least 10 years old. Describing the old bird at the time of death, she states it "was disfigured by two bulbous growths, each more than half an inch through, that sprang from the base of the beak on either side and encroached both upon the nostrils and upon the eyes."

In Nashville, Tennessee, A. F. Ganier (1937:15) banded a male Cardinal in February, 1924, that lived to be at least 13½ years old (it was last seen in November, 1936). Ganier says: "When feeding at his shelf he does not stand erect . . . as do the younger Cardinals. Instead, he crouches or even sits down while eating. His head is held resting on his shoulders so constantly that when the neck is occasionally straightened, the feathers do not fall to cover the gap and a bare section of the neck is exposed. Molting has become slow and tedious; at this writing [November 10, 1936], there is still a ragged appearance on the upper breast." The Cardinal at the Ganier home mated and reared

young at that advanced age, but the female described by Mercur was deserted by her mate and apparently did not acquire another during her last season.

Weights

From 95 weights of Cardinals taken by Baldwin and Kendeigh (1938:438) in Ohio, the monthly averages show maximum weights prevail from October through April. In the records of 183 adults I took in Tennessee, maximum weights occurred from October through February. The loss in weight is correlated with the breeding season, which in our milder climate starts earlier in the year. Among the Ohio birds, the greatest weight, 50.3 grams, was recorded in January for the single female weighed that month; the lowest occurred in August, when seven females averaged 37.9 grams. In Tennessee, highest weights were also found in January, when 37 males averaged 48.4 grams; the lowest were in April, when 5 females averaged 39.3 grams; the average weight of 85 males was 45.1 grams, which is 2.1 grams greater than the average weight of 98 females, 43 grams.

Abnormalities

I have found Cardinals, both nestlings and adults, and their nests singularly free from ecto-parasites. Nests and individuals of many other species in the area, including the Mockingbird, Brown Thrasher, Catbird, Bluebird, and Towhee, have been found heavily infested with mites, mallophaga, and ticks, but I have found only one Cardinal with mites, a male about six weeks old, trapped in August, 1940. Mrs. Nice tells me by letter of a fledgling trapped in Ohio, which was heavily infested with mallophaga. Ruth H. Thomas (1941:591), of Arkansas, reports trapping three Cardinals parasitized by ticks. Bayard H. Christy (1942: 182) found one nest in Pennsylvania which contained maggots and pupae of *Protocalliphora*.

My Cardinals were almost immune to the foot and tarsus diseases found frequently in other fringillids, particularly Towhees, and Field and Chipping Sparrows. Four Cardinals had small, wart-like growths on toes. These were either removed or treated with iodine or mercurochrome. Two of these Cardinals were retrapped later with no trace of the affliction visible; the growths of one of these had been removed, the other had been treated with iodine. Two individuals had suffered tarsal injuries; one had an injured heel joint, the other, a broken tarsus, healed in an abnormal position, so that it was crooked and lumpy. Several had damaged mandibles, four of which appeared to have been caused by biting hard materials. Cardinals use their beaks, in moments of stress, to grasp with a vise-like grip (Laskey, 1934:115). When one is removing them from a banding trap, they grip the wires of the cage, and any bander will testify to the need of care in handling this

species to avoid painful pinching of fingers. The birds clamp the strong beak over the fingers in a grip that is difficult to unlock. This seems to be a fear reaction rather than a fighting gesture, for a small article placed in the bird's beak is often retained and the bander's hand ignored. An immature male had a deformed upper mandible, abnormally pointed at the tip, with a dark, thickened area at the base. The lower mandible of one male was marred by an injured spot measuring 8 by 3 millimeters. A female had the lower mandible abnormally short and, in the center, dark colored as if decaying. Another male had lost a large portion of the upper mandible. Two birds were trapped with slightly injured eyes, cause unknown. In summer, a male, blinded in one eye, was seen feeding on the ground. A tuft of dislodged head plumage indicated a possible attack by a predator.

Abnormal feather loss in a male Cardinal at least eight years old has been described by Van Tyne (1943:195). This bird lost all feathers from head and neck in June, and remained bald all summer but lived normally. In September he grew a complete set of head feathers in 28 days, remaining fully feathered, at least during the following ten and a half months. Van Tyne mentions a bald specimen from Texas, several in Ohio, and two of mine. Inadvertently, incomplete data were sent to him on my records. Instead of two cases of baldness among the 1,621 Cardinals banded, there are seven. One female had the head completely bald during August molt, normal in December; a female was bald, except for the crest on July 10—she was not retaken. A young female was reported from a sub-station with head bare on October 22 but was apparently normal in December. A male, banded in October with new plumage about complete, was retaken the following May with feathers missing from the right side of the head. He seemed very wild and bit frantically at my fingers. On June 11, he was completely bald and was still in that condition when retrapped July 14. His next recapture occurred in January, when his plumage was normal, though his beak was damaged at the edges. In two cases, some data have been gathered that may account for the feather loss. One male, while in a banding trap on November 13, was attacked by a cat through the wires, and received a scalp injury. When the bird was re-trapped a few days later, the wound appeared to be healed, but the bird was bald. A female was brought to me in late March with an injured wing. A week later, having regained some flight power, she was released. She was attacked and chased by a mated female on whose territory she trespassed. Two days later, she was found in another section of our place, partly bald. Apparently when Cardinals lose their head feathers prematurely through accident, they are not replaced until the normal season for plumage renewal in autumn.

No Cardinal with even a trace of albinism has been found among my birds, but Harry Yeatman (1942:18), of Mt. Pleasant, Tennessee,

reports seeing a partial albino in the winter of 1940. J. B. Loefer (1941: 44) lists one all white, and for Tennessee an albino female with two albino young, "all white except for a coral tinge to the wings." Maurice Brooks (1934:1) describes a partially melanistic male whose head, including the throat and nape of the neck, was "shiny blue-black" with one abnormally elongated red feather in the crest.

Summary

The Cardinal was studied in the Nashville, Tennessee, area from 1931 to 1943, a total of 1,621 individuals being banded.

Young Cardinals begin to sing a distinctive warbling song at three or four weeks of age, and use phrases of adult song at least by the age of two months.

Cardinals have at least 28 different songs, but male and female song are indistinguishable.

Cardinal song may sometimes be heard the year round, but full song for the male usually extends from February to September, and for the female, from March until July or August.

Whisper singing, antiphonal singing, and night singing are all common with Cardinals.

Cardinals begin late in February to take up territory and choose mates.

Each sex defends territory against intruders of its own sex, but Cardinals as a rule show little belligerence.

The female of a pair tends to follow her mate throughout the winter.

Males are mildly dominant over the females during the winter months.

The male feeds the female during courtship and the first nesting.

Nesting, as a rule, begins in April, sometimes in March, and frequently extends into September.

The nest is usually built by the female alone; all incubation and brooding is by the female; the male assists in feeding the young and in nest sanitation, taking full charge of fledglings when the female proceeds with another nesting.

Four nestings in a season are not uncommon.

The usual clutch is three eggs; eggs hatch 12 or 13 days after the last egg is laid; young leave the nest from 7 to 11 days, usually 9 or 10 days, after hatching.

There is some parasitism by Cowbirds.

Banding records indicate that individuals remain in the same garden for breeding and wintering for several years, and an individual rarely if ever wanders farther than four miles from its birthplace.

The winter groups or flocks (of 6 to 25 individuals) are apparently composed chiefly of young of the year.

Of 1,135 Cardinals whose life span could have been three or more years, 30 (2.6 per cent) have reached the ages of three to six years, the

oldest female being 4½ years old; two males reached the ages of six years. A male and a female 10 years of age and a male 13½ years are cited from the literature.

Weights of Tennessee birds are compared with those of Ohio birds.

Only one Cardinal was found with ecto-parasites; a few were found with injured beaks, feet or eyes; seven cases of baldness were recorded; no albinism or melanism was found.

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Graybar Lane, Nashville 4, Tennessee

GENERAL NOTES

The Greater and Lesser Yellow-legs as fish eaters.—That small fish form a food item acceptable to the Greater Yellow-legs (*Totanus melanoleucus*), has long been known. Peabody (1839), Bartsch (1899), Clark (1905), Danforth (1925), Bent (1927), Trautman (1940), Cottam (1943), and others have furnished convincing evidence that this species not infrequently eats minnows and other small fish. Whether the Lesser Yellow-legs (*Totanus flavipes*) has a similar inclination has seemed much less certain.

Most shore birds and a surprising number of land and tree birds occasionally eat fish. Milton B. Trautman wrote (letter, Dec. 1, 1943), that the Gizzard Shad (*Dorosoma cepedianum*) constituted the principal source of food of the Greater Yellow-legs at Buckeye Lake, Ohio; on only one occasion, however, did he find a Lesser Yellow-legs feeding on fish; and, away from Buckeye Lake, he only once found the Greater Yellow-legs feeding on fish. It was a question, therefore, whether the fish-eating habit of this species was primarily a local characteristic.

To determine whether this habit is local, common, or seasonal, and to ascertain the relative importance of fish in the diet of these two interesting shore birds, we have studied the food-habits records of the Fish and Wildlife Service. We found that 703 stomachs of the Greater, and 771 stomachs of the Lesser, Yellow-legs had been analyzed in the Service's laboratory at Washington, D.C. (now at the Patuxent Research Refuge, Bowie, Maryland). Percentages were based upon the standard volumetric or bulk method as outlined by Cottam (1936).

Since a bulletin on the food habits of our shore birds is expected to be prepared after the war, only the fish food is considered here. As might be expected, the fish consumed were usually of the small, sluggish, shallow-water species that are of little or no direct concern to the angler or to the commercial fisherman. Our studies further revealed that fish were taken at all seasons of the year, but, probably because of difference in availability, the degree to which the fish entered into the birds' diet varied in different localities and sections of the country.

It was surprising to discover that 419 (59.6 per cent) of the 703 Greater Yellow-legs had made all or part of their last meal on fish; 204 (29 per cent) had made their entire meal on fish; and 86 (12.2 per cent) had consumed fish to the extent of 75 to 99 per cent of the meal. Fish constituted approximately 44.5 per cent of the average meal of the total 703 birds and 74.6 per cent of the average meal of the 419 birds that had eaten fish during their last meal.

Of the 771 Lesser Yellow-legs, 142 (18.4 per cent) had made at least a part of their last meal on fish; 25 (3.2 per cent) had nothing but fish in their stomachs; and 54 (7 per cent) had fed on fish to the extent of 75 to 99 per cent of the meal. Fish constituted 10.6 per cent of the average meal of the 771 Lesser Yellow-legs and 57.5 per cent of the average meal of the 142 birds that had fed on fish during their last meal.

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C. C. Sperry and Clarence Cottam, *U. S. Fish and Wildlife Service.*

Golden Plover and Lapland Longspurs in southern Indiana.—On November 11, 1943, I observed a Golden Plover (*Pluvialis dominica*) in a large upland field at Walesboro, Bartholomew County, Indiana. It was in the company of Horned Larks and several Killdeers. The Plover, which was in winter plumage, alighted within 15 yards of me before circling and disappearing in the distance, where I believe it was joined by another. The characteristic two-syllabled whistle of the species was uttered at least six times. On the Falls of the Ohio River at Louisville, Kentucky, Golden Plovers have been occasionally seen in fall from September 3 to September 20, with one record for October 1 (*Kentucky Warbler*, 15:42). The occurrence of this example in mid-November, well after the first light snowfall in the area, seems worthy of note.

I visited the same field on November 13 and saw a scattered flock of some 65 Lapland Longspurs (*Calcarius lapponicus*), which I observed for over an hour. Years of search have failed to reveal these birds in the vicinity of Louisville, Kentucky, only sixty miles to the south. The Longspurs were very active and noisy, and showed little fear, sometimes allowing me to approach to within 20 feet.—Robert M. Mengel, *Glenview, Kentucky.*

An Ohio specimen of the Purple Sandpiper.—On November 29, 1943, while Kenneth H. Doan and I were visiting Starve Island, near South Bass Island, Ottawa County, Ohio, I saw a small bird alight at the water's edge. About twenty minutes later I found the bird, a Purple Sandpiper (*Erolia maritima*), feeding among the *Cladophora*-covered rocks, which had been recently exposed by the falling water level. I collected the sandpiper after observing it for several minutes. Presumably the bird had been feeding about the *Cladophora* from the time I saw it alight.

Since the species is chiefly maritime, I carefully examined its stomach contents. The gizzard and proventriculus were filled, principally with the remains of small algae, which Dr. Clarence E. Taft identified as belonging to one or more species of the genus *Ulothrix*. There were wing and thorax fragments from very small beetles; 158 bits of gravel, 0.4 to 3.0 mm. in greatest diameter and totaling 0.4 grams; an otolith of a fish, 4.2 mm. in diameter; a portion of the right pharyngeal arch of a cyprinid fish; and a few small fish scales. No algae of the genus *Cladophora* were found, although the sandpiper had been feeding among them; apparently the bird could separate the minute *Ulothrix* from the *Cladophora* without consuming the latter. The otolith and pharyngeal arch were probably eaten as grit, since the sandpiper was too small to have swallowed whole a fish of the size indicated, and I know of no instance of a shorebird tearing a fish apart to eat it. The bird was a male, weighed 76.90 grams, and was very fat. The skin is in the Ohio State Museum.—Milton B. Trautman, *F. T. Stone Laboratory, Ohio State University, Put-in-Bay, Ohio.*

First Hudsonian Chickadee for Ohio.—Turtle Island is a dot of land in Lake Erie about two miles off North Cape at the southeastern corner of Michigan. It is less than 100 yards in diameter but lies half in Ohio and half in Michigan. When I visited the island on November 6, 1943, my attention was caught by a peculiar note, which I traced to a brownish chickadee in the higher branches of the elms at the northern edge of the island. I returned to my canoe for a gun, and meanwhile, the bird moved to a patch of weeds on the southern, the Ohio part, of the island. Collected, the specimen was sent to the University of Michigan Museum of Zoology, where J. Van Tyne confirmed its identification as the Hudsonian Chickadee, *Penthestes hudsonicus hudsonicus*. This is, I believe, the first record of the species for the state of Ohio and the first specimen record for Michigan south of the Straits of Mackinac.—Harold Mayfield, *3311 Parkwood Avenue, Toledo, Ohio.*

Notes on birds of the Upper Peninsula of Michigan.—The following incidental observations of birds were made while I was investigating the status of Pinnated and Sharp-tailed Grouse in the Upper Peninsula of Michigan, from July, 1940, to December, 1941 (Michigan Federal Aid to Wildlife Restoration Project No. 5 R, under the auspices of the Michigan Department of Conservation and the Federal Fish and Wildlife Service). Approximately half of the total daylight hours during this period were spent in the field. Only those notes that are thought to be a definite contribution to the knowledge of Michigan's avifauna are included. Statements on the status of the various species are based on Josselyn Van Tyne, Check List of the Birds of Michigan (*Univ. Mich. Mus. Zool. Occ. Paper No.* 379, 1938); Leonard Wing, Birds of the Upper Peninsula of Michigan (*Res. Studies of the State College of Wash.*, 7, No. 4, 1939); and on the files of the University of Michigan Museum of Zoology.

Mallard, *Anas platyrhynchos.* Records of Mallards wintering in the Upper Peninsula are uncommon. With Conservation Officer Allan Tweedy, I saw a flock of six Mallards along an open creek about five miles south of Rapid River, Delta County, on February 21, 1941. Several times earlier in the winter, Tweedy had seen what he presumed to be the same flock at the same place.

Long-eared Owl, *Asio wilsonianus.* There are few Upper Peninsula records for this species. I saw a specimen at Dollarville, Luce County, on August 11, 1940, that had been shot about a week earlier, and on the evening of July 22, 1941, I saw a live Long-eared Owl at Shingleton, Alger County.

Northern Cliff Swallow, *Petrochelidon albifrons albifrons.* This swallow is a very rare and local summer resident. On June 3, 1941, I found a small colony of Cliff Swallows on a farm in Luce County (Sec.12, T.45N., R.11W.). There were four new, nearly completed nests under the eaves of the farmhouse.

Hudsonian Chickadee, *Penthestes hudsonicus hudsonicus.* Although this chickadee is considered a common transient and winter visitant in the Upper Peninsula, I noted it on only two occasions. In a small flock of chickadees seen on July 8, 1941, northeast of C.C.C. Camp Cusino (Sec.17, T.47N., R.16W.), Schoolcraft County, I definitely identified one bird as a Hudsonian Chickadee. There were possibly two of the species in the flock, but the birds were so active that I could not be certain. Later, on July 26, I saw two Hudsonian Chickadees about three miles northeast of Shingleton, Alger County.

Catbird, *Dumetella carolinensis.* The Catbird is known to be less common in the Upper Peninsula than in Lower Michigan, but it seems noteworthy that I saw and heard only one of the species while I was afield. I saw this individual just east of Shingleton, Alger County, on June 29, 1941.

Blue-headed Vireo, *Vireo solitarius solitarius.* I know of only one published nest record of the Blue-headed Vireo for the Upper Peninsula (Van Tyne, *Univ. Mich. Mus. Zool. Occ. Paper No.* 379, 1938:31). On June 22, 1941, I flushed an adult Blue-headed Vireo from a nest at Au Train Lake, Alger County. The nest was on the end of a maple branch, about 15 feet from the ground. It contained one egg.

Northern Parula Warbler, *Compsothlypis americana pusilla.* The nest of the Parula Warbler has not yet been found in Michigan. I heard the characteristic Parula song repeatedly for over an hour at a spot along the edge of a heavy evergreen forest at Au Train Lake, Alger County, on June 22, 1941. I saw the singing bird from a distance of only ten feet and definitely identified it as a male Parula Warbler.

Cape May Warbler, *Dendroica tigrina.* Although Lincoln ("The Migration of American Birds," 1939:88) included northern Michigan in the breeding range of the Cape May Warbler, there seems to be no definite breeding record for the state. Braund and Aldrich (*Ool.*, 58, 1941:99,103) recorded a number of these warblers in Luce County in June, 1940. After careful observation, I identified a male Cape May Warbler in a swamp northeast of C.C.C. Camp Cusino (Sec.17, T.47N.,

R.16W.), Schoolcraft County, on July 8, 1941. The bird was in view for five or six minutes, but it flew nervously about among the crowns of the tall spruce trees, making it difficult to obtain a good view. Finally it flew down to within about 30 feet of me, and I noted most of the identifying features; just before it flew out of sight I saw the white wing patches characteristic of the Cape May Warbler. Throughout this time the bird held a caterpillar in its beak. Previously, on June 23, 1941, I had made a similar observation at the same place, but on that occasion the bird in question had remained near the tops of the tall spruce trees, and I could not identify it with complete certainty. It also held something in its bill.

Connecticut Warbler, *Oporornis agilis*. I heard and observed a Connecticut Warbler at close range in a wet poplar woods adjacent to a meadow three miles east of Shingleton, Alger County, on July 1, 1941. The bird sang repeatedly from the same perch and allowed me to approach to within about 30 feet. The white eye ring, comparatively large bill, the light mandible, and the other characteristic features of a male of this species were clearly discernible with the aid of 8-power binoculars.

Brewer's Blackbird, *Euphagus cyanocephalus cyanocephalus*. There is apparently but one specimen record for Michigan of the Brewer's Blackbird, a female collected by Leonard Wing, near Ironwood, Gogebic County, on July 26, 1932, and sight records are extremely rare. I saw a pair of Brewer's Blackbirds southeast of Crystal Falls (Sec.7, T.42N., R.31W.), Iron County, on May 1, 1941. The birds alighted about 25 feet from the car, and with the aid of 8-power binoculars, I clearly saw the light iris and purplish head of the male, and the dark iris of the female.

Hoary Redpoll, *Acanthis hornemanni exilipes*. On March 25, 1941, two miles west of Creighton, Schoolcraft County, I saw a flock of eight redpolls that appeared strikingly light-colored in comparison with most of the redpolls seen during that winter. One or two in this flock (probably adult males) were extremely light, and their breasts were suffused with a delicate pink. I collected two of the flock, and P. Brodkorb identified them as *exilipes*. Only two earlier Michigan records of this form have been confirmed by specimens.

Alaskan Crossbill, *Loxia curvirostra minor*. In the winter of 1940–41 Crossbills were abundant in the Upper Peninsula from early November to February. Twenty-one specimens which I collected were identified by J. Van Tyne as the Alaskan form, following Griscom's revision of the species (*Proc. Bost. Soc. Nat. Hist.*, 41: 77–210). Many of these specimens were found dead on Highway 28, between Shingleton and Seney, Schoolcraft County, where they had apparently been attracted by salt or calcium phosphate on the road and been hit by cars. Manville (*Wils. Bull.*, 53, 1941:240–241) found crossbills common the same winter in the Huron Mountains, Marquette County, and found some specimens in breeding condition. The testes of two males I collected on January 29, 1941, were enlarged, averaging in greatest diameter 2.7 and 5.2 millimeters. Two females were collected on the same day, one with several ova 0.5 millimeter in diameter, the other with the largest ova 1.0 millimeter in diameter.—George Andrew Ammann, *Camp Carson, Colorado.*

Circulatory congestion as a possible factor regulating incubation behavior —It is generally assumed that periodic hunger is the chief factor regulating attentive-inattentive incubation behavior in birds. But other physiological factors, especially restriction of circulation and related discomfort, may have more to do with determining the length of the attentive period than hunger as such. Recent experimental work (*Ann. Rev. Physiol.*, 3, 1941: 343) has emphasized the importance of the activity of the skeletal muscles in maintaining blood flow in the veins, where the pressure is usually very low. When the body is at rest the action of gravity, reduced arterial pressure, and absence of the kneading action of the skeletal muscles

all tend to produce restriction of circulation, which eventually results in considerable discomfort. Even in sleep, periodic movements occur reflexively, a result, at least in part, of stimuli from congested regions. Jackson (*Science*, 96, 1942: 564) has recently shown that in the sleeping human being an anticipatory increase in heart rate occurs before a general movement. Stimulation of receptors by local congestion, pressure, and increased skin temperature is interpreted as bringing about a reflex acceleration of the heart rate before the impulses are strong enough to bring about activity of skeletal muscles and a change in position. In recording the heart rate of incubating birds on their natural nests (Odum, *Ecol. Mon.*, 11, 1941: 318) a similar anticipatory acceleration in heart rate, occurring just before the bird left the nest, was often noted. Indeed, when a quickening of the heart (readily detected by ear) occurred without apparent cause, it was usually safe to predict that the bird would leave the nest within the next few seconds to begin an inattentive period. If circulatory congestion, together with local pressures and heating of ventral skin areas in contact with eggs or nest, is the cause of these anticipatory responses, then we have an indirect indication that the bird may end an attentive period on the nest as a result of the discomfort produced by sitting still. Since the smaller the animal the more rapid the heat loss and circulation rate, we would expect circulatory congestion to be felt more quickly in small birds than in large ones during periods of inactivity. Correspondingly, the length of the attentive period is generally shorter in the smaller species.

One might inquire at this point as to the condition at night. Even though the incubating bird remains continuously on the nest, it does not necessarily remain still. In making records with passerines at night, I was much impressed with the amount of muscular activity which often occurred (Odum, *Ecol. Mon.*, 11, 1941: 318). Sometimes the bird even left the eggs for short periods to move to the edge of the nest or to the front of the nesting box.

Since activity on the nest may serve the same purpose in relieving discomfort as leaving the nest, and since anticipatory cardiac acceleration by no means occurred in my records at the end of every attentive period, it cannot be concluded that circulatory congestion with related discomfort is the sole regulator of attentive-inattentive behavior. Also, psychic factors cannot be ruled out; perhaps cardiac acceleration results from cerebral stimulation, that is, occurs when the bird thinks about leaving the nest (granting that it does think at all). The physiological basis here, as in other forms of behavior, is probably complex, and regulatory factors may well vary at different times or in different species.—Eugene P. Odum, *Department of Zoology, University of Georgia, Athens, Georgia.*

An unusual song from a House Wren.—The note by Edward S. Thomas (*Wils. Bull.*, 55, 1943: 192–193) on a wren which sang the songs of both the Bewick's and the House Wren reminded me of an odd song which I heard near Lexington, Virginia, on May 18, 1943, from a wren which I definitely identified as a House Wren (*Troglodytes aëdon*). At first, when the bird was singing in thick underbrush, I thought that the song might be coming from either a Carolina Wren or a Kentucky Warbler, for it was like that type of Carolina Wren's song which so much resembles the song of the Kentucky Warbler. Later, when a glimpse showed me that the singer was a wren, I thought that it was an unusual song of the Carolina Wren, but as I followed the bird, it came out into the open and sang from a tree, showing itself unmistakably to be a House Wren.

Phonetic rendering of bird sounds is notoriously unsatisfactory, but this song sounded clearly to me like the syllables, "turple, turple, turple, teer teer," with a heavy accent on the first "teer." This the wren sang again and again. Later it sang several times another two-part song, the first part of which was like the song of the Carolina Wren, the second being the normal rippling notes of the House Wren.—J. J. Murray, *6 White Street, Lexington, Virginia.*

Juvenile Cardinal helping at a nest.—Skutch (*Auk,* 52, 1935: 257–258) and Nice (*Trans. Linn. Soc. N.Y.,* 6, 1943: 79–80) have reviewed species in which young birds have been observed to help their parents feed later broods. In addition, Lack (*Auk,* 57, 1940: 173) records this behavior in the European Swallow (*Hirundo rustica*), Waterhouse (quoted in *Auk,* 57:277) reports it probable in the Variegated Wren (presumably *Malurus lamberti*), and Skutch (*Auk,* 57: 306–307) adds the Central American House Wren (*Troglodytes musculus*). Nice (p. 79) also reports help with nest sanitation given by juveniles of the Eastern Bluebird (*Sialia s. sialis*). Neither of these activities seems to have been recorded in the Cardinal (*Richmondena cardinalis*).

At a nest of Cardinals that I found on August 3, 1943, and watched through August 8, the day before the young left, a grown juvenile—possibly 2½ months old and apparently a female—on the morning of August 8 made three feedings and once carried something away. On the other hand, occasionally during my 14 hours of observation this bird begged food from both adults, alighting near them and, sometimes craning forward, *tih-tih*-ing with quivering wings; once it was fed by the male, and twice the female tried to drive it off. The adults were both color-banded birds, the juvenile helper was unbanded; identifications were always positive.

The juvenile was fed on the evening of August 5. The adult male had just reached the nest tree with a billful of food when the young bird alighted beside him and began to beg. Instead of going on to the nest, the male turned and gave his food to the juvenile. Three times on August 8 while the adult female was similarly en route to the nest with food, and once while she was still at the nest after completing a feeding, the juvenile likewise alighted in the tree and begged. Twice the female paid no attention. Of the two attacks that she made, one was not visible in detail because of foliage; in the other, she twice flew at the juvenile with feet thrust out, although apparently she did not actually strike. Neither of the attacks drove the young bird from the tree; after the one described, in fact, it went to the nest while the female was still there, took what seemed to be a dropping from the depths of the cup, and flew away with it.

On August 8, I watched the nest from dawn until noon. The juvenile made its feedings of the nestlings at 8:03, 8:09 and 9:16 o'clock. Each time its unbanded legs were clearly visible, and its juvenile calls confirmed its identity. On the first and third occasions it arrived at the nest alone; no food was actually visible, but the bird was plainly seen to thrust its bill into the mouths of nestlings. On the other occasion, the juvenile and the banded female alighted in the nest tree together, with food visible in the bill of each. The female went to the nest. While she was still engaged at her feeding the juvenile moved to the nest-rim 90 degrees to her right and also tried to feed. Its offering, however, was too large to dispose of; after several vain attempts, it tendered the food to the female, which took part of it and fed it to a nestling; whether the helper then also made a feeding or whether it ate the rest of the food itself I could not see. Curiously, the juvenile now reverted to its customary begging: during the appreciable time that both remained at the nest it held its open bill toward the female, called, and quivered its wings.

On June 6 I had seen a very short-tailed juvenile, whose age I estimated at 15 days, accompanying the color-banded male of this August nest. It is therefore possible that the helper was that bird or another member of the same earlier brood, and if so its age on August 8 was about 78 days. I supposed the bird to be a female since it showed no bright red in its plumage.—Hervey Brackbill, *3201 Carlisle Avenue, Baltimore 16, Maryland.*

EDITORIAL

We are very glad to be able to continue this year the custom of publishing a colored frontispiece to the annual volume of the *Bulletin*. The Plumbeous Kite, the subject of our 1944 plate, has not, we believe, been portrayed in color by any other modern artist.

The Club's endowment income, which the Council has authorized using for such additions to the *Bulletin*, would not alone be adequate to provide such a plate, but fortunately, a devoted and enthusiastic member has generously contributed the balance needed.

The healthy condition of the Club's treasury, described on a following page, is a tribute to our many loyal members who have continued their steady support, or even raised their class of membership, and to the hard, unremitting work of our faithful Treasurer. With such strong support your editors can face optimistically even a new year that holds prospects of shortages of paper, ink, and manuscripts.

Ornithological News

After completing twenty-five years service with the Canadian government, Hoyes Lloyd has retired from his position as Superintendent of Wildlife Protection for the National Parks Bureau, and will devote his time to ornithology and natural history work.

The North American Wildlife Conference will be held at the La Salle Hotel in Chicago on April 24, 25, and 26.

The Arcadia Sanctuary, developed at Northampton, Massachusetts, by LeRoy S. Combs, has been given by Zechariah Chafee, Jr. and his family to the Massachusetts Audubon Society for permanent preservation.

The U. S. Fish and Wildlife Service has published a revised list (Wildlife Leaflet 179) of the 275 National Wildlife Refuges, with an indication of the principal bird and mammal species found in each. The Service encourages the use of these areas for bird study and photography. Permits may be secured by writing the refuge manager.

OBITUARY

H. F. Witherby, long the leader in the study of British birds, died December 11, 1943, at the age of seventy. He founded and edited through thirty-seven volumes the excellent journal, "British Birds"; organized bird banding in England; and originated, partly wrote, edited, and published the world's best bird manual, "The Handbook of British Birds."

Charles H. Townsend, director of the New York Aquarium from 1902 to 1937, died January 28, 1944, in his eighty-fifth year. He was naturalist on the "Albatross" from 1886 to 1896 and published important papers on the birds of various Pacific islands. In 1901 he was elected a Member of the American Ornithologists' Union.

ORNITHOLOGICAL LITERATURE

THE SONG OF THE WOOD PEWEE (*Myiochanes virens* Linnaeus): A STUDY OF BIRD MUSIC. By Wallace Craig. New York State Museum Bulletin No. 334. Albany, 1943: 186 pp., 1 pl., 19 figs.

In this paper, which really amounts to a book, we have fulfillment of the promise made by the author in his five-page preliminary report published in *The Auk* in April, 1933. It gives us the basis for his previous generalizations and elaborates and clarifies them in such a way as to furnish a very impressive presentation of an exceedingly interesting thesis, while to many it will come as a revelation of the possibilities of the intensive study of bird song. It contains much new matter, and it covers more than the Wood Pewee's song, for thirty of its pages are devoted to bird song in general, and especially to its musicology. As the subtitle states, this is a study of bird music, and throughout the book the Wood Pewee's song is treated as music, as esthetic art, but from the scientific point of view, for of course music is a science as well as an art.

The data for this study were furnished by 22 trained observers who supplied in all 144 records of the morning twilight song and 17 of the evening song. These records were made by taking down the phrases as the bird uttered them, using a number for each of the regular phrases of the song—*1* and *2* for the two familiar gliding phrases, and *3* for the rhythmic phrase, which occurs only in the twilight singing.

As a brief summary we can say that this species has two types of singing—the leisurely singing heard only in the daytime and used for the territorial song, and the rapid rhythmic singing heard chiefly in the morning twilight but also to some extent in the evening. In the daytime singing only the two gliding phrases are used, and there are long rests between. The twilight song is rapid as well as rhythmical and shows a tendency to a 50 per cent prevalence of phrase *3*. The phrases of this song usually appear in the form of musical "sentences," of which the commonest is *3132*, a "satisfying" musical composition resembling in pattern a stanza of "Home, Sweet Home" or, as Henry Oldys pointed out forty years ago, "Swanee River." Though the author uses the word "composition" in describing the twilight song, it is not to be understood that the individual singer is a composer in the musical sense. It is the species that does the composing, and the composition comes into being through the existence of certain underlying tendencies that are musical in character, especially "the tendency to sing more *3*'s, the rhythmical phrase, when singing fast, and the tendency to regular recurrence of the *1*'s, *2*'s, and *3*'s." Dr. Craig believes that the structure of the song "cannot be explained wholly by any theory of external utility, such as the theory of territorialism or that of sexual selection." Though stating that nothing in his paper is intended to contradict the mechanistic interpretation of animal behavior, he believes that the singing of birds is not entirely unconscious and unintelligent, that while the Wood Pewee is singing one phrase he anticipates the next, that birds give attention to sound and sometimes choose one sound in preference to another, thus making a beginning in musical taste. He believes that a study of the Wood Pewee's song helps in the study of the evolution of esthetics in general and that the esthetic is related to organic growth.

The twilight song of the Wood Pewee is so different from the ordinary daytime manner of singing that it lends itself particularly well to study, and yet it is by no means unique among birds, for not only do some of the other flycatchers, notably the Eastern Kingbird and the Crested Flycatcher, possess well differentiated twilight songs, but many other birds have developed special manners of singing which they keep for early morning (and sometimes also for evening), such as the Tree Swallow and the Chipping Sparrow, while still others, like the Hylocichlae, sing so much more steadily in twilight hours when all diurnal birds are stationary that we must regard the twilight singing as fulfilling quite a different purpose

from that of either courtship or territorial defense. This purpose Dr. Craig regards as the satisfaction of the esthetic sense of the singer, and I am inclined to agree with him. Some years ago I called attention to the rhythmic cawing of the Crow in groups of short caws—two, threes, and singles—which could not be regarded as purely mechanical but seemed to give evidence of the possession of an esthetic sense (*Auk*, 36, 1919: 112–113). If so unmusical a bird as the Crow can take pleasure in rhythm, surely birds with the gift of song can sing from pure enjoyment of the sounds they produce.

We have, then, three uses for bird song, not simply two as we have been used to suppose. In addition to its use for attracting a mate and its use for proclaiming the holding of territory, we have the non-utilitarian use of satisfying a psychological need of the singer, for many of us will believe with Craig that it is not taking an anthropomorphic view of bird psychology to grant birds a glimmering of esthetic taste. And even this use, I should think, may not be strictly non-utilitarian, since it probably keeps the singer going on an even keel by supplying a means of catharsis for the emotions involved in the strenuous business of bringing up a family. This is not to say that such singing is in itself emotional, which, as Craig says, it does not appear to be.

What I have so far said relates more to the ultimate conclusions of Craig's study than to the study itself, which is chiefly occupied with the extensive minute detail of the analysis of the records of the Wood Pewee's twilight song. There is much of great interest in this study that could not be indicated without unduly extending this review. Indeed, the reader is surprised at the number of interesting corollaries that the study has brought out. I will take up only a few points.

In considering the evolution of the Eastern Wood Pewee's song the author finds some evidence that it originally resembled that of the Western Wood Pewee (*Myiochanes richardsoni)*, which uses no phrase comparable with the No. 1 of *M. virens* but does have a slurred phrase resembling No. 2. He concludes that No. 2 is the older of the two common phrases phylogenetically and considers that that may account for the curious fact that it is the phrase with which it begins its song-day in the morning and ends it in the evening. He shows that the evening twilight song as a whole is a mirror image of the morning song.

There is also a very interesting discussion of the song day of the Wood Pewee, a discussion that would apply equally well to most of our song birds. The Pewee anticipates both daylight and nightfall by beginning his day before it is really light and ending it before it is really dark, just as migrating birds, by a physiological mechanism, anticipate the seasons. The song and other activities are governed by an internal mechanism. "Every animal and every plant is a chronometer."

In the discussion of bird song in general the author brings out some points that may be new to the reader. Among these is the importance of distance between breeding pairs in the development of song. The birds that have developed song to an important extent are those that breed at such a distance from others of their kind as to make song useful—neither so near as to make it unnecessary for communication nor so far as to make communication by sound impossible.

Imitation as a factor in bird song is discussed, and the author reviews the evidence for and against the theory that it plays a principal part. He finds the preponderance in favor of the theory that songs, as well as call-notes, are inherited, not acquired. As to the Wood Pewee, the observational evidence indicates that the song is uninfluenced by the singing of other birds of that or any other species. This applies both to the melody of each phrase and to the order of utterance. On the general subject, however, it is certain that the last word has not yet been written. Mrs. Nice in Part II of her "Studies in the Life History of the Song Sparrow" (1943) questions the complete validity of the conclusions reached by one of the authors whom Craig cites. Her own observations of the Song Sparrow led her to the conclusion that the main pattern of the song of that species is innate, that the quality is probably acquired by imitation, and that the particular songs

are more or less original with each individual. It would seem, therefore, that all three elements enter into the development of song—inheritance, imitation, and originality.

But in the space of this review it would be impossible to comment on everything the author has to say on the general subject of bird song. Some of the special topics treated illuminatingly are evolution of ability in singing, intelligent esthetic choice, contrast between birds and mammals, the material of bird music, the form of bird music, ranking of songbirds, the concept of bird song. Preceding the author's summary there is a section, "Problems for Future Study," in which good advice is given to young field observers.

This reviewer is not quite certain of some of the statements he finds in the paper. One of these is that on the correlation of the singing of the Wood Pewee's twilight song with the bird's respiration. On pages 54–55 we read: "Because of the continuity of the sound in the gliding phrases it seems necessary to assume that the entire phrase is sung with one expulsion of the breath. From this, and from other facts, we conclude, tentatively, that at the height of the rhythmic song the Pewee inhales and exhales only once for each phrase; his rate of singing is his rate of respiration.." Now, the fastest singing recorded averaged 32 phrases per minute, which I should think would be a very slow respiration rate for a Wood Pewee. According to Baldwin and Kendeigh in "Physiology of the Temperature of Birds" (1932) the Wood Pewee's average temperature was found to be 108°. They obtained no respiration rate for this species, but they found that the respiration rate of the Chipping Sparrow at a body temperature of 108° was 104 per minute, and the slowest rate they record at the same temperature is the Robin's of 74 per minute. There may be evidence with which I am not familiar that the Wood Pewee's respiration rate is considerably slower than that of other small birds, but Craig cites no authority for an assumption that such is the case.

I am not aware that the relation between respiration and song has ever been studied, and I suggest this as a subject for investigation by physiologists. How, for instance, can so small a bird as the Winter Wren pour forth for a period of eight seconds (A. A. Saunders in "A Guide to Bird Song") a continuous succession of warbles and trills without any apparent pause for breath? To return to the Wood Pewee, I find it impossible to account for the rate of singing on the supposition that it represents the normal rate of breathing, but an explanation of the facts is still to seek. Perhaps the time consumed by each gliding phrase is really considerably greater than the average time of all the phrases and the intermittent rests, and perhaps the bird takes several short breaths during each rest instead of only a single respiration, and thus by occasional very rapid respiration builds up a bank of oxygen upon which to draw. Or perhaps air stored in the air-sacs could be drawn upon without respiration; a considerable amount of air could be stored there for use in song. Another, though I think less probable, explanation might be that the syrinx is capable of producing sounds in inhalation as well as exhalation, so that birds might have the power of producing continuous sounds by complete respiration—aspiration following expiration without a hitch between—a feat that is difficult, if not impossible, for the human larynx to perform, though easy enough for the whistler.

Other things upon which I should not agree with Dr. Craig are largely matters of emphasis and opinion—as, for instance, I should attach much more importance to the role of the imitative factor in bird song than he does—but this is not the place for that kind of discussion. From my own point of view one of the most important contributions of the paper is the concept of the unemotional twilight song as belonging to an entirely different category from the courtship and territorial songs and from song as an emotional outlet and as a mere habit extended beyond its period of utility.

This seems to me a very important paper and one that is destined to influence profoundly the study of this most interesting phase of bird behavior.—Francis H. Allen.

Waterfowl in Iowa. By Jack W. and Mary R. Musgrove. Illustrated by Maynard F. Reece. State Conservation Commission, Des Moines, Iowa, 1943: 6 x 9 in., ix + 122 pp. 12 pls. (8 col.), 11 vignettes. $1.00.

For its cost, no bird guide offers more help in identifying game waterfowl than this little book, which has been prepared not as a scientific treatise but rather as an introduction to wild waterfowl. Six chapters briefly describe 37 Iowa species (2 swans, 6 geese, and 29 ducks)—which occur also in most of the central states. Four chapters discuss molts and special plumages, lead poisoning, enemies of waterfowl, and migration. The description of fall migration is a real contribution to waterfowl natural history.

The illustrations by Maynard F. Reece compare very favorably with more expensively reproduced work of well-known bird artists. The problem of necessary crowding on the plates has been satisfactorily met by varying the action and poses. With a few exceptions such as the diving ducks (whose bodies seem too long), the birds are well drawn. Unfortunately, the text and color plates do not always agree, and a few rather serious errors have crept in. For example, the "juvenile male" Red-breasted Merganser (pl. 8) has the *adult* wing, and actually is a second year or adult drake (in earlier molt than the adult drake figured just above). The "juvenile male" Redhead (pl. 5) is more like an adult female. The "juvenile" drakes of the Wood Duck, Ring-necked Duck, and American Golden-eye are not true juveniles in the "plumage succeeding the natal down"—to quote from the authors' glossary—but are shown well along in their post-juvenal molt into the first adult (nuptial) plumage. Of two dabblers shown "in eclipse," the Wood Duck is correct, but the Mallard erroneously shows traces of green head plumage and white neck-ring, which are regularly lost in full eclipse. Unfortunately, the text and illustrations present the two unproved subspecies of the Black Duck but omit all mention of plumage differences between the sexes. Actually the plate shows a pair (drake at left) rather than two races.

No mention is made of the double molt of females; but we are not surprised at this omission, considering the errors and gaps in the literature on waterfowl plumages. Crediting the Ring-necked Duck with a "soft, purring note" is to omit the very harsh, croaking notes it often utters.

Perhaps faulty color work, rather than artist's errors, is responsible for failure to show the light blue of the bills of the Ruddy and Buffle-head drakes and the pink band on the bill of the Old Squaw drake. The juvenile Snow and Blue geese are figured with pink, instead of grayish-black, bills and legs.

Nevertheless, the book will be very helpful to a great many people, especially to those who do not own the more detailed and more expensive Kortright manual. The Iowa State Conservation Commission, the authors, and artist are to be congratulated on the publication of this useful guide.—Miles D. Pirnie.

The Raft Book. By Harold Gatty. George Grady Press, 445 West 41st St., New York, 1943: 5½ x 7⅝ in., 149 pp. 29 pls. (2 col.), 2 folding maps. $3.25.

The destructive forces of modern war have made shipwreck so common that we have now a special book published for those about to be lost at sea. Harold Gatty, famous aerial circumnavigator of the globe, has used his knowledge of the remarkable native Polynesian methods of navigation to prepare a volume which will, he believes, enable even an untrained person without navigating instruments to find his way to land after being set adrift in a life boat.

To judge by his allotment of space, Gatty considers bird study second only to astronomical methods in value to the navigator forced to find his way at sea without instruments. The authenticity of Gatty's thirty-five pages and six plates devoted to birds will be instantly recognized by every bird student when he finds that the author's adviser was Robert Cushman Murphy, and his bird artist, Francis L. Jaques.

Gatty says that "birds have played a far greater part in the opening up of the world than is generally realized . . . A study of the tracks of the migration of land birds in the Pacific, and further consideration of the evolution of bird migration routes, shows that man's path in the Pacific has followed the paths of land birds. No people, whether primitive or civilized, would set out over thousands of miles of ocean without knowing that they were going to some land. The Polynesians, who were, like all primitives, close observers of nature, saw the land birds taking off year after year in the same direction, and knowing that they were not able to rest on the ocean, must certainly have realized that another land lay in that direction. What else would lead these seafaring people from Tahiti to New Zealand but the repeatedly observed migration of the Long-tailed Cuckoo between these two places?" (p. 6).

The scope of the ornithological part of the book is best indicated by the titles of the sections: Migratory Birds as Winged Pilots, Land Sighting Birds as Navigating Instruments, Land Indications from Seabirds, Birds of the Ocean and their Distribution.

The five Jaques plates figure sixty-six birds of forty-three species chosen as representative of the principal kinds of sea birds.

The book is published in two editions—one for shore use and a water-proofed edition reserved at present for use in lifeboats and rafts.

Anyone interested in the ocean and its birds will find fascinating and profitable reading in this very attractive little book.—J. Van Tyne.

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Wilson Ornithological Club Library

The following gifts have been recently received:

A. E. Borell—8 reprints
Phil Goodrum—6 pamphlets and reprints
Joseph J. Hickey—1 reprint
Leon Kelso—4 pamphlets
George H. Lowery, Jr.—17 pamphlets
W. L. McAtee—14 reprints
E. A. McIlhenny—1 reprint
Howard L. Mendall—1 bulletin
Henry Meyer—1 reprint
Katie Roads—2 books, 8 journals
R. W. Sheppard—10 reprints
Dayton Stoner—2 reprints
M. G. Vaiden—4 reprints
Richard L. Weaver—3 reprints
J. M. Winterbottom—1 reprint

ANNUAL REPORTS

REPORT OF THE RETIRING TREASURER

Balance as shown by last report dated Dec. 31, 1942 ...$	334.48	
Receipts, Dec. 31, 1942 to Feb. 27, 1943		
Dues:		
Associate	125.50	
Active	76.50	
Sustaining	20.00	
Subscriptions to *The Wilson Bulletin*	87.25	
Sale of back numbers of *The Wilson Bulletin*	.50	
Miscellaneous receipts	3.15	
Total		$647.38
Disbursements		
Editor's expense: postage, mailing	16.20	
Treasurer's expense: express	.50	
Bank charges	1.20	
Bad checks returned	7.00	
Total disbursements		24.90
Balance turned over to new treasurer, Milton B. Trautman, Feb. 27, 1943		$622.48
ENDOWMENT FUND		
Balance in savings account as shown by last report dated Dec. 31, 1942 ...$	815.05	
Interest on U. S. Postal Savings Coupon Bonds	9.75	
Total savings account		$ 824.80
Bonds at purchase value as shown by last report		2261.25
Total savings account, and bonds at purchase value, turned over to new treasurer, Milton B. Trautman, June 21, 1943		$3086.05

Respectfully submitted,

June 21, 1943 GUSTAV SWANSON, *retiring Treasurer*

REPORT OF THE TREASURER FOR 1943

Our financial status on January 1, 1944, appears satisfactory despite increasing printing costs and the slight decrease in membership. Our balance is considerably higher than last year.

Cash transferred from former treasurer Feb. 27, 1943 ...$	622.48	
Receipts Feb. 28, to Dec. 31, 1943		
Dues		
Associate	1303.81	
Active	1067.90	
Sustaining	231.40	
Subscriptions to *The Wilson Bulletin*	116.50	
Contributions	51.00	
Sale of back numbers of *The Wilson Bulletin*	40.75	
Miscellaneous Receipts	.75	

TOTAL RECEIPTS		$3,434.59
Disbursements:		
The *Wilson Bulletin:* printing, engraving, mailing	$2,332.13	
Editor's expense: postage, mailing, secretarial aid	142.22	
President's expense	2.50	
Secretary's expense: stationery, postage, clerical aid	62.77	
Treasurer's expense: postage, printing, clerical aid	142.60	
Membership Committee expense: postage, printing	131.22	
Bank charges	17.31	
Foreign exchanges	.96	
Bad checks returned	2.00	
Reprints	7.57	
TOTAL DISBURSEMENTS		$2,841.28
Balance on hand in Ohio National Bank, Columbus, Ohio, Dec. 31, 1943		$ 593.31

ENDOWMENT FUND

Cash balance transferred from former treasurer, June 21, 1943	$824.80	
Received by present treasurer Feb. 28 to Dec. 31, 1943:		
Interest on U. S. Postal Savings Coupon Bonds	9.75	
New Life Members	375.00	
Total receipts	$1,209.55	
Purchase of U. S. Savings Bonds, Series G., Sept. 1, 1943	1,000.00	
Balance in savings account, Ohio National Bank, Columbus, Ohio, Dec. 31, 1943		$ 209.55
Bonds on deposit in safety deposit box, Ohio National Bank, Columbus, Ohio		
U. S. Savings Bonds, Series G, purchased Sept. 1, 1943		$1,000.00
Bonds transferred from former treasurer:		
U. S. Postal Savings Coupon Bonds, dated July 1, 1935		780.00
U. S. Savings Bonds (maturity value May 31, 1945: $900.00), purchase value		675.00
U. S. Savings Bonds (maturity value Aug. 1, 1948: $1,075), purchase value		806.25
Total endowment fund		$3,470.80

Respectfully submitted,

December 31, 1943 MILTON B. TRAUTMAN, *Treasurer*

REPORT OF THE ILLUSTRATIONS COMMITTEE

The Illustrations Committee has aided the Editor in a limited way during the past year in securing photographs for reproduction in the *Bulletin*. Also, the chairman has acted in an advisory capacity regarding certain illustrations considered for use in the *Bulletin*. Richard Grossenheider, Karl Maslowski, and Roger T. Peterson of this Committee are now in the armed forces.

Respectfully submitted,

January 13, 1944 W. J. BRECKENRIDGE, *Chairman*

REPORT OF THE SECRETARY FOR 1943

The Wilson Club, despite a second straight year without a formal meeting of our members, has enjoyed a fairly prosperous and successful year during 1943. Our club year closes (as of December 1) with our rolls showing a membership of 1,028, a net loss for the year of 26 members. We lost from all causes during the year 169 members. New members received totaled 143, of whom 8 are Sustaining Members, 27 are Active and 108 Associates.

Our membership by classes is now distributed as follows: there are three living Founders; and we have 19 Life Members, 45 Sustaining Members, 334 Active Members, and 627 Associate Members.

Our success in maintaining a membership at very near the level of normal times must be credited in large part to the interest and devotion of our members, but a great amount of the credit must go to Richard L. Weaver and his active Membership Committee. The Secretary would like to take this official means of expressing to him and to his Committee the heartfelt thanks of the Wilson Club, and to wish for him the greatest success in his new work. The new Chairman of the Membership Committee, F. M. Baumgartner, is also commended to our members, actual and prospective, with the hope that his relations will be pleasant ones in his present capacity. Special thanks are also due to the men and women in the armed services who have devotedly maintained their Wilson Club membership.

The election of officers, conducted by mail again this year, has resulted as follows:

President: S. Charles Kendeigh
First Vice-President: Olin Sewall Pettingill, Jr.
Second Vice-President: Harrison F. Lewis
Secretary: Maurice G. Brooks
Treasurer: Milton B. Trautman
Councillors: Burt L. Monroe, Eugene P. Odum, Lawrence H. Walkinshaw.

Josselyn Van Tyne was re-elected Editor of *The Wilson Bulletin* by unanimous vote of the Council.

The Secretary wishes to thank the many officers and members of the Club for their continuing assistance to him, and to the organization. It is to be hoped that we may, by 1945, be able to resume our Annual Meetings, since many of us miss these pleasant contacts more, perhaps, than we had thought possible until we no longer had them.

Respectfully submitted,

March 1, 1944 — Maurice G. Brooks, *Secretary*

REPORT OF THE COMMITTEE ON AFFILIATED SOCIETIES

At its annual meeting last April the Wisconsin Society for Ornithology voted unanimously in favor of affiliation with the Wilson Club. We welcome them as our latest affiliate.

During the past year, accounts of the activities of the Inland Bird Banding Association, the Georgia Ornithological Society, the Virginia Ornithological Society, and the Wisconsin Society for Ornithology have been published in the *Wilson Bulletin,* and we hope that such news notes from affiliated societies may continue to appear in the *Bulletin.*

W. E. Scott has left to enter the armed services, and his successor as a member of the committee has not yet been named.

The committee asks for suggestions on ways in which affiliation can be made more active and vital.

Respectfully submitted,

January 18, 1944 — Gordon M. Meade, M.D., *Chairman*

REPORT OF THE LIBRARY COMMITTEE

During 1943 the Wilson Club Library received gifts of 18 books, 938 periodicals, 127 reprints, and 24 pamphlets. Among the books were five of Bent's *Life Histories,* raising the total of these to ten. Those lacking now are the *Diving Birds, Petrels and Pelicans, Marsh Birds,* and *Birds of Prey,* part 1. The largest single contribution was a collection of 725 copies of natural history magazines from Mr. R. M. Barnes, of Lacon, Illinois. The Library has at present about 145 books, 55 current periodicals, and 3,000 reprints and miscellaneous publications. For a fuller account see the September number of the *Bulletin* (pp. 208–211). There has been some increase in the use of the Library by members of the Club, but there is plenty of opportunity for greater use, and members are cordially invited to send for publications, or inquire about what is available. During the coming year we hope to publish a list of the periodicals currently received by the Library.

We wish to pay tribute to a former member of the Library Committee, Mr. Bayard H. Christy, whose death occurred last year.

Respectfully submitted,

February 29, 1944 HARRY W. HANN, *Chairman*

NEW LIFE MEMBER

LAWRENCE H. WALKINSHAW graduated from Olivet College and the University of Michigan Dental School and is a practicing dentist in Battle Creek. He began studying birds systematically in 1918, and his investigations of bird life histories have since taken him to Tennessee, Florida, Mississippi, Utah, Oregon, Idaho, and Alberta. The resulting publications have contributed greatly to our knowledge of the Field Sparrow, Prothonotary Warbler, and other species. At present he is working on a monograph on the Sandhill Crane. He is a Member of the A.O.U. and is on the Council of the Wilson Club.

THE WILSON BULLETIN PUBLICATION DATES

The actual dates of publication of the four numbers in 1943 were: March 23, June 25, September 28, December 28.

TO OUR CONTRIBUTORS

Our members are asked to submit articles for publication in the *Bulletin*. Manuscripts will be accepted with the understanding that they have not been published or accepted for publication elsewhere.

MANUSCRIPT. Manuscripts should be typed on paper of good quality and of letter size (8½ x 11). Write on one side only and use double spacing. The title should be brief and carefully constructed so as to indicate the subject clearly. Ordinarily the scientific names of the birds treated should be given and should appear early in the article. Most articles should have a brief summary at the end.

BIBLIOGRAPHY. Literature referred to in the text should be cited by author's name, year of publication, and exact pages of the particular reference. Such citations should ordinarily be listed in full at the end of the paper.

ILLUSTRATIONS. Photographic prints, to reproduce well as half-tones, should have good contrast and detail. Please send prints unmounted, and attach to each print a brief but adequate legend. Do not write heavily on the backs of photographs.

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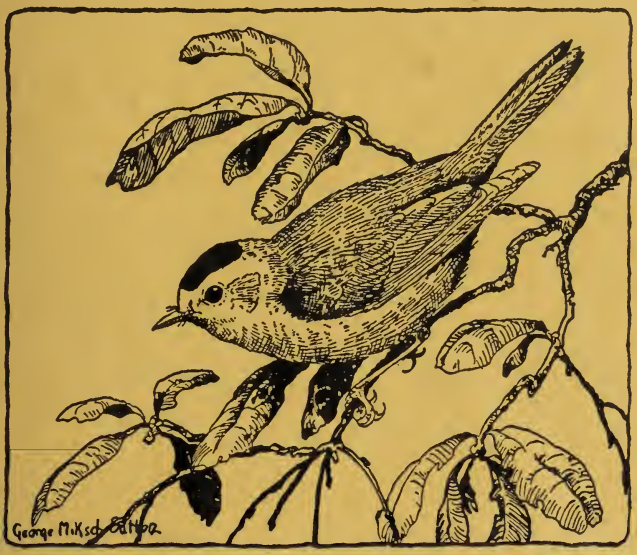
Vol. 56 JUNE, 1944 No. 2

The Wilson Bulletin



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PANAMA ANT-THRUSH
(Formicarius analis panamensis)

At nest on Barro Colorado Island, Canal Zone, May 19, 1929. The nest was three feet above the ground and contained one egg. Flashlight photograph by Howard H. Cleaves.

THE WILSON BULLETIN

A QUARTERLY MAGAZINE OF ORNITHOLOGY

Published by the Wilson Ornithological Club

Vol. 56 JUNE, 1944 No. 2

NOTES ON THE LIFE HISTORY OF THE EMERALD TOUCANET

BY HELMUTH O. WAGNER [1]

THREE representatives of the Ramphastidae occur in Mexico. Of these the Emerald Toucanet (*Aulacorhynchus prasinus*) [2] has the widest distribution as well as the most northerly range. It is distinctly a bird of the virgin forest. In southern Mexico I encountered the Emerald Toucanet only in the mountains between 1,000 and 2,500 meters (3,280 and 8,200 feet), never at lower altitudes, even where apparently suitable habitats were available. Farther north in Mexico one finds it at lower altitudes and in much drier habitats. Obviously, then, its ecological requirements are not the same in all parts of the country, and the observations recorded below, which were made in the south of Mexico, are valid only for that region.

Observation Area

My observations of the Emerald Toucanet were made close to the Guatemalan border, in the state of Chiapas, during several lengthy visits in the course of the last 10 years (1933 to 1942). I observed the bird at all seasons of the year, sometimes almost daily.

Along the Pacific coast runs a chain of mountains, the Sierra Madre de Chiapas, an extension of the South American Cordillera. In my observation area, near Mapastepec (a railway station between Tonala and Tapachula), these mountains rise to an altitude of 2,300 meters (7,544 feet). Here the continental divide is at some places no more than 10 miles from the Pacific.

I made observations on both the Atlantic and the Pacific slope of the mountains. Extensive undisturbed virgin forest is the habitat required by the Emerald Toucanet in Chiapas. The bird does not occur where the forest gets drier, as is the case, for example, on the Pacific slope below 1,000 meters (3,280 feet).

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[1] Translated by Margaret and Ernst Mayr.

[2] The Emerald Toucanet was portrayed in color by George Miksch Sutton in an earlier *Bulletin* (Sutton and Burleigh, 1940).—Ed.

Figure 1 illustrates the local conditions in Chiapas—the vegetation zones and the distribution of the Emerald Toucanet at different seasons. The breeding range is in the high mountains in typical cloud forest. Its lower borders are at altitudes of about 2,000 meters (6,560 feet) on the Pacific slope, and 1,750 to 1,800 meters (5,740 to 5,904 feet) on the Atlantic slope. The birds spend most of the time between breeding seasons at lower altitudes. They are found on both slopes of the mountains, but the flocks are much more numerous on the Atlantic side, where the humidity is higher. On the Pacific slope, I have found them only at the bottom of humid valleys.

Climate of the Habitats

Sharply defined dry and rainy seasons alternate in most parts of Chiapas. The beginning and length of these seasons vary from year to year by several weeks, but the rainy season usually extends from the middle of May to October. At an altitude of 1,000 meters (3,280 feet) on the Atlantic slope, the average yearly rainfall (taken over seven years) was 390 cm. (153 inches). At the end of October the heavy rains stop, the sun begins to shine, and both dryness and temperature begin to increase steadily. In April and May, temperatures of 30° and 35° C. are recorded at the local weather station (which is not, however, within the virgin forest).

The climate of the higher altitudes is quite different: there is a pronounced rainy season between May and October, but during the other months, when it is hot and dry at lower altitudes, it is still cold and rainy here. Cold northerly winds from the Gulf of Mexico drive rainclouds against the mountains above an altitude of 1,800 meters (5,904 feet), and these precipitate continual light rains. Thus one cannot speak of a dry season in the higher altitudes, especially in the wide mountain valleys. Unfortunately, I cannot give a figure for the annual rainfall here, but in spite of the fact that rain falls the year round, the annual total is probably less than at lower altitudes, where there is sometimes more than 12 cm. (5 inches) rainfall in 24 hours.

The difference in the climate of the two habitats of the Emerald Toucanet finds its most conspicuous expression in their dissimilar plant associations. In the breeding area, the invariably damp rainforest, large oaks are the prevailing tree. Beneath their high, widespreading crowns is only a spare undergrowth, among which large tree ferns are conspicuous. Every bough and twig is covered with a thick water-soaked layer of moss. On the great horizontal boughs of the oaks, 50 meters (164 feet) or more above the ground, there are luxuriant growths of orchids, ferns, and other epiphytes.

The virgin forest at lower altitudes, where pronounced dry and rainy seasons alternate, has a quite different aspect. This forest, too, is luxuriant, and because of the high temperatures, especially quick-

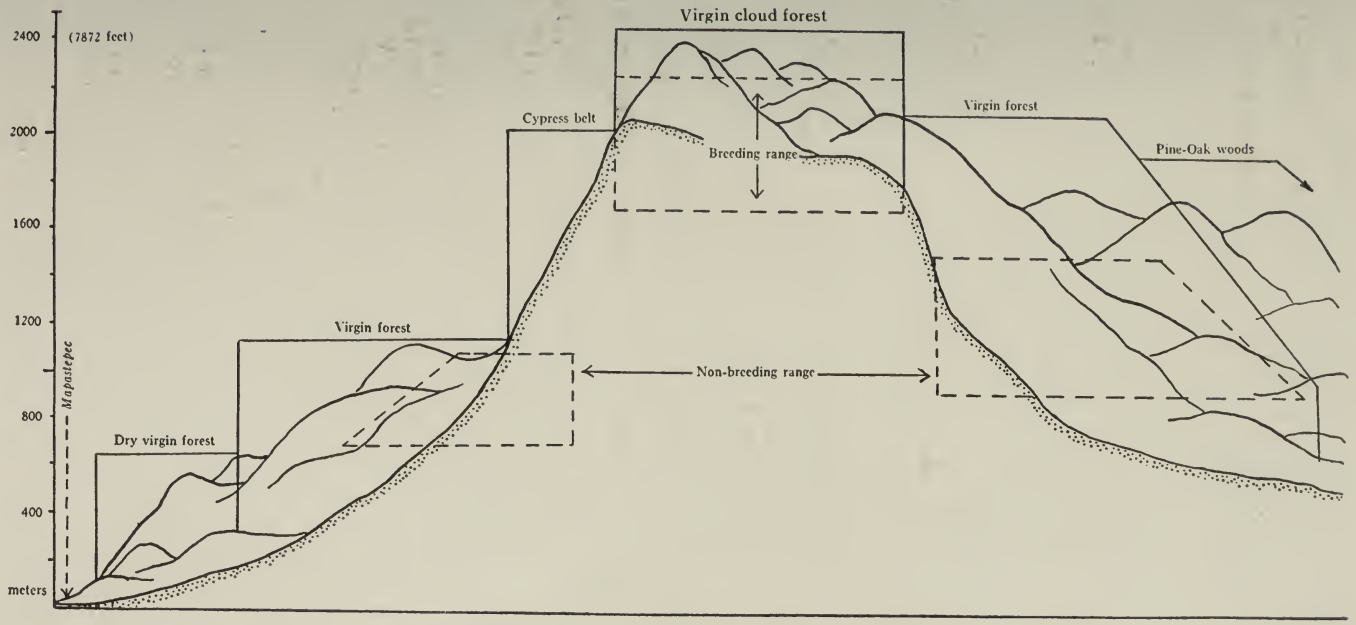

Figure 1. Diagrammatic cross-section through the range of the Emerald Toucanet in the Sierra Madre de Chiapas near Mapastepec, Chiapas, Mexico. The breeding range (Nov./Dec.-May/June) and non-breeding (summer) range are indicated by broken lines.

growing. However, plants requiring uniform moisture throughout the year, which are common at higher altitudes, are lacking here. Distinct seasonal changes are apparent in the appearance of the vegetation, whereas at higher altitudes, only a few miles distant, the same general aspect is preserved all the year round.

Vertical Movements

The Emerald Toucanet in Chiapas shows a limited adaptability to environment. After extensive observations and comparisons, I have come to the conclusion that it is less the plant associations than a very definite degree of atmospheric humidity that determines the sporadic distribution and the migrations there—changes in temperature and in available food supply playing only a minor part. The seasonal migrations of the Toucanet are regulated by seasonal fluctuations in the humidity of the air; also whenever there is a marked departure in either direction from the optimum humidity, the birds react by a temporary emigration.

The threshold at which the migratory impulse is released can be accurately determined: emigration from the always humid rain forest takes place when the atmosphere has become saturated with moisture, and raindrops on leaves and branches do not evaporate even when the rain stops. The Toucanets, which live in the dense tree tops, apparently dislike to stay in the continuously dripping foliage, and they leave the area for relatively dry places. Mature males and yearlings of both sexes precede the mature females, which are still busy with the care of the young.

I saw this demonstrated with remarkable clarity in May, 1942. On May 24 I crossed the mountains in splendid weather on my way to the coast. I heard the Toucanets in the dense treetops at a number of spots in the breeding range. When I returned the same way two days later, there was a pronounced change in the weather. The wind was blowing cloud shreds down the slope to the 1,000-meter (3,280-foot) level, and higher up I found myself in dense clouds. When I reached the cypress belt, with its light stands of pines and cypresses, a flock of Toucanets suddenly passed me in the fog, rushing downhill. A second and third flock followed. Beyond the continental divide, at 1,500 meters (4,920 feet), I met another flock, of five or six Toucanets, and later, a flock of more than ten. All these birds were leaving their breeding range, not to return until six months later. I approached the last flock to within five to seven meters, and could tell by the size of the bills that it did not include any young of the year. This is the only time I ever observed such a mass migration of these toucanets. Usually the migration occurs by degrees, probably according to individual variation in the reaction threshold.

The Toucanets return to the high mountains at the beginning of the dry season in November. This return migration occurs when a

certain degree of aridity is reached, which has its visible expression in a conspicuous change in the vegetation's appearance, particularly on the drier slopes. A few flocks linger in deep valleys at about 1,300 meters (4,264 feet), which are more humid because they are surrounded by mountains, and it happens sometimes that flocks of yearlings remain throughout the year at such places.

I have frequently observed that birds in general show a tendency to form larger groups in bad weather. This is also true of the Emerald Toucanet. The small flocks, which roam through the forest in the summer months, gather at the end of August into larger units of up to 20 birds. In September and October, when the soil and atmosphere are saturated with moisture even at the lower altitudes, so that there is no escape for the Toucanets into favorable environments, one finds the species usually on the crests of the mountains, where the foliage dries more quickly. But if during these months there are days on which it rains continuously and the mountains are covered with clouds to below 1,000 meters (3,280 feet), then they gather with other forest birds in the coffee plantations. Since the circulation of air is better in the light stand of trees shading the coffee bushes, it is a little drier there than in the neighboring primeval forest. On such days I have seen Emerald Toucanets perching wretchedly in the Chalun trees quite without their usual vivacity and noisiness. They find no suitable food in the coffee plantations at this season; hence I can attribute their flight only to the desire to avoid contact with the dripping leaves and branches. As soon as conditions at all permit, that is, as soon as the rain slackens and the sun occasionally shines, the Toucanets leave the plantations as quietly as they came.

Breeding

The Emerald Toucanets breed in the rain forest of the high mountains from March to June. They arrive in their breeding range in December but do not immediately start breeding activities. The flocks (of from 4 to 10 birds) begin to break up in February. The mature females leave first, and the mature males follow shortly afterwards. Birds of the previous year remain in flocks since they are not sexually mature until they are two years old, and the mature males probably return to the flocks as soon as the females have started incubation.

So far as I could observe, the roosting holes were not used as nests. The entrances of the roosting holes were always rather exposed, and the birds could be seen from some distance as they entered or left, whereas the entrances of two nesting holes which I found were so well concealed by branches and creepers that I discovered the nests only by accident.

I have only once had the good fortune to make detailed observations on an occupied nest. On April 15, 1942, I camped in a shallow valley at an altitude of about 1,900 meters (6,232 feet). The spot was a clearing in the woods, which 20 years before had been used as a

camping ground by mule trains crossing the mountains but had since been abandoned. In the intervening years, dense scrub and young trees had grown up between fallen rotting tree trunks, and everything was covered with a thick growth of vines.

While pitching my tent I noticed a Toucanet moving quietly and timidly about the camping ground. I soon found the nest, about 20 meters (66 feet) from my camp, in a rotten tree trunk some four meters high. I then suspected, and later verified, that it contained recently hatched young. From my camp I could watch the nest without interruption while I worked. At intervals the Toucanet came flying from the tops of the forest trees to smaller trees in the clearing which were about 30 meters from the nest. It always waited here a few minutes to reconnoitre. If everything seemed safe (and the bird soon became accustomed to my presence), it moved in low, swift flight to a slender branch about 50 cm. (20 inches) below the nest entrance. Here it paused again for an instant and then jumped to the hole and disappeared inside the cavity. At each such visit it remained inside some 20 or 30 minutes, which was about the same length of time that it stayed away from the nest looking for food. I have several times observed in the tropics that during inclement weather the young are brooded for a certain interval after each feeding. When I recorded the temperature in the immediate neighborhood of this nest, the reason for such behavior became apparent. During the two weeks I spent at this spot, the lowest day temperatures occurred at 6 A.M., and were between 7° and 12° C.; the highest occurred at 2 P.M., and were between 15° and 19° C. The cold was made doubly uncomfortable by the moisture in the atmosphere. And yet March and April are the warmest months there; in winter the temperature sometimes falls below the freezing point.

I never observed near the nest more than the one bird, and this later proved to be a female. It is possible that her mate had been killed, but I suspect that in this species the male does not take part in the rearing of the young. In the same week I shot two adult males from wandering flocks, which, since the sex ratio in this species is apparently balanced, would also tend to indicate that the female rears the young alone.

I never saw food in the bill of the female when she was flying to the nest, and on dissection, I found no crop for the transportation of food. While the young are small the food is either carried inside the parent's mouth or it is regurgitated.

My observations were abruptly ended on April 20. At twilight I suddenly heard distress calls from the nest of the Toucanet. When I approached the tree trunk I heard sounds of a struggle. I plugged the nest entrance to prevent escape of the predator, and at once everything was quiet. I then cut a small hole in the trunk below the nest entrance, and seeing the eyes of the predator, I fired a load of birdshot. When I

opened the trunk further I found the dead Toucanet, which had been bitten through the occiput, a dead weasel (*Mustela frenata*), and two live young Toucanets. The opened trunk and the young are shown in Figure 2. A tangle of creepers, which originally covered the trunk completely, was removed before the photograph was made. Only the lower half of the nest cavity was opened, and the undisturbed entrance can be seen in the upper part of the picture.

The lower edge of the entrance was 260 cm. (8½ feet) above the ground. Fresh wood was exposed only where the Toucanet, in passing to and fro, had worn away the edges of the hole. I assume that the cavity had been excavated originally by a Green Woodpecker (*Piculus rubiginosus*)—the site in an old rotten trunk is typical of that species. A comparison with three other Green Woodpecker holes which I measured showed that this Toucanet's breeding cavity was only slightly larger. Apparently the only work which the new occupant had undertaken was a vertical extension of the entrance, which can be seen in Figure 2. The End Figure shows the measurements of the nest, which contained no nest material. The flat bottom of the cavity was perfectly clean and was lightly covered with wood dust.

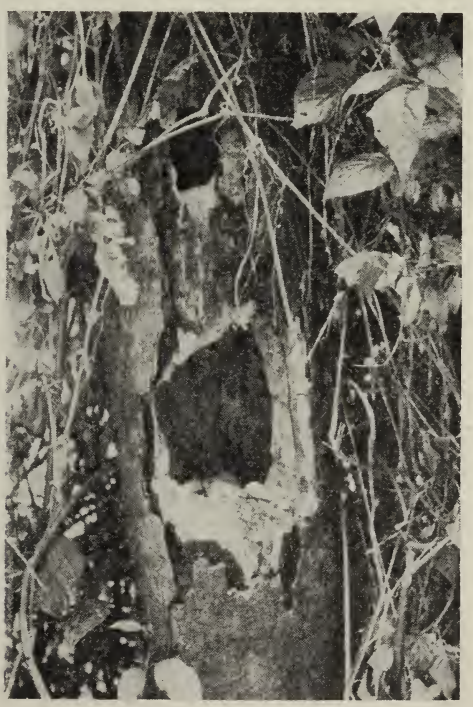

Figure 2. The Emerald Toucanet's nest, with two young. Entrance is shown in upper part of picture.

Nestlings

To judge from their size, the two young were about 10 days old. They were 9.6 and 9.9 cm. long, respectively. The eyes had not yet opened, and I had the impression that they would not open for another 10 days. The dried vestiges of the yolk-sacks were still attached to the young. No feather tracts or down were visible, and merely a few bristles showed on the hand and tail region. The ear opening was barely visible and still closed. The peculiar shape of the young bird is illustrated in Figure 3*a*. It is apparent that the abdominal cavity comprises a very large part of the body. At this age the sternum is quite undeveloped. The ratio, length of sternum to length of the ventral surface of the abdomen (measured from sternum to vent), is 1.2 cm. to 4.8 cm. in the young bird. In an adult male this ratio is 9.2 cm. to 4.7 cm. The abdominal length is thus the same in young and adult birds, whereas the sternum in the adult is 7.5 times as large as that of the young.

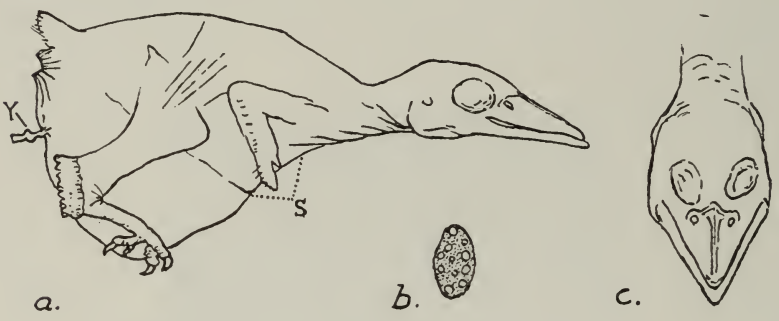

Figure 3. Emerald Toucanet. *a*. Nestling about 10 days old. *b*. Heel-pad viewed from below. *c*. Head of nestling viewed from above, showing the projecting lower mandible. *Y*. Vestige of yolk-sack. *S*. Sternum.

The wings are still very undeveloped. On the legs, the strongly developed heel-pads are conspicuous. The heel-pad is a plate attached to the ventral side of the intertarsal joint (Beebe, 1917:206; Van Tyne, 1929:30). The part of the leg above the heel-pads is strongly developed in contrast with the foot, which is still soft and flabby—an indication that the pads function earlier than the feet. The spikes or tubercles on the pads seemed to be neither definite in pattern nor constant in number. One of the young had 10 and 11; the other 12 and 14 (Figure 3*a* and 3*b*).

The bill of the young bird is rather remarkable. Its shape is very different from that of the adult bill. It is flattened (the greatest diameter at the base being lateral instead of vertical) and the lower mandible projects markedly beyond the upper (Figure 3*c*), perhaps an

adaptation for receiving food from the mother. The tongue is smooth and shaped like the bill. It is still soft, not horny and fringed as in the adult, and can be freely moved.

I do not know when the young leave the nest, but I believe it is not before the age of six weeks. Van Tyne (1929:34) estimates the nest-leaving age to be 45 days in *Ramphastos brevicarinatus*. Beebe (1917: 201) figures a nestling of *Pteroglossus aracari,* but the age of 10 days which is given for the bird is most improbable. I would estimate at least 20 days. The same bird is shown when seven days older, and one can see how slow growth is, especially in the bill. In fact, it is the small size of the bill that makes it possible, even in the field, to distinguish birds several months old from adults. (The plumage of the immature is so similar in color to that of the adult that it is difficult to distinguish the birds in the field by plumage characters.) In the male, the bill reaches its full size only in the second or third year.

Population

The population density on the breeding ground is very low, but it is even lower in the range which the Emerald Toucanet occupies between June and November, because that extends over a much greater area. One can count only three to five small flocks in one valley about 7 to 10 km. long, whose slopes have an altitudinal range of 500 to 700 meters (1,640 to 2,296 feet). In spite of this, the Emerald Toucanet cannot be easily overlooked, for its continuous calls can be heard at a distance of several hundred meters.

Calls

The calls of the Emerald Toucanet are so varied that it is impossible to describe them in detail. One thing they have in common, they are all loud and penetrating. These birds are good mimics, but they apparently imitate a given call only so long as they continue to hear the original caller from time to time. During the breeding season in the high mountains I heard most frequently the *yow yow* call of the Mexican Trogon (*Trogon mexicanus*), the *rayg rayg* of the Quetzal (*Pharomachrus mocinno*), or the *eeya eeya* of the Azure-hooded Jays (*Cyanolyca mitrata*). In the non-breeding range, I heard none of these calls, but instead the *dir-rit* of the common Jalapa Trogon (*Trogon collaris*) or the typical *hoot hoot* of the male Lesson's Motmot (*Momotus momota lessonii*). Sometimes these mimicked calls deceived me, and I would expect to see a different bird in the foliage.

Food

All the Emerald Toucanets which I examined (eight birds at different seasons) had only vegetable food in their stomachs. Their preference for ripe berries rather than large fruits is the reason that one

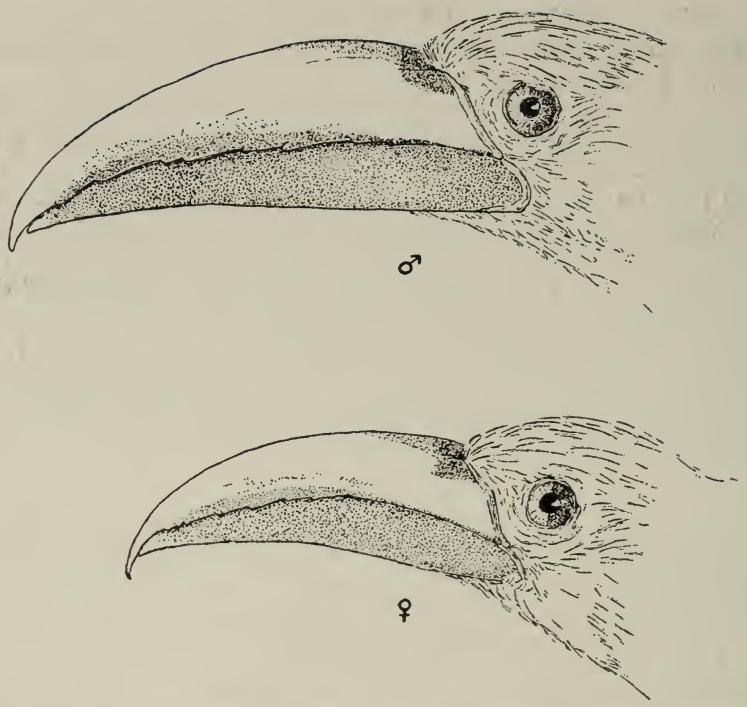

Figure 4. Heads of male and female Emerald Toucanet, showing difference in size and shape of bills. Two-thirds natural size.

finds them at given seasons, year after year, on certain trees scattered through the wide virgin forest. They feed on fruit with large pits and little pulp only with reluctance, presumably because these fruits are more difficult to eat. Several flocks may gather on a tree with an abundance of food, but they form a single unit only while they are feeding together.

During the breeding season in April (to judge from the stomach contents of the four birds which I examined) they feed mainly on a small blue berry which grows on low bushes on the highest peaks, where the prevailing winds prevent a high growth of trees. The Toucanets are joined at this season by a number of other berry-eaters from neighboring forest valleys, and it is most surprising to encounter such a flock of tropical birds where an icy wind blows shreds of cloud through the dwarf bushes.

The Function of the Bill

One cannot avoid asking the reason for the singular shape of the toucan's bill. No one who has an opportunity to observe toucans, especially the larger species, can fail to notice how cumbersome the bill is.

It has been generally held that the bill was so shaped to facilitate the picking of berries and fruit. It seems to me that exactly the opposite is true: the bill is often an impediment during feeding. This is obvious to anyone observing them when they need to bite pieces from large fruits. The broad bill of the trogon, which feeds on the same berries and fruits, is, for example, much better adapted to eating this kind of food.

In my opinion the form of the bill is a secondary sexual character, originally present in the male only, appearing subsequently in the female, though in a less striking form. The bill of the adult male is both larger than that of the female and different in shape (Figure 4). Van Tyne (1929:39) believes that "the bill of the toucan is not a special correlation of structure to function . . . but is rather to be explained perhaps as the result of an orthogenetic evolution leading to increased size of bill."

Summary

The Emerald Toucanet was studied in Chiapas, southern Mexico, at intervals from 1933 to 1943.

The habitat in Chiapas is virgin forest, at altitudes above 1,000 meters (3,280 feet), the occurrence and movements of the birds being determined by a definite degree of atmospheric humidity.

The breeding range in Chiapas is above 2,000 meters (6,560 feet) on the Pacific slope, and above 1,750 meters (5,740 feet) on the Atlantic slope. The birds spend the non-breeding season at lower altitudes.

The birds live in flocks during the greater part of the year. The adults leave the flocks in February, but yearlings (not yet sexually mature) remain in flocks.

The population density is very low.

An occupied nest was found on April 15, 1942, and observed until April 20, when a weasel killed the parent bird (a female). No male was noted near the nest during the five days of observation.

Intervals spent in brooding were about equal to intervals spent away from the nest (20 to 30 minutes).

The two young (about 10 days old) found in the nest were naked except for bristles on the hand and tail. Both eyes and ears were still closed. Wings and legs were still very undeveloped. The tubercles on the heel-pads seemed to be neither definite in pattern nor constant in number. The bill of the young was flattened, and the lower mandible projected beyond the upper. The tongue was still soft and freely moveable.

Young birds, though similar in plumage and body-size to the adults, can be distinguished in the field by the smaller size of the bill for some months after nest-leaving.

The Toucanet's calls are loud and varied and include imitations of many local species of birds.

All of the Toucanets examined (eight birds at different seasons) had only vegetable food in their stomachs.

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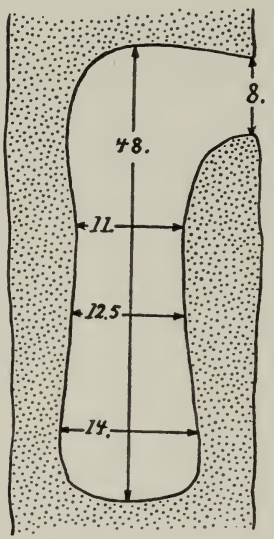

Measurements (in centimeters) of Emerald Toucanet's nest. Width of entrance: 6.1 centimeters.

A PLIOCENE FLAMINGO FROM MEXICO

BY LOYE MILLER

FIELD parties from the California Institute of Technology have been fortunate in locating a variety of fossil deposits in Mexico that included bird remains. Some have been very rich in the quantity and variety of material; for example, the San Josecito Cavern of Nuevo León (Miller, 1943), a deposit of Pleistocene age, yielded several thousand bird bones assigned to over forty species. The present paper deals with a collection of ten fragments, all but one of which are included in a single species. I am indebted to Dr. Chester Stock in charge of the explorations for the opportunity of working with the bird collections. Dr. Alexander Wetmore has loaned comparative material, and Dr. Hildegarde Howard has been a most congenial fellow student during many conferences on the flamingoes, both Recent and Fossil. To these several colleagues my sincere thanks are offered.

The ten fragments are from collecting locality No. 289, California Institute of Technology, known as the Rincón Pliocene, Chihuahua, Mexico. Associated mammal remains include horse, camel, antelope, and carnivore species. The matrix is a fine grained silt of lightest color, without cementing material. A stiff brush serves to remove it from the well petrified bones. Unfortunately the specimens are most fragmentary. They do, however, prove to be of interest in several respects; most notably they prove (since several speciments are from pre-volant young) that a small species of flamingo was present as a breeding bird. This is the earliest record for the family in America. Flamingoes are recorded from the Upper Oligocene of France (Milne-Edwards, 1868:53), but the earliest previous record from the New World is from the Pleistocene of Oregon (Shufeldt, 1892:410).

Phoenicopterus stocki, new species

Stock's Flamingo

Type specimen $\frac{289}{3245}$, California Institute of Technology, tibiotarsus (distal end) from the Rincón Pliocene of Chihuahua, Mexico. The species has the morphological characters of the genus but is of pigmy size. (See Figure 1.)

From the same locality, there were retrieved several other fragments that are here assigned to the one species. The proximal end of a tibia may have come even from the same individual, though from the opposite side. This specimen shows certain characters that are distinctive and, were the conspecific identity of the fragments more completely assured, these osteological characters could be added to the description of

the species. There is less backward extension of the inner articular facet as compared with *Phoenicopterus ruber* and *P. chilensis,* the postero-axial border of this facet (*F,* Figure 2) is more nearly an arc of a true circle, and the posterior notch (*E,* Figure 2) is shallower. In these characters the Pliocene bird approaches the Old World species, *Phoenicopterus antiquorum,* more closely than it does either *P. ruber* or *P. chilensis* from the New World. No skeletons of the genus *Phoenicoparrus* were available for comparison, but skins of the two species of

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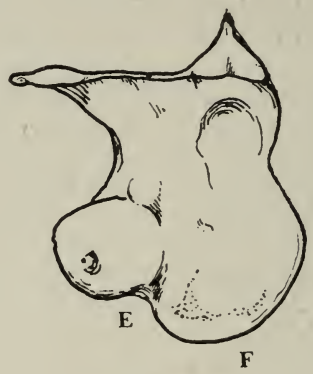

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Figure 1. *Phoenicopterus stocki.* Type specimen. Tibiotarsus (distal end). Twice natural size.

Figure 2. *Phoenicopterus stocki.* Tibial head assigned to the same species as the type. Twice natural size. *E,* posterior notch; *F,* postero-axial border. Drawings by Gretchen L. Burleson.

that genus show them to be larger than the Pliocene bird. The generic characters of *Phoenicoparrus* seem to be displayed mainly in the peculiarly heavy beak with its prominent and horizontal lamellae. Whether osteological characters of the tibiotarsus are distinctive is not known. It was considered wiser, therefore, to place the fossil species in the typical genus of the family.

In making this study, certain characters of the limb bones of flamingoes (Table 1) were uncovered which might be of value to later students of the genus *Phoenicopterus.* Peters (1931:141) recognizes no geographic races in any of the species despite their wide and sometimes interrupted ranges, and homogeneity is evident in such skeletons as could be assembled. In the series of Old World birds, *Phoenicopterus antiquorum* (=*roseus*); four specimens were taken in India and one in Egypt. All are of the same sex, but there is greater size variation among those from India than appears between the Indian and the Egyptian birds. Two specimens of *P. chilensis* (♂, ♀) were examined. Both,

TABLE 1

MEASUREMENTS OF VARIOUS FLAMINGOES' LEG BONES

		Length	Width of head	Width of distal end	Sagittal diameter condyles	Width of shaft	
P. chilensis[1]	♂	298 mm.	17.7 mm.	15.4 mm.	17.5 mm.	7.1 mm.	Tibiotarsus
P. chilensis[2]	♀	273	17.2	15.7	17.6	7.2	
P. ruber[3]		307	16.6	14.0	17.6	6.9	
P. antiquorum[4]	♀	392	20.7	17.8	20.4	8.4	
P. antiquorum[5]	♀	358	21.2	17.7	20.3	7.5	
P. antiquorum[6]	♀	351	19.7	17.4	20.0	8.2	
P. antiquorum[7]	♀	358	19.5	17.2	20.2	7.8	
P. chilensis[1]	♂	290	18.5	18.5		5.4	Tarsometatarsus
P. chilensis[2]	♀	251	18.1	19.7		5.6	
P. ruber[3]		287	16.9	17.9		5.7	
P. antiquorum[4]	♀	378	20.5	20.7		6.3	
P. antiquorum[5]	♀	334	20.2	20.8		6.0	
P. antiquorum[6]	♀	352	21.0	19.6		6.7	
P. antiquorum[7]	♀	346	20.0	19.4		6.5	

1, *U. S. Nat. Mus. 344,931.* 2, *U. S. Nat. Mus. 344,932.* 3, *Los Angeles Mus. Bi-1,295.* 4, *Univ. Calif. at Los Angeles 1,786.* 5, *Univ. Calif. at Los Angeles, 1750.* 6, *Univ. Calif. at Los Angeles 1,785.* 7, *Univ. Calif. at Los Angeles 265.*

seemingly, were mature birds, but the male had longer and more slender tibia and tarsus and a smaller foot than the female. These variations are not such as commonly depend upon age, and they are probably not sexual, but individual, differences.

An interesting character is seen in the form of the intercotylar knob at the proximal end of the tarsus. In *Phoenicopterus chilensis* this knob is very broad and rounded; in *P. ruber* it is much narrower and more pointed; in *P. antiquorum* it is intermediate but approximates that of the Chilean bird. Unfortunately the intercotylar knob is not represented in the Pliocene collections.

TABLE 2

TIBIAL CONDYLES IN PHOENICOPTERUS

		Transverse diameter	Sagittal diameter	Ratio
P. ruber[3]		14.0 mm.	17.6 mm.	.78
P. ruber[8]		14.0	17.8	.78
P. chilensis[1]	♂	15.4	17.5	.83
P. chilensis[2]	♀	15.7	17.6	.83
P. antiquorum[4]	♀	17.8	20.4	.87
P. antiquorum[5]	♀	17.7	20.3	.87
P. antiquorum[6]	♀	17.4	20.0	.87
P. antiquorum[7]	♀	17.2	20.2	.87
P. copei[9]		17.0	20.0	.80
P. stocki[10]		12.9	16.2	.798

8, *Univ. Calif. at Los Angeles 1,981.* 9, *Amer. Mus. Nat. Hist. 3,485.* 10, *Calif. Inst. Tech. 3,245.* 1 to 7 as in Table 1.

In a study of the distal articulation of the tibia another interesting character is uncovered by taking the ratio of maximum transverse diameter to maximum sagittal diameter. This ratio (Table 2) is least in *Phoenicopterus ruber* (78 per cent) followed in order by *P. stocki* (79.9 per cent), *P. copei* (80.5 per cent), *P. chilensis* (83 per cent) and *P. antiquorum* (87 per cent).

Two distal fragments of the humerus were collected at the Rincón locality. Both are from the left wing, and they differ markedly in size; the larger is almost equal to *Phoenicopterus chilensis,* and the other is smaller than any living species of which the skeleton is available. The question naturally arises as to their specific identity. There appears to be a great variability in size of wing relative to leg bones in the flamingoes. In two specimens of *P. chilensis* from the same source, the male has the longer but the narrower tibia. The humerus is, however, both longer and thicker. A similar high degree of variability is seen among several specimens of *P. antiquorum* of the same sex, date, and source.

In view of this variability among Recent birds it seems justifiable to allocate all the Pliocene material to a single species although the possibility of error must be conceded. There might possibly have been two species of flamingo resorting to the same lagoon just as today we may have several species of heron feeding in the same marsh or breeding in the same heronry. Akeley (1924:128) found two species of flamingo of different genera in the same flock at Lake Hannington in northern Africa.

As stated above, the only other fossil flamingo recorded from the Western Hemisphere is *Phoenicopterus copei* of the Oregon Pleistocene, a bird which Shufeldt (1892:410) considered to be "longer winged and longer legged and toed than *P. ruber.*" It inhabited a terrain that was probably not greatly different from the preferred niche of the living species of the genus, namely an open body of water with extensive mud bars from which the truncated nest-cones can be easily piled up or added to without much change of stance on the part of the builder. From this shallow mud pan the food of the flamingo is sifted by the peculiarly constructed beak held in the "topsy-turvy" position to which the birds have been structurally adapted at least since Oligocene time. It seems justifiable then to conclude that the Pliocene bird had the same habit and that the presence of pre-volant young accentuates the picture of shallow lagoon and mud flat.

Furthermore the birds seem to have a strong predilection for waters of a fair degree of salinity. The African bird is especially abundant about the bitter waters of the African plateau country. *P. ruber* is partial to those "half islands" in the Caribbean area, where water and mud are scarcely differentiated, and to the saline crater lakes of the Galápagos Islands. The Chilean bird finds in the semi-desert of Argentina, Chile, and Patagonia the same salt-pan environment (Hudson, 1920:

127). Is it not justifiable therefore to postulate a comparable environment in Pliocene time at the Rincón locality of Chihuahua?

The very word flamingo brings to the mind of an American ornithologist the thought of tropical regions, and unless he turns his attention to species other than the familiar *P. ruber* and *P. antiquorum* his judgment of the value that fossil flamingoes hold as climatic indices may be somewhat distorted. Hudson (p. 129) says that he "spent half a winter in Patagonia at a house built on the borders of a small lake, and regularly every night a small flock of Flamingoes came to feed in the water about 200 yards from the back of the house." These birds did not migrate to the milder latitudes in winter although Hudson had the impression that others of the same species that were reared at higher altitudes or farther from the coast did move to the northward in autumn. The Pleistocene flamingo from Oregon and this Pliocene species of Chihuahua do not necessarily indicate, therefore, a warmer nor yet a damper climate during those earlier epochs. They do, however, indicate a local ecologic niche that has disappeared.

A genus of birds that had reached the high degree of specialization seen in *Phoenicopterus* at a time as early as Oligocene (Milne-Edwards, 1868:53), when the horses were but the half-horses of *Mesohippus* stage, might be expected to have almost run their earthly course by Recent time. Perhaps it is not so strange that North America has more fossil flamingoes than there are represented in our living fauna.

Discussion

The New World has four living species of flamingoes belonging to two genera. Two species of the genus *Phoenicoparrus* are of restricted range and reduced numbers. The other genus, *Phoenicopterus,* has a wide range, with some striking interruptions in the specific range of *P. ruber.* The Old World likewise has two flamingo genera but with only two species. One of these (*Phoeniconaias*) again is more restricted in range, the other is wide ranging. None of the species is divisible into geographic races.

A first impression produced by this picture might be that the flamingoes had arisen as a New World group. But on the one hand, the Oligocene of Europe yielded to Milne-Edwards (1868:53) a fairly abundant fauna of phoenicopterid birds, including the typical genus as well as some less specialized in beak structure (Lambrecht, 1933:344). The number of individuals also is not insignificant. We get therefore an impression that the family was of considerable importance in the Oligocene avifauna. (Their subsequent withdrawal to the southward and the dropping out of many species follows a pattern that is not unlike those of some of the ordinal groups of mammals that are now better represented farther to the south, even in ultra-tropical latitudes.)

On the other hand we find no record for flamingoes in the New

World until much later. For fifty years the literature of American paleontology has held but one record, *Phoenicopterus copei* Shufeldt of the Oregon Pleistocene. The present paper furnishes the second record and takes the family back only to Pliocene time. The extensive Tertiary mammal beds of both North and South America are entirely lacking in flamingo remains. It seems hardly probable, then, that birds so gregarious as these could have held a place here comparable in importance with their position in the Old World. The phororhacid birds left such an extensive record in the South American Tertiaries that the flamingoes might properly have left a comparable record had they been present as a vigorous, evolving family. My own impression is that the family is a relatively late arrival in the Americas, where it has undergone minor differentiation and has survived with a greater number of living species than in its ancestral home, Eurasia.

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NESTING OF THE AMERICAN REDSTART [1]

BY BERNARD W. BAKER

FROM late June to early August, 1942, I studied five nests of the American Redstart (*Setophaga ruticilla*) at the University of Michigan Biological Station, Douglas Lake, Michigan. Since the early part of the Redstart nesting season was not covered in this study, the results reported here may differ somewhat from those obtained by other observers.[2] The nesting season in the Douglas Lake region starts in May. In 1939, at Wilderness Park, about 15 miles north of Douglas Lake, I found a nest about half finished on May 31. The season reaches its peak in June and ends in late July.

Most of the observations were made from a green canvas blind on a tower platform raised slightly above the level of the nest; some were made from the ground. Each young was marked with a daub of colored nail polish on the upper mandible, and both adults and young were banded. The net for catching the adults was made of three fine hair-nets, sewn together, and attached to a wire loop. This was placed over the nest at a 45° angle and held in place by strings. When flushed, the bird would fly directly into the net and thus was easily caught and banded.

Nesting Habitat

The preferred habitat of the American Redstart at Douglas Lake was second growth maple *(Acer saccharum)*, 15 to 30 feet high, situated on low-lying ground. This preference of the Redstart has been noted also by E. H. Short in New York (1893:197). Nests are found, however, in every kind of forest, from mixed birch, poplar, coniferous cedar forests, to ash lowlands, hemlock and tamarack. Nests 1, 2, and 5 of this study were in maple, Nest 3 in hornbeam *(Ostrya virginiana)*, and Nest 4 in black ash *(Fraxinus sambucifolia.)*

Territorial Behavior

In the last days of June and the first week of July, 1942, I found seven singing males and two nests with young (Nests 1 and 3) on an area of about one acre on Grapevine Point, about ¼ mile from the Biological Station buildings. The forest here was mostly a thick stand of young maples with a scattering of other deciduous trees.

The two nests were approximately 20 meters apart, and the seven males perched at intervals of from 10 to 20 meters in an area about 100 meters square. Hickey (1940:256) found that "the size of territories

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[1] Contribution from the University of Michigan Biological Station.

[2] I wish to express my appreciation to Dr. Olin Sewall Pettingill, Jr., and Dr. Theodora Nelson for their advice and assistance in my field work, and to Josselyn Van Tyne for aid in preparing the report.

was usually about one acre or less, but in one instance was compressed to about half an acre." He described the species as "highly territorial," and its intolerance of trespass by other Redstarts has also been noted by Short (1893:199) and Wood (1904:34). Wood, however, recorded one instance of a nest peaceably shared by two pairs.

I observed little territorial defense—possibly because my observations were made so late in the nesting season. At Nest 1, on July 4 and 6, the male drove off another male that entered the nest tree and came within two or three meters of the nest. But from two to four males sang all through the day within 100 yards of the nest tree, and occasionally two males sang at the same time within 40 feet of the nest. A strange male once (on July 14, when the young were six and seven days old) stayed near Nest 2 for 30 seconds without being chased away. The female scolded and then left the nest, returning after two minutes with two insects which she fed to the nestlings. Also a strange male perched within two meters of Nest 5 on July 15, and remained about 30 seconds; he was not driven off. The males of Nests 2 and 5 were both yearlings. The male of Nest 2 was observed at his nest only three times in 36 hours of observation, but he once displayed for two minutes near the nest (on July 12, two days before the young left the nest). Hickey (1940:255) has described the display as "short, horizontal, semi-circular flights made with stiffened wings and out-spread tails."

Song

The varied song of the Redstart has been adequately described by Frank M. Chapman (1907:293) and others. American Redstarts were singing in large numbers the last week of June and the first two weeks of July; song then gradually decreased, stopping altogether early in August. On Grapevine Point six and seven males sang during June and early July. On July 22, only three males were singing, and on July 28, only two (from the treetops instead of from the lower branches as before). July 29 and 30, I heard only one male sing each day. August 2, 3, and 4, I heard no singing at all in the area.

Singing was strongest during the morning hours. Mousley (1924: 286) states that it is unusual for the males of American warblers to sing in the nesting tree. At Nest 1, the male (a second-year or mature) often sang from the nest tree, sometimes when perched only a few feet from the nest. At Nest 2, the male (a yearling) was never observed singing in the nest tree. The males usually sang from a favorite tree near the nest, perched 4 to 15 feet from the ground, a habit also noted by Mousley (1924:285). Hickey (1940:255), however, did not observe the use of singing perches; he noted one male singing only one or two feet from the ground. Though both yearlings and second-year birds sing, the second-year Redstarts seem to have the stronger song.

I heard the yearling male at Nest 2, which was about 40 feet from my cabin, singing constantly while the nest was being built and during

the first days of the incubation period, but I never heard him sing during the latter part of incubation or at any time during the nestling period.

The female often chips softly at the nest, even when not disturbed or (apparently) calling her mate. I did not observe the females singing, though Jones (1900:36) said that the female "sings at least the more simple of the variations." Short (1893:197) said that the female utters a "sweet trill" during the mating period, but later, except for the warning call, becomes silent.

The last two days of nest life the nestlings make soft noises and flutter their wings when being fed.

Figure 1. Female Redstart on Nest 4. One nestling has worked its way through the side of the nest and strangled itself.

Nests

Nests were placed in an upright three- or four-prong crotch from 4 to 20 feet from the ground. Materials used in building the nests were birch bark, grapevine bark, milkweed fibre, feathers, grasses, and deer hair. Four were lined with deer hair, the fifth with grasses and fibres. Some nests had pieces of birch bark woven into the outside and the

bottom of the nest; the outside of one nest was mostly milkweed fibre, with no birch bark. Spider web was used in binding the outside of Nest 2 together. Chicken feathers were used in Nests 1, 4, and 5. Wood (1904:33) and Short (1893:198) found similar structure and placement to be typical of Redstart nests. Table 1 shows the measurements of five nests.

TABLE 1

Measurements of Redstart Nests

Nest	Total Width	Cup Width	Total Depth	Cup Depth	Height From Ground
1	65 mm.	48 mm.	60 mm.	25 mm.	6.00 m.
2	65	40	60	33	3.00
3	70	46	80	39	2.50
4	66	45	62	34	1.25
5	67	45	53	29	3.50
Av.	66.6	44.5	63	32	3.25

Incubation and Brooding

Nest 2 (found July 2) contained a Cowbird egg (which I destroyed) and three Redstart eggs; Nest 4 (found July 13) had three Redstart eggs; Nests 1, 3, and 5 (found June 30, July 5, and July 15) contained four, two, and three young, respectively. The usual clutch is four eggs, but Wood (1904:34) found that a second set "rarely exceeds three eggs." Victor Kehrer, Jr. (MS), found the incubation period of Redstarts to be 13 days; A. L. Sears (Chapman, 1907:292) reported about 12 days for one nest.

Only the female was observed to incubate or to brood. At Nest 2, the female spent 144 of 180 minutes observation time (morning hours) on the eggs; the seven intervals on the nest varied from 6 to 44 minutes (average, 22.1 minutes); the seven intervals away from the nest varied from 2 to 10 minutes (average, 5 minutes). After the first egg hatched (between 8:00 and 10:00 A.M., July 7) the female spent 227 of 294 minutes observation time on the nest. The young was not fed the first day; the second egg hatched early on the morning of July 8; the third egg in this nest did not hatch. The female was very uneasy during the hatching of the young and would spend 30 seconds at a time inspecting the eggs and young and picking around in the bottom of the nest.

For the first few days nestlings are brooded most of the time. At Nest 1, during the first few days of brooding, the female left the nest only long enough for the male to feed the young. Brooding intervals, however, are shorter than incubation intervals, averaging 9.1 minutes; the longest brooding interval I recorded was 18 minutes. At Nest 2, the female remained on the nest on July 7, the day the first egg hatched,

77 per cent of the observation time; on July 8, 73 per cent of the observation time; on July 12, 31 per cent; and on July 14, 27 per cent. (Observation periods ranged from 204 to 394 minutes in length.) On July 15, the day before the young left the nest, she brooded only 13 of 120 minutes observation (11 per cent). The day before nest-leaving, at Nest 1 (July 5) the young were brooded only 18 minutes (during rain) of 115 minutes observation time, and at Nest 5 (July 15) not at all during 119 minutes observation.

During rain the female extends her wings over the sides of the nest, with the head held straight into the air. The female at Nest 2 always continued to brood in the empty nest during the time (about five minutes each day) that I was photographing and weighing the young.

Figure 2. Mature male Redstart feeding young at Nest 4.

The two young left Nest 2 on July 15 and 16, at the ages of eight days, and (about) eight days nine hours. Mousley (1924:285) also recorded young leaving a nest at eight days of age.

Feeding

At Nest 2, the female took complete care of the young. I saw the male near this nest only three times, and saw him attempt to feed the young only once (on the first day). At the other nests the male and female shared in feeding the young. The male of Nest 1 did most of the feeding during the first days while the female brooded; later she increased her part in the feeding. At the nest observed by Mousley (1924:287) the female fed the young 32 times, the male 12 times, in 10 hours observation; he found the average feeding interval to be 13.6

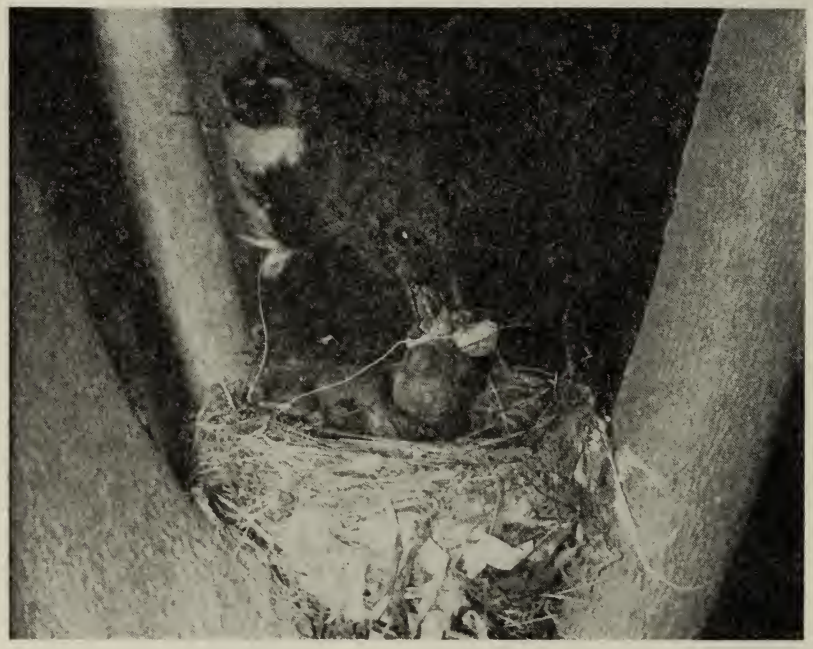

Figure 3. Mature male Redstart feeding young at Nest 1.

minutes. At the nests I observed, feeding intervals varied from 2 to 24 minutes. During the morning, nestlings were fed at average intervals of 11.1 minutes, in the afternoons, at average intervals of 13.6 minutes. The male at Nest 1 was once observed to feed the female on the nest (during heavy rain, in the afternoon of July 3, when the young were about six days old); at the same time he fed one of the young that had its head stuck out from under the female's wing. The male at Nest 2 likewise once fed the female, also during rain, during the early part of the incubation. Feedings increased in number during the last days of the nestling period. At Nest 2 the female fed the nestlings 24 times

in 290 minutes observation on July 9 (young, one and two days old), 44 times in 204 minutes observation on July 14 (young, six and seven days old).

Various kinds of insects and larvae were fed to the young—Mayfly *(Ephemera)*, Rosy Maple Moth larvae *(Dryocampa rubicunda)*, House Fly *(Musca domestica)*, and many others I could not identify. During a Mayfly hatch 90 per cent of the insects brought to the nests were Mayflies. It was not unusual for the male to bring in two or three Mayflies and feed two young on one trip. On one occasion a male brought four Mayflies at once and fed three young. Very small insects were fed the young the first day or two, larger insects later. The male at Nest 1 brought in more insects per load and fed more young than the female.

TABLE 2

Weights and Measurements of Redstart Nestlings

Date	Nestling	Age	Weight	Culmen	Tarsus
July 7	1	Hatched	1.10 gm.	.....	6 mm.
8	2	Hatched	1.20	2.0 mm.	5
8	1	1 day	1.80	3.0	7
9	2	1	1.80	2.0	6
9	1	2 days	2.64	3.5	9
10	2	2	3.00	2.5	8
10	1	3	3.95	3.5	10
11	2	3	4.20	3.0	11
11	1	4	5.30	3.5	13
12	2	4	5.50	3.0	12
12	1	5	6.10	4.0	15
13	2	5	6.56	4.0	14
13	1	6	6.93	4.0	16
14	2	6	7.15	4.0	16
14	1	7	7.50	4.0	17
15	2	7	7.84	4.0	16
15	1—Left nest 9:44 a.m. aged about 8 days, 1 hour.				
16	2—Left nest 2:05 p.m. aged about 8 days, 9 hours				

Nests were kept clean all through nestling life. During the first part of the nestling period the fecal sacs were eaten, but from the fourth day they were usually carried away. At Nest 2, on July 8, 9, and 10 (when the young were one to three days old), the female was observed to eat the sacs 20 times in just under 19 hours observation. On July 12 she carried away sacs six times and ate one sac in 261 minutes observation. On the following days she was observed to clean the nest eight times (in about five hours observation), and each time she carried the sacs away.

Growth of Nestlings

The young are very helpless the first day. They are naked except for some natal down on the dorsal feather tracts and on the head. Their eyes open on the fourth day. Primary feathers begin to grow on the

third day, to unsheath on the sixth day. At seven days the young began to preen their wing-feathers, and on the eighth day spent much of the time picking and preening. The four nestlings in Nest 1 weighed 7.90; 7.95; 7.70; 8.10 grams, respectively, on the day before they left the nest, when they were about eight days old. Table 2 shows the daily weight and growth of the nestlings in Nest 2. They were weighed and measured about 6:00 P.M. (E.S.T.) each day.

Nesting Success

Five of the six eggs found (Nests 2 and 4) hatched. The two young in Nest 2 reached at least nest-leaving age. One of the three young in Nest 4 worked its way through the side of the nest and was strangled. This was a poorly constructed nest and in bad condition due to rain. I did not visit this nest after July 19, so I do not know whether the other two young reached maturity. All 10 young found in Nests 1, 3, and 5 reached at least nest-leaving age.

Summary

Five nests of the Redstart (*Setophaga ruticilla*) were studied at Douglas Lake, Michigan, in late June, July, and August, 1942.

The preferred habitat was second-growth maple, but nests were found in every kind of forest.

Little territorial defense was observed.

The males were in full song until mid-July, when song gradually decreased, stopping in early August.

Only the female was observed to incubate or brood. Except at one nest, male and female shared in feeding the young.

Incubation intervals averaged 22.1 minutes, brooding intervals, 9.1 minutes; intervals between feedings, 12.3 minutes.

Fecal sacs were eaten during the early part of the nestling period; later they were carried away.

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Marne, Michigan

BIRD STUDY AND SEMI-CAPTIVE BIRDS: THE ROSE-BREASTED GROSBEAK

BY H. R. IVOR

SOME fifteen years' study of a number of species of song birds in a semi-captive state and comparison of their behavior with that of the same species in the wild, have shown me that observation of semi-captive birds is an important and dependable method of investigating specific patterns of innate behavior. This statement is illustrated by a detailed study, made in 1939, of two pairs of Rose-breasted Grosbeaks (*Hedymeles ludovicianus*) kept in semi-captivity near Erindale, Ontario. The results are here presented,[1] not as an exhaustive account of the species, but as a short general history of one breeding season of semi-captive Grosbeaks, to be used for comparison by those who have studied this and related species in the wild. "By semi-captivity I mean that any pair of birds which nest in the aviary are given day-time liberty during the period of egg laying and incubation and full-time liberty . . . during the time of rearing the young. . . ." (Ivor, 1941:415). For other results from semi-captive birds, see Ivor (1943 and 1944).

Early Song

The Rose-breasted Grosbeak begins singing about the middle of March, but like many native passerines, it does not come into full song until later. The early song is so faint that one has to listen carefully, even at a distance of three feet, to hear it. It is typically Rose-breasted Grosbeak, but, unlike the songs of a later date, it is continuous for as much as two or three minutes. Many of the low, sweet notes of the courtship song run through it. It is, in fact, much more like the courtship than the territorial singing. For about two weeks this faint song continues; then gradually, day by day, it becomes stronger until near the middle of April it can be heard quite distinctly at a distance of some 30 feet, though it is still uttered with the bill closed. It continues to develop, and about the first of May the bird is in full song.

Territorial Behavior

During the latter part of April (1939) there was some fighting in the winter aviary among the female Rose-breasted Grosbeaks, and the males became decidedly pugnacious toward one another. This fighting was due to competition, both for mates and (presumably) for territory, although gaining evidence for the latter is necessarily difficult in an aviary. The males drove the females with some ferocity during this period, but courtship chasing did not become unmistakably evident until later.

[1] The writer makes grateful acknowledgement to Margaret M. Nice who for a number of years has given me her support and encouragement in my studies of controlled birds, and who, with Josselyn Van Tyne, was of inestimable help in preparing the present paper. Thanks are also due to Hugh M. Halliday for the photographs which accompany the text.

I was unable, in the main, to distinguish between the territorial songs of a hand-reared male and a trapped wild male, except that at times the latter added two or three long-drawn high-pitched notes at the end of his song. The song of the hand-reared bird was, to my ears, typical of those I had heard in the wild state. (Territorial behavior during nesting is described below, under "Extent of Territory.")

Mating

Toward the end of April, I moved the birds I was keeping under observation (about 25 species, comprising some 75 individuals) to the summer aviary. This was a wire-mesh structure, 26 by 30 feet in area and 7 feet high. The main flight compartment, which was 10 feet wide, was in the center of the aviary with breeding compartments on either side. During the period of mating, this flight extended the full length of the aviary, north to south, but later its northern end was partitioned off for nesting compartments. (In the restricted space of an aviary where a large number of species desire territory and nesting sites, it is necessary, of course, to allocate these.) Hawthorn and arbor vitaes were growing in the main flight, seven-foot arbor vitaes in each of the nesting compartments.

As soon as it was possible to identify mated pairs, I placed pair No. 1 of the Rose-breasted Grosbeaks in a compartment, 6 by 16 feet, on the east side of the main flight; pair No. 2 in a compartment, 8 by 10 feet, on the west side. The birds of pair No. 1 were hand-reared, the male was four years old, the female three; this was their third mating together. The male of pair No. 2 was a trapped wild bird, not less than three years of age; his mate was a three-year-old, hand-reared. (The female of pair No. 2 was from the same brood as the male of pair No. 1; the others were not related.)

Courtship Song and Display

The courtship song and display of the Rose-breasted Grosbeak are of indescribable beauty, but they have apparently not hitherto been recorded. When pair No. 1 had been placed in the nesting compartment I saw the male fly to within two feet of the female, who was on the ground close beside me. He spread and drooped his rapidly quivering wings so low that the tips of the primaries grazed the earthen floor. His body was held in a crouching position with the breast almost touching the ground; his tail partly spread and slightly elevated; his head retracted so far that his nape lay against the feathers of his back. The mating song poured forth from his open beak as he moved toward the female, weaving his head and body in an erratic dance in which he resembled some magnificent butterfly rather than a bird. The downward and forward sweep of his wings revealed in striking contrast the blacks and whites of the separated flight feathers, the vivid rose of the underwing coverts, and the white of the rump. The song, quite different from the territorial song, was soft, low, and continuous, with a

great variety of notes; some of the sweetest notes were so faint that I had to listen intently to hear them even though the bird was only two feet away. The songs of the Hylocichla thrushes are of extreme beauty, but for pure rapture I cannot recall any song which equals the courtship song of the Rose-breasted (and the Black-headed) Grosbeaks.

As the song ended, he rushed at his mate, seized her primaries in his bill, and held on so long and so tightly that I was afraid he would break them. He repeated this action three times with no resistance on the part of the female until he let go; then she tried to bite him. Suddenly the female crouched, pointed her bill toward the sky, and spread her tail. Coition followed. Immediately afterward the female shook herself vigorously, and the pair touched beaks. At once the male began again to display, whereupon the female flew at him and closed her bill on his tail. He jerked away, flew to a branch, and began his territorial song.

I observed this courtship ceremony many times during the next seven days. There were times when the female after copulation would repeatedly mount the male, taking hold of his bill before she did so. Usually the behavior of the male was one of ecstacy, while that of the female was more subdued, but sometimes her excitement also was great. After the excitement had passed, however, it was usual for her to become quite ferocious toward him—even pulling whole tufts of feathers from his body. The courtship of pair No. 2 was similar.

Since I have never heard the mating song of this species in the wild, I am unable to compare it with that of male No. 1. However, the mating song of male No. 2, the wild bird, seemed to be like that of male No. 1. There was probably some variation, for it is unusual for any two birds to sing exactly alike, but because of the great variety of notes in the Grosbeak song it would take a trained ear to distinguish differences.[2]

Nest Construction

Since the majority of the Rose-breasted Grosbeak nests I had found in the wild were built in arbor vitaes, I placed clumps of branches of this tree in each nesting compartment. These and the 7-foot arbor vitaes growing in the compartments were examined by both male and female Grosbeaks, but more particularly by the females. In 1937 and 1938 I had had several times to change the locations of the various clumps in the compartment of pair No. 1 before the female would settle on a nest site, but this season (1939) she quickly chose the site

[2] During the lives of the progeny of pairs No. 1 and No. 2, a male Black-headed Grosbeak has been in the aviary. In 1940 and 1941 the young Rose-breasted males sang the typical song of the species. In 1942, all but one began to acquire some of the Black-headed notes, and by 1943 had lost their own song so completely that at times it was difficult to tell whether it was one of them or the Black-headed Grosbeak singing. The one male retained the song of his kind, with the addition of some Black-headed Grosbeak notes.

of her 1938 nest. Female No. 2, after examining both the growing arbor vitaes and the various clumps of branches, chose one of the former.

It had been my experience that the wild bird used dead hemlock twigs of varying degrees of fineness for building and lining the nest. I carefully collected similar twigs of this tree in sufficient quantity to allow for a large choice. Although I have observed these birds in the wild break the twigs from the tree instead of gathering them from the ground, I scattered over the ground in the nesting compartment most of the twigs I had gathered; the others I placed on the arbor vitae.

The female immediately began to examine these twigs with great care. Some were merely glanced at; others were tested in the beak. Many were discarded. When a suitable twig was selected, it was taken to the nest site and carefully placed in position. Twigs were chosen much more often from the ground than from the arbor vitae.

To show that these females had, in captivity, lost nothing of the nest-building ability of the species or the knowledge of the exact quality in a twig which is important, I may say that I had to gather fresh bunches of twigs several times. Unsuitability of the remaining twigs was evidenced by the bird continually picking them up and discarding them and even flying to the wire of the enclosure when I approached. As soon as I entered the compartment with a fresh lot, she would fly to my hand immediately and begin taking twigs from it before I scattered them.

Female No. 2 finished her nest on May 22 (I do not know the exact date she began). Female No. 1 began building on May 22, laid the first egg in the unfinished nest on May 23, and finished the nest on May 24. During previous years, male No. 1 had helped in nest building, but this year neither male did so. This year, male No. 1 entered the nest, at times when the female was away collecting twigs, and seemed to examine it.

I inspected the nests continually not only while they were being built, but also after they were finished, and could detect no difference between them and those of wild Rose-breasted Grosbeaks.

Incubating and Brooding

The eggs were incubated by both male and female. They were rarely left uncovered for more than the time required for one bird to leave the nest and the other to enter it. At times the sitting bird left the nest as the returning one entered the gate. At other times the sitting bird was reluctant to change places with the one returning. If the mate remained away for an unusual period, the sitting bird would sometimes show restlessness. It then might get off the nest to drink, but left the eggs uncovered only for the length of time necessary to go to the drinking dish and back. The eggs were turned often, and since the birds sometimes returned to incubating with the feathers somewhat

damp from bathing, the eggs were kept moist. The female invariably incubated the eggs during the night. During brooding of young, both parents carried on their activities for the first few days in much the same manner as when incubating.

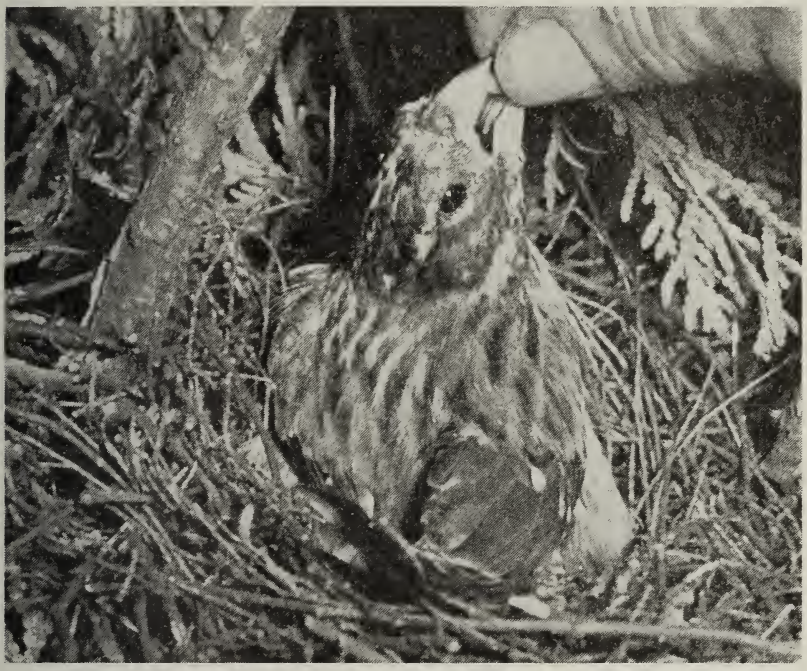

Figure 1. Female Rose-breasted Grosbeak being fed on the nest. About June 2, 1942.

Both parent birds gave a signal song when returning to the nest to exchange places (cf. Allen, 1916:54). These songs were shorter and much fainter than the territorial song. The birds also sang on the nest while incubating or brooding. The nest song of the tame and the trapped males seemed to be alike, but one must be very close to hear the female's nest song. (The female also sang while hunting food in the trees—a song similar to her nest song but louder. In general, she did not sing nearly so often as the male.)

Eggs and Nestlings

In their first nests three eggs were laid by female No. 1, four by No. 2. The eggs varied slightly in size, very little in color. Burns (1915: 285) gives 14 days for the incubation period, but I found 12 and 13 days (see Table 1). All seven young were reared to maturity. A slight variation was noted in the length of down between the nestlings of the

TABLE 1

INCUBATION OF SEMI-CAPTIVE ROSE-BREASTED GROSBEAKS
ERINDALE, ONTARIO, 1936–1939; 1942

	Nesting		Egg laid	Egg hatched[a]	Period[b]
Pair No. 1	1936	1st egg	May 26	June 7	
		2nd	27	8	12 days
	1937	1st egg	June 12	June 25	
		2nd	13	26	13 days
	1938 *A*	1st egg	May 27	June 8	12 days
	1938 *B*	1st egg	June 22	*broken*	
		2nd	23	July 5	
		3rd	23	5	12 days
	1939	1st egg	May 24	June 7	
		2nd	25	7	
		3rd	26	8	13 days
Pair No. 2	1939	1st egg	May 23	June 6	
		2nd	24	6	
		3rd	25	6	
		4th	26	7	13 days
Son of pair No. 2	1942	1st egg	May 26	*broken*	
		2nd	27	*broken*	
		3rd	28	June 10	13 days

[a] Since the eggs were not marked, it is not positively known that eggs hatched in the order of their laying, as tabulated here.
[b] Calculated from the laying of the last egg to the hatching of the last.

two pairs, but otherwise they seemed alike. So far as I have been able to ascertain, the exact age at which the egg tooth disappears in the nestling of the wild bird is not known; with the young in the aviary it had entirely disappeared 13 days after they hatched.

When the young of both pairs were within a short time of being ready to leave the nest, both females began to build again, outside of the aviary, leaving the care of the young almost entirely to the males. When I found and examined these second nests (nests of pair No. 2 on July 3 and July 10; [3] nest of pair No. 1 on August 1), they seemed to me typical of the species. In each, three eggs were laid, and three nestlings reared to maturity. I moved the nestlings to the aviary before they could fly. Thirteen young (nine males and four females) were reared this season, and all were perfectly normal. Thus two pairs of semi-captive birds hatched 100 per cent of their eggs and reared 100 per cent of their young. Five years later (1944) I still have in the aviary four males and one female from these broods and two of their offspring (females).

[3] The July 3 nest of female No. 2 was abandoned. The bird was on the nest when I discovered it, but there were no eggs. The nest may have been robbed.

Food Habits

When the first egg was laid in the nest of each pair, I made a small gate, two by three inches, in the wire mesh enclosing each compartment, and placed a shingle platform in the opening. In a very short time all four Grosbeaks found these gates and started visiting the woods surrounding the aviary to seek natural food. Even then the eggs were

Figure 2. Rose-breasted Grosbeak male No. 1 feeding young twelve days old. June 18, 1939.

never left uncovered for more than a few moments, only one bird of a pair leaving the aviary at a time. During incubation, the usual food (a great variety of seeds and grains, fruits, vegetables, mealworms, and crushed shells) was placed before the birds, but they ate very much less of it than before they had had their freedom. They now took only their favorite foods, such as mealworms, raw peanuts, and sunflower seeds, for insect life was plentiful in the surrounding woods, and the Grosbeaks had lost none of their natural ability to recognize and secure them as food.

Just before nest-leaving, the parents fed the young a small amount of "nestling food," a quite wet paste made up of various ingredients, which I supplied. But except for this, they did not use artificial food in feeding the nestlings. To the newly-hatched young they gave very small amounts of soft-bodied insects that had been broken up and rolled around in the mouth until heavily coated with saliva.[4] They inserted the food into the throats of the young with extraordinary gentleness and extreme care. I was able to watch all of the activities of the three hand-reared adults as closely as I desired; but male No. 2, the trapped bird, was very wild and flew at me, screaming, if I approached the nest while he was there. I could handle the eggs and young of pair No. 1 (both hand-reared birds) without arousing any resentment on their part; but female No. 2 (also hand-reared) showed that she preferred that I not handle the young by gently taking hold of my finger with her bill. She showed real mistrust, however, only when I attempted to feed the nestlings. Either she would snatch the food off the food-stick as I was putting it into the mouth of a nestling, or, if I succeeded in inserting the food, she would take it out of the nestling's mouth and place it there herself much more carefully than I was able to do.

As the young grew, the parents fed them a greater number of insects, and larger insects, than before, but they showed just as great care in feeding them as when the young were newly hatched. When a large caterpillar was given, it was first well beaten, then one end was held in the beak of the parent until a secure grip was taken by the nestling and the act of swallowing was evident. The caterpillar might be withdrawn several times before the parent seemed satisfied that the nestling would have no difficulty in swallowing it. So far as it was possible to see (and with the exception mentioned above), the young were fed entirely on insects, a small amount of green stuff (apparently a tree-leaf), and at times, a little earth.

Nest Sanitation

When the young were newly hatched and during the first hours of their life the feces were not contained in a sac, but were ejected very weakly, in a small, almost thread-like string, after each feeding. The parents were exceedingly careful to see that all of the excrement was passed, even to the extent of pulling it from the vent. At this stage they always ate, and even competed for, the feces.

After the sac was formed, the parents were just as careful that it be removed immediately. After feeding they watched for the movement of the nestling which indicated that evacuation was about to take place and usually took the sac in the beak before it could drop into the nest.

[4] This great care in the preparation of food may in some measure explain the statement of Esten (1935:400) that the Rose-breasted Grosbeaks he observed "always regurgitated all foods given." I am quite convinced that these Grosbeaks do not regurgitate at any time.

At first they usually ate the sacs, but as the young grew older and the sac larger it was eaten less often. When not eaten, it was carried some distance before being dropped.

Independence of Young

When the young of pair No. 1 were 27 and 28 days old, the father began to feed them less often, and with growing reluctance. The mother, who now returned only at rare intervals to the compartment, struck at them with her beak if they coaxed for food. When they were 30 days old the father also became exceedingly ill-humored. He brought insects to the compartment, but when feeding the young, he literally jabbed the food into their mouths and immediately afterwards struck them on their bills. His irascibility was so great that they became decidedly afraid of him. Neither parent was seen to feed them after that age. I had first seen the fledglings taking seed for themselves when they were 28 days old.

The young were not allowed liberty during this year. But when they were learning to fly (at about 12 days of age), several of them were coaxed out of the aviary by the parents. All but one (a female) were found within a day or two and placed back in the compartment. I was unable to find the young female, but when she was 26 days old the father showed her the way into the aviary (or she may simply have followed him in). She had been at liberty for 14 days. When the young were put back in their compartment, I placed a guard over the entrance on the inside so that the young could not find their way out. This guard was complicated, but the parents had no difficulty in solving it.

Extent of Territory

During the time the birds had their liberty, it was quite easy to plot their territory roughly. The boundary line between the two territories was the main compartment of the aviary (extending north to south between the two nesting compartments) and a partly undetermined line running north from the aviary through the woods. The territory of pair No. 1 (whose compartment was on the east) was east of this line: the territory of pair No. 2 was west and southwest. Although the gates to the nesting compartments were alike, I observed almost no territorial trespass. What little there was occurred when male No. 2 (the trapped bird) neglected his brood for a time while his mate was busy with her second nest. On several occasions during the period of neglect, male No. 1, having arrived at his own entrance with food for his own nestlings, heard the brood of pair No. 2 literally screaming for food. He flew over the top of the aviary to the gate of pair No. 2, entered, and fed the young.

Since the second nestings were outside the aviary, it was more difficult to determine the territories exactly, but the boundary line between them seemed to be a continuation of the line between the earlier

territories. This was natural, since the males were for a time taking care of the first broods. The distance between the two second nests (somewhat more than 100 feet) was considerably greater than that between the two first nests. Female No. 1 built the second nest 115 feet north of her first; female No. 2 built 60 feet west of her first. I observed no fighting or chasing during either nesting.

Roosting

In sleep the head was placed on the back, either to the right or left, in varying positions. The positions varied from one in which the beak and most of the head were buried in the scapulars and lying alongside the wing, to one in which the beak and lower part of the forehead were buried under the wing about half an inch back of the elbow. The head might be placed in any position between these two extremes. Sometimes the whole beak, sometimes only the tip of the beak, was placed under the wing. The bird raised its wing slightly when placing its head in the extreme position (beak and lower forehead under the wing), and also when withdrawing the head from this position. (Although the whole head was never placed under the wing, the expression "with its head tucked under its wing" is, in my opinion, not entirely a misconception.)

Alertness

During the breeding season, a pair of Cooper's Hawks nested within about a hundred yards of the aviary. Screech Owls, which here prey extensively on smaller birds, also nested in the vicinity. That hawks killed many wild birds was evident from the feathers of their prey found on two or three stumps in the woods not far from the aviary. It is clear, therefore, that my birds, when allowed their freedom, needed all the natural alertness of the species.

When the young from the second nest of pair No. 2 were just beginning to fly, the father (the wild male) was killed by one of the Cooper's Hawks. Part of his body and his feathers were found a short time later on one of the above-mentioned stumps. He had been in perfect health, exceedingly alert, and quite untameable. Yet he was the only one of the 4 adults and 13 young that was killed. The male of pair No. 1 lived for nearly eight years, at last being killed by a Sharp-shinned Hawk. One of the females lived for seven years, the other for five.

Homing Instinct

As noted above, when gates were made in the aviary walls, all four Grosbeaks discovered them within a short time. Since three of these birds had not had natural food for 8 or 10 months, their first visit to the woods, where they gorged insects, was somewhat protracted. None had any difficulty whatever in finding the aviary again, nor any difficulty in finding its own compartment and entrance gate. With both

pairs, it was the male that went out of the aviary first. Upon his return, the male took his place on the nest, and the female went away to the woods. After the first departures from the aviary the length of outside visits became normal. For example, on June 12, when the young were four and five days old, the male visited the nest with food at 5:56, 6:09, 6:23, 6:27, and 6:35 A.M., the female at 5:44, 6:16, 6:19, 6:30, and 6:50 A.M. These may be considered normal for the nestling period. During incubation, returns to the nest had been less frequent.

Molt

It might be contended that the artificial food supplied to these aviary birds would affect the duration of the molt. In my opinion, however, such is not necessarily the case. Not only are the birds very adaptable, but the food supplied to them approximates that which they get in the wild. During the time they are kept entirely in the aviary, weed seeds supply a large part of their requirements, and the seeds are supplemented by various other foods such as fruit, flower buds (hawthorn, apple, etc.), and greenstuff. During the nesting season, which may cover a period of three months, they live almost exclusively on the natural food which they secure in the same habitat as the wild birds do theirs.

My records over many years show a consistent period of almost four months for the prenuptial molt. Some changes in plumage can be seen early in January, and the molt is finished toward the end of April. This molt is not complete: in the adult, the primaries, secondaries, and rectrices of the previous year are retained; but in the young, some of the flight feathers are renewed during the first prenuptial molt. Some of the young then acquire entirely new tails, others only one or more pairs of new rectrices; some acquire two or four new primaries and two new secondaries on each wing. The third prenuptial molt (spring of the bird's third year) perfects the body plumage.

The postnuptial molt begins toward the end of July and is complete by about mid-September. In the young, the second postnuptial molt (July of the bird's third year) produces the full adult plumage in the male.

Migratory Tendencies

In order to reach a definite conclusion about whether or not migratory instinct is dulled or obliterated by keeping birds captive, a very difficult series of experiments would have to be carried out. As each migration season approached, my captive Grosbeaks showed a decided restlessness, flying from perch to perch in the aviary all night. They continued this for a longer period than the migration of the wild birds would cover. I observed a certain amount of night restlessness in male No. 1 until the time of his death, at the age of nearly eight years, and

in the two females for at least five years. However, as the years passed, the restlessness became less pronounced and lasted for a shorter period. A similar decline should perhaps be expected to occur in wild as well as in captive birds, and to be evident, not only in the expression of the migratory instinct, but in all forms of natural behavior. As old age approaches, both physiological and psychological processes are slowed down.

Birds of the second generation also showed restlessness in the aviary during migration seasons, but there seemed to be some diminution. So far, I have been unable to determine whether or not this applies to the third generation of my Grosbeaks, but restlessness in them seems to be confined to wakefulness on moonlight nights.

Comment

The above observations agree with my experience with some sixty species of native song birds which I have studied under controlled conditions. And they support the conclusion that the patterns of innate behavior of a bird kept in semi-captivity may remain fundamentally unchanged. I should like to emphasize, however, that the conclusion does not necessarily apply to all species of birds, and that it is only birds kept in a proper environment that will yield valuable results in behavior study. Birds kept caged under completely unnatural conditions will, of course, behave unnaturally (see Scott, 1904).

The comparatively close quarters of even the largest aviary may magnify antipathies, which can result in much more severe fighting than would be usual among wild birds. This, however, is only an exaggerated form of natural behavior, not a fundamental change. Preliminary selection of territory and its defense also modified in an aviary. But it is clear from the above Rose-breasted Grosbeak history that, with these possible exceptions, the innate behavior of my semi-captive birds did not differ from that of wild birds to a greater extent than could be caused by individual variation. That a controlled bird will differ from a completely free bird is self-evident, but it differs simply by the addition of learning to innate behavior. Since this paper deals only with innate behavior patterns, no description has been given here of the innumerable instances of learning, nor of the insight into bird psychology gained through the study of controlled birds. Such study does not take the place of observation of wild birds, but is supplementary to it, and yields exact and detailed knowledge that is otherwise difficult or even impossible to obtain.

Summary

To illustrate the value of semi-captive birds in the study of bird behavior, an account is given of detailed observations, made in 1939, on two pairs of Rose-breasted Grosbeaks (*Hedymeles ludovicianus*) which were kept in semi-captivity near Erindale, Ontario.

Song is not fully developed until about the first of May, but a faint

early song, different from the later territorial and courtship songs, begins near the middle of March. Territorial behavior is evident during the latter part of April. Courtship song and display (here first described in detail) begin in late April or in early May.

One female laid four eggs, the other three eggs, in the first nests of the season (built in the aviary in the latter half of May); three eggs were laid in each of the second nests (built outside the aviary).

All 13 eggs hatched and all 13 young were raised to maturity.

The parents shared in incubating, in brooding, and in the care of the young. When the females started the second nests, the males took almost complete charge of the first brood.

The incubation period was 12 to 13 days; nestling period, 10 days; period of dependence of young after nest leaving about 20 days.

The parents used a signal song when exchanging places on the nest, and also sang on the nest while incubating and brooding.

When allowed freedom after the first eggs were laid, the birds regularly visited the woods to feed on insects, ceasing almost entirely to use the artificial food provided in the aviary.

The young were fed insects, greenstuff, and a little earth (a small quantity of artificial nestling food was given them just before nest leaving).

The excrement was eaten by both parents during the first days of the nestling period; later, it was sometimes eaten, sometimes carried away.

Both pairs observed territorial boundaries.

One male several times fed the nestlings of the other male, when these were neglected by their parents.

The Grosbeaks lost none of their natural alertness in semi-captivity.

They found the entrances to the aviary without difficulty after foraging in the woods.

The prenuptial molt (not complete) extends from January to April, postnuptial molt (complete) from July to mid-September. In the first prenuptial molt some flight feathers are renewed, but the adult retains the flight feathers from the previous year. The third prenuptial molt perfects the body plumage, the second postnuptial molt produces the full adult plumage in the male.

At the time of spring and fall migration, the captive birds showed night restlessness, which decreased as the birds grew older.

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Cooksville, Ontario

THE CHESTNUT-COLLARED LONGSPUR IN MANITOBA

BY R. D. HARRIS

THE nesting habits of the Chestnut-collared Longspur (*Calcarius ornatus*) were studied during the years of 1930 to 1932 inclusive, on a half square mile of prairie pasture on the western outskirts of Winnipeg, Manitoba.[1] A total of 23 nests were observed.

Migration

Spring. The first arrivals were noted on April 10 (1932), April 11 (1930), and April 12 (1931). The main migration began a day or two later, and lasted until about April 18. After that date, occasional birds were seen flying overhead, but such flights seemed to be only local wanderings. On the first day of migration, no more than a single individual was usually noted, but afterwards 10 or 12 were counted in a day. They arrived principally during the forenoon, either singly or in groups of two or three.

Autumn. The birds collected into flocks before turning southward. Young birds were the first to gather, frequenting the outskirts of the nesting areas. With the termination of nesting about the middle of August, adults joined the flocks of juveniles. The species then entirely abandoned the grassy breeding grounds, and was found in adjacent ditches, dried-up sloughs, and similar low-lying, rough ground (though rarely stubble or plowed land). This rather remarkable change of habitat may be due to the availability of the autumn crop of weed seeds, combined with the reduced number of grasshoppers, which constitute the bulk of the species' food in summer; but the cause may lie deeper than that, and involve the psychological and physiological changes bound up with migration. Young and old together spent the last half of August in the new habitat, in loose, restless flocks numbering up to 30 or more individuals. During September, southward migration began, and the latest date on which I noted the species at Winnipeg was September 28.

Pre-nesting Period

Habitat. On arrival in April the birds settled immediately on their breeding ground. In the present study, this consisted of prairie, its flatness relieved by occasional low ridges and shallow sloughs. The dominant vegetation was composed of grasses of the following species: *Panicum virgatum, Poa arida, Agrostis hyemalis* and *Agropyron tenerum.* Wolfberry (*Symphoricarpos occidentalis*) in straggling

[1] The writer is indebted to B. W. Cartwright, A. H. Shortt, and T. M. Shortt for their generous assistance in the course of the investigation, and to Margaret Morse Nice for reading a preliminary draft of this paper. [Mr. Harris, overseas with the R.C.A.F., was unable to check the final proofs of this paper, but Margaret M. Nice and T. M. Shortt have given invaluable help in preparing the manuscript for publication.—Ed.]

patches, prairie sage (*Artemisia gnaphalodes*), goldenrod (*Solidago canadensis* and *S. hispida*), and gum-weed (*Grindelia squarrosa*) were also present.

Courtship and mating. During a visit to the nesting area on April 14, I found the birds widely scattered and wandering restlessly. I heard no singing. Although the snow had disappeared and higher spots were dry, low-lying areas were covered with water. Only a few insects had appeared. Five days later the land had dried considerably. Both males and females were present in abundance, and a few males were in song. At least two males, one of which was accompanied by a female, appeared to have staked claims to territories. On April 27, singing was vigorous, and swift erratic pursuits of females by males were frequent. On May 9, I observed competition between males for the same female, once seeing as many as four males together, fighting, singing, and springing aloft in outbursts of zeal. By May 22 all the birds were paired.

Territory. A nesting territory of this species is usually roughly circular in shape, and comprises an area of short, open grass, with a variable quantity of wolfberry used by the male for perches. Two territories that were measured contained 25,000 and 45,000 square feet respectively. The territory has no definitely marked boundary, but merges into an area of unclaimed ground which the nesting pair may occasionally visit. Tussles between neighboring males sometimes take place in this area, both on the ground and in the air, and always seem to end with the retreat of the one that has ventured the farther from his own territory.

Nesting

Nest construction. The nest is located in the central part of the territory. A second nest built by one pair was placed 40 feet away from their first nest; another pair built their second nest 100 feet from their first. These moves involved no alteration in the boundaries of the territories. The nest is built on the ground, in light to moderately thick grass, sometimes in a scattered growth of short wolfberry. Of the 23 nests found, 10 were beside cattle droppings. DuBois (1935:70-71) records several nests well concealed. In the present study the nests were usually situated in rather sparse cover a few inches high. Only one nest was located in heavy grass. Grass was always the main cover plant; in four instances, wolfberry contributed to the concealment; gum-weed was present around one nest, and other herbaceous plants around another. The poorer concealment noted in this study, as compared with the findings of DuBois, may have been partly attributable to grazing and to the abundance of grasshoppers. The nests measured in internal diameter, 2.2 to 2.6 inches; in internal depth, 1.5 to 1.9 inches. The lower portion of the nest fits into a hollow in the ground, excavated, according to Bailey and Niedrach (1938:244),

by the female. Above ground, there is a large, solid rim of dry grass. The wall is thin but firmly woven, of dry grass, with, occasionally, leaves and herbaceous stems; it is usually lined with finer grass, and in two nests a little horse or cow hair was added to the lining. In the nests described by DuBois (1935:71), only grass was used in the main body of the nest, with hair often added in the lining.

Nesting season. During the three seasons of this study, I found a total of 23 nests (Table 1), the earliest on May 27 (two nests: No. 11, which contained one egg; and No. 12, which was under construction), the latest on August 1 (nest No. 23, which contained one egg and four young). Sixteen of the nests contained eggs when found, three contained young, three contained both eggs and young, and one (mentioned above) was under construction. I found nests with young as early as June 13 (Nests 13 and 14), but the earliest hatching I actually observed was June 23 (Nest 15). Table 1 summarizes the nesting data; Table 2 presents an analysis of egg-laying dates.

TABLE 1

NESTING DATA FOR THE CHESTNUT-COLLARED LONGSPUR AT WINNIPEG, MANITOBA, 1930–1932

Nests	Date found	Contents when found	Total eggs laid	Date of hatching	Size of brood	Date of nest-leaving
No. 7	June 29	5 e	6	July 10	6	July 19
8	July 17	5 e	5	July 19	4	
9	July 31	5 e	5	Aug. 5	5	Aug. 14
10	July 31	4 e	4	Aug. 1–4	3	Aug. 11–13
11	May 27	1 e				
12	May 27	0				
13	June 13	1 e, 4 y			4	
14	June 13	1 e, 5 y			5	
15	June 13	5 e	6	June 23–24	6	July 3–4
16	June 16	5 y			5	
17	July 8	1 e	4	July 21	3	July 31–Aug. 1
18	July 17	5 e	5	July 27–29	5	Aug. 4–6 ?
19	July 18	5 e	5	July 23– ?	?	
20	July 20	4 e	4	July 23–?	3	Aug. 2–3
21	July 20	4 e	4	July 23–24	4	
22	July 26	5 y			5	July 26
23	Aug. 1	1 e, 4 y			4	Aug. 7–8 ?

e = eggs; *y* = young.
See text for data on Nests 1 to 6, and for further data on Nests 8, 11, 12, 17, 18, 23.

Description of eggs. Thirty-four eggs, comprising eight sets, were measured. The means were as follows: long diameter, 20.0 ± 2.0 mm.; short diameter, 14.5 ± 1.2 mm. Their shape was ovate, but in one set examined the eggs were unusually rounded, almost broadly elliptical. One abnormal egg was seen—not included in the above measurements—

the smaller end of which was elongated for about 3 mm. DuBois (1935:69) records one set (out of 21 sets found) of small, nearly spherical eggs. The ground color of the eggs ranged from a greenish white through various shades of white, gray and buff, to a deep brownish buff. The first and last shades were unusual, however, and the most common color was one varying from gray to pale buff. The markings consisted of deposits of dark reddish-brown pigment, either on or below the surface of the shell, in the latter case appearing a cloudy lavender color. The markings varied from fine specks and lines to heavy irregular blotches (a wide mixture occurring in a single egg), and were most dense at the larger end.

Date of laying. Table 2 shows the distribution (by 10-day periods) of the dates of completing egg-sets in Manitoba, together with a similar distribution given by DuBois (1935:69) for Montana. A comparison

TABLE 2

Distribution by Ten-Day Periods of the Dates of Completing Egg-Sets

DuBois, Montana		Harris, Manitoba	
Period	No. completed	No. completed	Nests
May, 1st third	1 (4.5%)	0	—
2nd third	5 (22.8%)	0	—
3rd third	2 (9.1%)	3 (17.6%)	Nos. 11, 13, 14
June, 1st third	6 (27.3%)	3 (17.6%)	Nos. 8, 12, 16
2nd third	2 (9.1%)	1 (5.9%)	No. 15
3rd third	3 (13.6%)	1 (5.9%)	No. 7
July, 1st third	3 (13.6%)	1 (5.9%)	No. 22
2nd third	0	6 (35.3%)	Nos. 17–21, 23
3rd third	0	2 (11.8%)	Nos. 9, 10
	22 (100.0%)	17 (100.0%)	

Data from 17 clutches (Nests 7 to 23—see Table 1). The date of laying of the final egg was known from actual observation at three nests (Nos. 7, 15, and 17); hypothetical dates of May 30 and June 3 were used for Nests 11 and 12 (see text); for the remaining twelve nests the date of laying of the final egg was calculated on the basis of an ascertained laying rate of one egg per day.

of the two sets of figures shows that nesting is one or two weeks later in Manitoba than in Montana. The figures also point to the existence of two main egg-laying periods. In the present study, the first main period extended from late May through early June, the second from July 11 to 20. The date of laying the first egg of a clutch was known from actual observation at two nests: May 30 at Nest 12; July 8 at Nest 17. The date of laying the last egg of a clutch was known at three nests: June 30 at Nest 7, June 14 at Nest 15, July 11 at Nest 17. Thus both dates were known from actual observation only at Nest 17:

July 8 to July 11 (a clutch of four). The dates for other nests were calculated, however, on the basis of an ascertained laying rate of one egg per day.

Number of sets. Two of the pairs under observation each completed at least two nestings in a season. Apparently no change of mates took place, but this point was not definitely ascertained. In the case of one pair (Pair C), laying of the first clutch began on June 9 (nest No. 15, Table 1); the six young left the nest on July 3 and 4; on July 8 laying of the second clutch (nest No. 17) began; only four eggs were laid; the young left on July 31 and August 1. Pair B had been observed feeding a brood of young in their territory when their first observed nest (No. 7) was found on June 29. The nest contained five eggs, a sixth egg was laid on June 30, and six young left the nest on July 19. The young they had been feeding remained in the territory until July 6. Another nest (No. 9) of this pair was found July 31, when it contained five eggs; five young left on August 14. DuBois (1935:69) concludes from his tabulation of data (summarized with mine in Table 2 of this paper) that "the distribution of dates . . . leaves it uncertain whether more than one brood is raised each year," and that the protracted nesting season may be due to repeated unsuccessful trials. But it would seem from the above evidence that three broods are at least occasionally raised in a season, while two per year is a common condition, and perhaps the normal one.

Size of clutch. The following data are taken from the clutches known to be complete (nests Nos. 7-10, 15, 17-21,-Table 1): number of clutches, 10; number of eggs, 48; average number of eggs per clutch, 4.8. The frequency distribution is as follows: 4 clutches of four; 4 clutches of five; 2 clutches of six. In Montana, DuBois found (in 20 sets known to be complete): 14 sets of four eggs; 6 sets of five; none of six. Pairs A, B, and C, all known to have nested twice or three times, each had a clutch of six in their first observed nest of the season; Pairs A and C had clutches of four, Pair B, a clutch of five in the second observed nest of the season.

Incubation. Eggs are laid on successive days. Although laying appears to take place only in the early part of the morning, the female is usually to be found on the nest at any time of day. The incubation period (from the laying of the last egg to the hatching of the last), determined at three nests (Nos. 7, 15, and 17), was 10 days, though DuBois (1935:70) records 12½ days for one nest (in Montana). Incubation is by the female only. She is difficult to flush, and some individuals, when discovered, drag themselves away through the grass with wings half spread and fluttering. Once having left the nest, she remains hidden until the observer has gone.

Activities of male. During the incubation period, the male divides his time between feeding quietly in his territory and mounting guard on his favorite perch. Wolfberry is used by the male for perches—

though he may also select stones, fences, and telephone wires when these are present. Perches are rarely used by the female during nesting, but regularly by the male, who selects one or two definite stations near the nest. He watches attentively for his mate, and when she flies to or away from the nest, he follows and alights beside her. Now and then throughout the day he launches himself into the air, rises to a height of 10 to 50 feet, spreads wings stiffly, and, floating slowly to earth, delivers his short, clear melody. At the approach of a human intruder, the male retires to his favorite perch, from which he marks the intruder's progress. With uneasiness growing stronger, he takes wing and flies back and forth over his territory, giving utterance to a warning *wheer* note and sometimes a song. Some males have a habit on these occasions of reaching the highest point of their flight directly over the nest.

Hatching. In one observed case, hatching of one egg required over half a day, but in the majority of cases it seemed to take a shorter time. An irregular series of perforations is made by the young bird around the circumference of the shell about mid-way down the main axis. When the cut is completed, and the young bird has finally extricated itself, the two halves of the shell are carried away by the parent; pieces of shell have been found as far as a hundred feet away from the nest.

Young

First day. Newly hatched birds lie prone in the nest, flexing their limbs only occasionally, and raising their heads with difficulty. They are covered with buffy gray down about one-fourth inch long. On the capital tract two rows of down, beginning at the loral region, run posteriorly to the occipital region, where they join a transversely placed tuft. An isolated tuft stands above each eyelid. A wide patch occurs in the spinal region, narrowing as it enters the pelvic region. Down is abundant in the humeral tract. In the alar tract, it is distributed in two rows on the dorsal surface. A prominent patch is found in each femoral tract, and scattered tufts can be detected in the crural tract. Mandibles are flesh color, darkening at the tip. Tarsi, toes, and claws are pale flesh color.

Second day. The young show a little more activity on the second day. They are brooded by both parents [2] alternately for periods of from one to 20 minutes, each period being terminated by the arrival of the other parent with food.

Fourth day. Feather sheaths in all tracts are above the skin. The eyelids are now separated but cannot be moved.

Sixth day. The birds struggle when handled; eyelids are movable; feathers are beginning to break sheaths on all parts except the head.

[2] In my notes, the male is recorded as taking part in brooding, but Margaret Morse Nice (1943, *in litt.*) thinks that if a bird does not incubate it probably doesn't brood, and suggests that the male Longspurs may have merely stood over the young as she has observed male Song Sparrows do. I have not had the opportunity to clarify the point.

As an indicator of the rate of feather growth, the length of a single primary was measured daily in the case of several birds. Plotted graphically, these measurements showed an almost constant rate of growth, and graphs of the measurements of young from two different nests were almost exactly equivalent. Starting at zero on the second day, growth proceeded at the rate of 2 mm. per day up to the fourth day; it then maintained a steady rate of 3 mm. per day for the remainder of the nestling period.

TABLE 3
CARE OF YOUNG (AT NEST 18)

	Age 1–3 days	Age 5–7 days
Period observed	July 30, 11:00–12:04 A.M.	Aug. 3, 11:15–12:18 A.M.
No. nestlings	5	5
Feedings by ♂	8	2
Feedings by ♀	9	24
♂ brooded[a]	Twice (total of 4 min.)	0
♀ brooded	8 times (total of 44 min.)	0
♂ cleaned nest	Once[b]	0
♀ cleaned nest	Twice[c]	7 times[d]

[a] See Note 2 of text.
[b] ♂ swallowed one sac, flew away with one.
[c] ♀ swallowed three sacs.
[d] ♀ carried away sacs.

Parental attention. Male and female share the burden of caring for the young in the nest, but the male's part is a subordinate one. Brooding periods become progressively shorter, and daytime brooding ends altogether on the fifth day after hatching. Thenceforward the daylight hours are spent, by the female particularly, in an almost ceaseless hunt for and transport of food. Both parents clean the nest, either swallowing the sacs or flying off and dropping them some distance way. Two observations on feeding visits are summarized in Table 3. As the nestling period progressed, rate of feeding and of nest cleaning increased, though the male grew less attentive. So far as could be determined by observations from blinds placed two to three feet from the nests, the almost exclusive food of nestlings is grasshoppers, which, during the years when the present study was made, were extremely abundant. Species collected are as follows: *Chorthippus curtipennis, Camnula pellucida, Arphia pseudonietana, Melanoplus dawsoni, Melanoplus bivittatus, Gryllus assimilis* (identified by Norman Criddle).

Nest leaving. The young left the nest when 9, 10, or 11 days old; DuBois (1935:68) gives a nestling period (one nest) of "about 10½ days." The actual departure of a brood was witnessed once. The move-

ment, perhaps stimulated by my activity around the nest, began without warning. The birds suddenly became very restless, kicking violently, and soon were panting hard for breath. After a few minutes they stopped simultaneously, and were quiet for about ten minutes. Again they began, and this time one bird, curiously enough the smallest of them all, pushed itself over the rim and crawled and hopped away from the nest in a wildly erratic course, finally coming to rest beside me two feet from the nest. Meanwhile, another bird, which had projected itself over the opposite side of the nest, turned back, and, shoving itself across the backs of its fellows in the nest, went toward the first one. The birds began to utter the *chi-eep* note and were answered by their parents, which were flying about overhead. After a general period of rest, a third one managed to scramble out, and the second one, in amazingly strong hops, followed an aimless course around the nest.

Post-nestling Period

On the day of nest leaving, the bird is quite incapable of flight, and, except for occasional attempts at hopping, it remains crouched in the grass, receiving food from its parents. It grows, however, with extraordinary rapidity. After another day it is able to fly, when alarmed, for 100 feet or more. The flight is direct and labored. After alighting, the bird crouches upon the ground—I did not determine the age at which it is able to stand upright and walk.

Fourteen days after hatching (four days after leaving the nest), the young bird begins to use the *til-lip* call note characteristic of the species. Its flight has now become undulating.

On the fifteenth day the bird is still being fed regularly by the male parent and occasionally by the female. If another nest is to be started, the female stops caring for the young at a time varying from two to seven days after they have left the nest; thenceforth they are in the sole care of the male.

By the twenty-fourth day, the bird appears to be fully grown. It may still be attended by the male parent, but it has sometimes to assume a begging posture, with wings outspread and fluttering, before the parent will give it food.

It begins to wander at large on about the twenty-sixth day. If the parents are finished nesting, young and old go off together, but otherwise the young bird joins roving bands of juveniles.

Nesting Success

For the three seasons of this study, nesting success was remarkably high. In 10 nests for which there are adequate data (Nests 7, 9-12, 15, 17, 18, 20, 23—see Table 1), a total of 44 eggs were laid (this includes *five* eggs for Nest 23 where four eggs had already hatched when I discovered the nest). Of these 44 eggs, three failed to hatch (one each at Nests 10, 20, 23); six disappeared (one each at Nests 11

and 17, four at Nest 12). Of the 35 young which hatched successfully in these 10 nests, three were killed in a storm (one at Nest 18, two at Nest 23); and 32 young (72 per cent of the total number of eggs laid in the 10 nests), reached nest-leaving age. Mrs. Nice (1937:143) estimates an average of 40 to 46 per cent success for open nests in the North Temperate Zone. (For comparison: leaving out of consideration young already hatched when nests were first discovered, a total of 80 eggs was recorded in all 23 nests: 40 of these hatched, 5 failed to hatch, 7 disappeared, 4 were collected; for the remaining 24 eggs, data are either lacking, as in Nests 2, 4, and 5, for example, or inadequate, as in Nest 19, and they must be classified under "fate unknown.")

Because of incomplete data, 6 of the 23 nests found are not included in Table 1: Nest 1 (with 3 young) and Nest 2 (with 5 eggs) were found on July 15; Nest 3 (with 4 Longspur and 2 Cowbird eggs—all collected) was found on July 13; Nest 4 (with 4 eggs) on July 22; Nest 5 (with 5 eggs) on June 6; Nest 6 (with 6 eggs) on June 28. There were no later data on Nests 1-5. In Nest 6, I found one young with skull open on July 17; the other five eggs may have hatched and the young left.

Data (not included in the table) on other nests are as follows: In Nest 8 (found July 17 with 5 eggs), one egg disappeared between July 17 and 20; the parents deserted the nest and young (hatched July 19) when I erected a blind near the site. Nest 11 (found May 27 with one egg) was abandoned after the egg disappeared on May 29. Nest 12 was discovered on May 27, when it was still under construction; it was finished May 29; the first egg was laid May 30; three more eggs were laid on the three succeeding days, but all disappeared on June 6. In Nest 17 (found July 8 with one egg) four eggs were laid, but one disappeared on July 18. A sudden rainstorm, accompanied by a sharp drop in temperature, occurred on August 6 when the five young in nest No. 18 were 8 to 10 days days, and the four young in nest No. 23 were obviously ready to leave the nest (their exact age was unknown). Later I found one dead young outside nest No. 18, and two dead in nest No. 23. I found no trace of the other young, which also may have been killed by the storm.

I did not identify the agents responsible for the disappearance of the seven eggs (one each at Nests 8, 11, and 17; four at Nest 12). The ground squirrel (*Citellus tridecemlineatus*) and the garter snake (*Thamnophis sirtalis*) were likely suspects.

Voice

Song. The song is a short trill, lively and melodious, generally given as the bird glides to earth on set wings after an upward flight to a height of 25 to 50 feet. The song conforms almost invariably to one pattern, except in the ending, which varies between individuals. My own rendition of it is: *say it loud, so loud, ul - ee - ee,* and these words

indicate the tone and tempo fairly well. One male, instead of using this song pattern, sang a curious combination of alarm and flocking notes: *wheer wheer wheer, lil-lip.* Longspurs appear to explore the possibilities of their voice in the first autumn, for on August 15, a young bird perching on a fence was heard to utter hesitantly a jumble of notes reminiscent of a distant flight song of a Western Meadowlark. It experimented with variations for several minutes.

Calls. The common call note is a *til-lup* or *til-lip* (the accent on the first syllable), sometimes lengthened to *til-lil-lip.* It is a general flocking and flight note, and in the breeding season it seems to express anxiety. The usual alarm note is a whistled *wheer,* used mostly by the male. A *tzip* and a rattling *tri-ri-rip* indicate extreme alarm and perhaps anger. On coming to the nest with food, the female sometimes utters a soft *lu,* and the young then stretch open their mouths. Low, conversational notes are exchanged between the parents at the nest.

Notes on Plumages

On arrival in spring, some birds are not yet in full breeding plumage (produced by molt on head and throat, and by wearing off of the buffy tips from the black and chestnut of the body plumage—see Dwight, 1900:184). A male, for example, was seen on April 27 that had a large area of the black underparts still covered by the pale feather tips. Post-nuptial molt begins about July 20 and is still incomplete when the birds move south. Occasionally a male is encountered in summer with areas of chestnut on the black underparts. Another anomaly is the occurrence of females in male plumage. DuBois (1935:69, and 1937:107) observed at least three females of this type, one "with all the male markings"; the others in an intermediate plumage, with the black underparts, but lacking the chestnut collar. A female with this intermediate type of plumage was collected on June 14, 1933, by T. M. and A. H. Shortt on my study area (it was carefully sexed). The specimen is now in the Royal Ontario Museum of Zoology. The whole plumage was like that of a male, except that all the browns were paler.

Summary

A study was made of 23 nests of the Chestnut-collared Longspur (*Calcarius ornatus*) during the years 1930 to 1932 near Winnipeg, Manitoba.

Spring migration extended from about April 10 to April 18. Fall migration began with flocking (the young gathering first) on the outskirts of the nesting areas; the last stragglers had left by the end of September.

Courtship and territory selection began in the latter part of April and early May.

Territories were roughly circular, from 25,000 to 45,000 square feet in area.

Most of the nests were placed in low grass with little concealment.

Egg laying in Manitoba began in late May (two weeks later than DuBois found for Montana).

Clutches varied from 4 to 6 eggs, the average of 10 clutches being 4.8. (No six-egg sets were found by DuBois in Montana.)

Two nestings per season seemed to be usual, and three nestings occasional. Later sets were smaller than the first.

Incubation was by the female only, but the parents shared in caring for the young. The incubation period (determined at three nests) was 10 days; the nestling period, from 9 to 11 days. The young were independent 24 days after hatching (14 days after leaving the nest).

Nesting success for 10 nests was 72 per cent.

Except in its ending, the flight song conformed almost invariably to one pattern. In addition to the flight song, the Longspur used a variety of call notes.

The postnuptial molt (which is complete) began about July 20; the prenuptial molt is incomplete.

One female was recorded whose plumage resembled that of the male.

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Binscarth, Manitoba

GENERAL NOTES

Notes on molting time of loons and grebes.—George Miksch Sutton (*Wils. Bull.*, 55, 1943: 145–149) has indicated that Loons probably do not undergo two complete molts per year. The extent of the prenuptial molt especially seems to be uncertain, and the time of the postnuptial molt may vary greatly, some individuals probably not acquiring their winter plumage until they have reached the wintering grounds. The same latitude in time seems to be true of the prenuptial molt.

On April 13, 1940, I observed 15 Common Loons (*Gavia immer*) on Guilford Lake, Columbiana County, Ohio. I was puzzled to see that two of them were still in winter plumage while the others were in breeding plumage. On April 20, 1940, I saw 14 Loons there, two still in winter plumage. On April 27 and 28, 1940, I saw 12; two, probably the same ones observed before, were in winter plumage. On April 11, 1941, I saw six loons at Guilford Lake, one still in winter plumage.

On October 20, 1941, I saw two Holboell's Grebes (*Colymbus grisegena holboelli*) at Jefferson Lake, Jefferson County, Ohio. Both were still in breeding plumage, with the reddish neck plainly visible. It would seem, therefore, that grebes might fall into the same category as loons in regard to variation in time of molting.—Forest W. Buchanan, *Amsterdam, Ohio.*

Cooper's Hawk observed catching a bat.—On the evening of April 26, 1943, I. T. Bode and I sat on the porch of a cabin on Caney Mountain State Game Refuge, Ozark County, Missouri, watching the dusk descend. Two small brown bats (species unknown) were flitting over the creek in front of the cabin, when a Cooper's Hawk (*Accipiter cooperi*) burst through an opening in the trees and took after one of the bats. A short chase ensued, in which the bat twisted to the right and left with the hawk following every turn. As they passed 50 feet in front of us, the hawk tipped back on its fanned tail, reached an incredible distance forward with both feet, and gracefully picked the bat out of the air. With scarcely a flutter the bird recovered normal flying posture and went out of sight in the timber, carrying the prey. This incident occurred at about 8:00 p.m., E.S.T., by which hour it was becoming quite dark. The bats had been out for at least 30 minutes. We were surprised to see the Cooper's Hawk abroad so late.

Allen ("Bats," 1939: 280–292) summarizes the literature on the known raptorial enemies of bats, most of which are owls and falcons. Stager (*Condor*, 43, 1941: 137–139) reports an instance of several Duck Hawks preying regularly upon Mexican free-tailed bats around a cave in Texas. But I am unable to find any record of accipitrine hawks utilizing such prey.—A. Starker Leopold, *Missouri Conservation Commission, Jefferson City, Missouri.*

Evidence of polygamy among Marsh Hawks.—Marsh Hawks (*Circus hudsonius*) are common winter and summer dwellers in the Palouse country of southeastern Washington. As a matter of fact, they are one of the most numerous of the hawks in this region. While studying the nesting habits of the Hungarian Partridge during the spring of 1940, I kept under observation two Marsh Hawk nests in an 80-acre patch of sweet clover and weed stalks, left unplowed from the previous year, which was located approximately two miles northeast of Pullman, Washington (Sec. 33, T. 15 N., R. 45 E.)

The first nest was situated 75 feet from a patch of Canadian Thistle (*Cirsium arvense*). It contained six eggs on April 18, when it was discovered by a student who was helping me census the area for partridges. The student had almost stepped on the nest before the female flew. Both the male and the female defended the nest very vigorously, uttering excited cries as they dived repeatedly within a few feet of the observers.

The second nest was found May 2, 400 yards from the first nest, and 30 feet from a Canadian Thistle patch. It contained one egg. On May 7, when the female was flushed, it contained three eggs. The female at this nest had no tail feathers and was easily distinguished from the female of Nest 1. The very light-colored male that had so vigorously defended Nest 1 also defended Nest 2. It made no difference which one I approached first nor how often I walked from one nest to the other: he always attacked with the same vigor, diving repeatedly as I came near either nest. Each female, however, was concerned only when her own nest was approached.

Both nests were kept under observation until May 7, when some students shot the female of Nest 1. After this female had been killed, the male did not protest my trespassing on the area around Nest 1, but he continued to protect the remaining female and nest until May 11, when both he and the female were discovered dead, probably shot by students.

At no time was there observed another male Marsh Hawk in the vicinity that took any interest whatever in either nest.—Charles F. Yocom, *Department of Zoology, State College of Washington, Pullman, Washington.*

Flight of a hunting Marsh Hawk.—At about 10:30 A.M. on December 27, 1943, I was driving northward towards Defiance (Defiance County, Ohio) when I saw an adult male Marsh Hawk (*Circus hudsonius*) rise from a field and begin flying in a line with my car. It continued for 2 1/10 miles in the direction I was going, thus enabling me to make the following observations on the correlation of speed and type of flight with kind of hunting territory covered.

The hawk's flight speed was: over plowed fields or fields of shocked corn, between 30 and 35 m.p.h.; over short-grass pastures, between 25 and 32 (usually about 27) m.p.h.; over wheat-stubble fields, between 20 and 25 m.p.h.; over weedy or fallow fields (where chances of obtaining food would presumably be best), between 12 and 18 m.p.h. The flight, over plowed fields, was straight, and over stubble fields somewhat zigzag; over weedy or fallow fields, the hawk zigzagged across a path about 75 feet wide. Because of this beating back and forth, the actual speed of flight over weedy or fallow fields would be greater than the 12 to 18 m.p.h. recorded by the speedometer of the car, which was following a straight course. The average speed for the 2 1/10-mile stretch was 23 m.p.h. The hawk was flying at heights between 5 and 30 (usually about 20) feet above the ground, except on one occasion, when it described a small circle and came to within 2 feet of the ground to look over something which had attracted it. At the end of the flight, the hawk made an unsuccessful pounce for prey, rose, and then flew off in a westerly direction.

The hawk's flight was north by west, the wind direction west by south (therefore from the bird's left, and at a 90° angle). Wind velocity was less than 5 m.p.h., air temperature, 35° F. Fog made visibility poor—objects at a distance of less than half a mile disappearing from my view. The ground was not frozen and was free of snow.—Milton B. Trautman, *F. T. Stone Laboratory, Put-in-Bay, Ohio.*

Knot in Auglaize County, Ohio.—During the morning of September 10, 1943, a group of five Knots (*Calidris canutus rufus*) flew into the State Fish Farm from Lake St. Marys, Auglaize County, Ohio. Since their wariness prevented close observation, one was shot for identification. The skin is now in the Ohio State Museum at Columbus. My search through the literature has revealed only two other records for this species from the central portion of Ohio: Wheaton ("Birds of Ohio," 1882: 478) recorded it from the Licking Reservoir, Buckeye Lake, May 27, 1878; and Blincoe (*Auk*, 48, 1931: 596) noted it at the lake at Englewood dam, Montgomery County, August 17, 1927.—Clarence F. Clark, *Ohio Division of Conservation and Natural Resources, St. Marys, Ohio.*

Unusual records for north central Oklahoma.—The following unusual records were made at the Lake Carl Blackwell Project in Payne County, Oklahoma, in 1942.

Whistling Swan, *Cygnus columbianus*. Two were seen resting on Lake Carl Blackwell on November 11, and they permitted a close approach in a rowboat. This species is seldom recorded from Oklahoma.

White-winged Scoter, *Melanitta deglandi*. An immature male was seen at Lake Carl Blackwell on June 2. I approached in a motor boat to within 30 feet of the swimming bird before it took flight. I saw all of the field marks clearly with an 8X binocular. Apparently this is the first record for the species in Oklahoma.

Sanderling, *Crocethia alba*. I saw a Sanderling several times during the period August 8 to 21. This species has been recorded on several occasions in western Oklahoma, but I am not aware of any previous record for the central or eastern part of the state.

Forster's Tern, *Sterna forsteri*. A single bird was feeding with a flock of Black Terns over the fish culture ponds on May 23. Its peculiar flat note and characteristic wing and tail color were conspicuously different from the call and markings of the Common Tern. Apparently the Forster's Tern has not been recorded before in Oklahoma.

Black-capped Vireo, *Vireo atricapillus*. A male was singing vigorously on May 20 in a patch of black jack oak. This vireo is rare throughout the state and has not been recorded previously in the Stillwater area.—F. M. Baumgartner, *Department of Entomology, Oklahoma A. and M. College, Stillwater, Oklahoma.*

An escaped Magpie at Madison, Wisconsin.—A male Magpie (*Pica pica hudsonia*) was shot from the top of an oak tree near Second Point on Lake Mendota, May 7, 1944. When examination showed that the tips of the upper rectrices were worn away, I became suspicious and called the Vilas Park Zoo (about two miles south of Second Point). I learned that they had received a shipment of 12 Magpies from Montana last winter (1943–44). Seven of the birds died; the other five escaped from their enclosure on April 28 (1944).

There remain, then (assuming survival), four escaped birds, which will be in fresh normal plumage after the autumn molt. For some time thereafter, the origin of any Magpie taken within any considerable radius of Madison will be questionable. Magpies have in the past been collected as far east as Virginia, but the incident of escaped birds reported here, indicates a need for caution in accepting these as records of natural occurrence.—A. W. Schorger, *168 N. Prospect Avenue, Madison, Wisconsin.*

All-day record of an incubating Robin.—A female Robin (*Turdus migratorius*) started to build her nest in a leafless elm in full sight of my window on March 23, 1938, adding a little material to the nest almost every day until April 7, when she began to work more steadily. Two days later she had to search about considerably for lining material, since everything, including the nest, was covered with snow. The first egg was laid April 13, and incubation started the following day. On April 24, I watched the nest from 5:22 A.M. till 7:20 P.M.; the day was clear with temperatures ranging from 56° to 72° F. The Robin left the nest 32 times, her periods off the nest ranging from one to 10 minutes, and averaging 5.6 minutes; the periods on the nest ranged from 6 to 45 minutes and averaged 20.6 minutes. She changed her position on the nest 70 times and turned the eggs 22 times. The male came to the nest 16 times, often coming immediately after his mate had left; he spent a total of 68 minutes at the nest.

This female left the nest twice as many times per day as the female Robin I observed in 1935 (*Wils. Bull.*, 51, 1939: 157–169), which left 10 to 19 times a day (the average of 16 all-day records being 16.3). The percentage of daylight hours on the nest were, however, equivalent—79 per cent in this record of 1938 (14 hours observation), and 80 per cent in 1935 (37 hours observation). William Edward Schantz, *1532 Aberdeen Avenue, Columbus, Ohio.*

EDITORIAL

The frontispiece of this *Bulletin* is the first published photograph of the Panama Ant-thrush (*Formicarius analis panamensis*), taken by Howard H. Cleaves, in the jungles of Barro Colorado Island, at the first known nest of this subspecies. In 1908, George K. Cherrie wrote that the related form on Trinidad nested in holes in trees, but he apparently published no further details. (A 1910 record of a completely different type of nest ascribed to the Costa Rican representative of the species is probably a case of mistaken identity.)

Because of the request from Washington that conventions not directly connected with the war effort be canceled, the officers of the Wilson Ornithological Club have abandoned plans for a 1944 annual meeting of all members. Since many matters of business have accumulated which cannot be handled effectively by mail, President Kendeigh has called a meeting of the members of the Council and the Chairmen of the standing committees. The meeting will be held August 11 and 12, at the F. T. Stone Laboratory of Ohio State University, at Put-in-Bay, on the invitation of Thomas H. Langlois, Director of the Laboratory. Arrangements are in charge of our Treasurer, Milton B. Trautman, who is Research Associate of the Laboratory. Members are asked to write to the Secretary of the Club, or to the Treasurer, on any matter of business which they would like to have brought before the meeting.

OBITUARY

Charles E. Hellmayr, outstanding authority on the classification and distribution of neotropical birds, died February 24, 1944 in Switzerland at the age of sixty-six. After acquiring an extraordinarily complete knowledge of the bird collections of Europe, he came to Chicago in 1922, as Associate Curator of Birds in Field Museum of Natural History, to complete the monumental series of volumes on "The Birds of the Americas" begun by Charles B. Cory. Ten more volumes have been published since, and the manuscript of the remaining parts is being held in Switzerland until war conditions permit sending it to this country.

Dayton Stoner, New York State Zoologist, died May 8, 1944, in Albany. He was born in Iowa and did his early ornithological work there; later he worked in the Fiji Islands, New Zealand, and the West Indies. He was best known among ornithologists for his series of detailed studies of the Bank Swallow. He had been an active member of the Wilson Ornithological Club since 1912.

William E. Ritter, noted biologist and philosopher, died January 10, 1944, in his eighty-eighth year. Fortunately for us, birds were among his many and varied interests, and in 1938 he published a remarkable book on the California Woodpecker.

Ornithological News

The Audubon Society of Western Pennsylvania has issued the first number of a new ornithological journal, "The Ruffed Grouse," edited by E. H. McClelland. The cover design was drawn by Andrey Avinoff, Director of Carnegie Museum.

Joseph J. Hickey, now engaged in war research at the University of Chicago, has been awarded a post-war Guggenheim Fellowship for a study of bird migration and population, based on the bird-banding files in Washington.

ORNITHOLOGICAL LITERATURE

Alaska Bird Trails. By Herbert Brandt. Illustrated by Major Allan Brooks and others. Bird Research Foundation, Cleveland, Ohio, 1943: 7½ × 9¾ in. xviii + 464 pp. $10.00.

"Alaska Bird Trails" is the detailed story of a five-man ornithological expedition which set out from Fairbanks, Alaska, on March 20, 1924; made its way by dog-sled over the Alaska and Kuskokwim ranges by way of Nenana, Lake Minchumina, McGrath, Iditarod, Flat, Holy Cross, and Mountain Village, to the mouth of Hooper Bay—an 850-mile trip requiring 40 days; and surveyed the bird-life of that region for several weeks. The author, who had organized and led the party, left Hooper Bay on June 26, returning to Nenana by boat, while the others (H. B. Conover, O. J. Murie, Frank Dufresne and Jack Warwick) remained there to continue collecting specimens and banding waterfowl. A vast amount of work was accomplished. Splendid collections were brought back, numerous fine photographs were made, and, best of all, a careful diary was kept. Mr. Brandt's book is based largely on his diary—and a very beautiful, very readable book it is.

What the reader will note instantly in "Alaska Bird Trails," and not soon forget, is its enthusiasm. Its author is, in the best sense of the phrase, a lover of nature. The beauty of birds stirs him deeply. He is thrilled by their color, their songs, their behavior, their habitat. Since he is especially interested in their nesting habits, he feels that he does not really know them until he has found their eggs, watched them brooding, examined their newly-hatched young. His book bubbles and runs over with the high joy of discovery, and so vivid is his account that we find ourselves marching back and forth across the tundra with him, hunting Godwit nests in the rain, flushing Steller's Eiders from their down-cradled eggs, and watching Savannah Sparrows run off like mice through the short grass. It is good to read a book of this sort now and then—for there is something youthful and invigorating about it. Specimens are mentioned now and then, of course, but these are far from any stale-aired museum, and what we feel as we move from page to page is fresh wind from the sea, soft moss underfoot, and firm, smooth-shelled eggs in our hands.

Since many of the common birds of the region are little known, Mr. Brandt's graphic accounts of them are a welcome contribution. Of special interest is what he reports concerning the Steller's and Spectacled Eiders, the Pacific Godwit, Black Turnstone, Western Sandpiper, and Alaska Yellow Wagtail. His comparison of the behavior of various shorebirds at their nests is particularly good (pp. 298-300), and his descriptions of the downy young of such species as the Black Turnstone, Emperor Goose, Long-billed Dowitcher, and Western Sandpiper merit special mention. Two detailed color-plates, by Edwin R. Kalmbach, illustrate the natal plumages of these and four other little-known water birds.

An appendix of more than a hundred pages is devoted to an annotated list of the species recorded by the expedition. Here data pertaining to specimens collected are so presented as to make it possible for a taxonomist or student of molts and plumage-sequences to ascertain exactly what material was preserved; problems of distribution are discussed; and many facts concerning nests mentioned in the narrative part of the book are enlarged upon. Eggs are described in great detail.

Throughout the narrative the common bird-names are somewhat confusing. Thus, when we come upon the name 'Alaska Jay' we wonder momentarily whether the bird belongs to the genus *Perisoreus* or *Cyanocitta*. Had the bird been called the 'Alaska Whiskey Jack,' or, better still, simply the 'Whiskey Jack' or 'Canada Jay,' we would have known instantly what species was referred to. Similarly, the name 'Alaska Ptarmigan' is misleading. 'Willow Ptarmigan' would have been better. The name 'Eastern Snow Bunting' is inadequate, if not downright inaccurate in that (a) it implies a western or Alaskan race of *Plectrophenax*

nivalis (McKay's Snow Bunting is given full specific rank by many authors); and (b) it wholly fails to take into account the Old World distribution of the species. Such names as 'Siberian Rough-legged Hawk' and 'Pacific Black-bellied Plover' are ponderous and of doubtful value, first because the author devotes very little space to discussion of geographical races or of any species' over-all distribution, as such, and second because some of these geographical races are of very dubious validity. Anyone who is eagerly reading for facts about the behavior of Alaska birds, or following the fortunes of an expedition, does not want to find his thinking muddled by nomenclatural surprises. The place for long, complex trinomials is the appendix.

The A.O.U. Check-List is, at least to some extent, to blame for these unsatisfactory common names. In future editions of this widely-used work it is to be fervently hoped that the Committee will be content with common names for full species only, or find common names for the subspecies which will take into account *all facts* concerning the species as a whole. 'Eastern Snow Bunting' and 'Eastern Goshawk' are excellent examples of common names which deny the species any Old World distribution whatsoever. American ornithologists will win for themselves, and deserve, a reputation for provincialism if this unfortunate custom continues.

Most interesting is Mr. Brandt's discussion of the specific distinctness of the Cackling Goose and Lesser Canada Goose. Personally I agree with him wholeheartedly; but my experience with Richardson's Goose (*Branta canadensis hutchinsi*) on Southampton Island, where this exceedingly small race nested almost side by side with the rarer *Branta canadensis leucopareia,* leads me to feel that failure of the two forms to mate together does not necessarily constitute "good evidence that they are specifically distinct" (p. 276). I should call the Richardson's Goose and the Lesser Canada Goose only subspecifically distinct. Yet on Southampton Island they certainly summer together.

The color-plates in "Alaska Bird Trails" are a delight to the eye. Those by Major Brooks are splendid examples of his work, and they have been exceptionally well reproduced. The full-page photograhs are artistic and interesting, that of the Snowy Owl at its nest (opp. p. 128) being especially exciting.

All in all, "Alaska Bird Trails" is a most timely work. Although it does not cover the whole territory of Alaska it will serve as a guide to the ornithology of this region until a more complete work appears, and its glowing account will lead many an ornithologist of future years to travel northward to tackle the unsolved problems of that glorious wilderness north of the Yukon.—George Miksch Sutton.

The Ecology and Management of the American Woodcock. By Howard L. Mendall and Clarence M. Aldous. Maine Cooperative Wildlife Research Unit, Orono, Maine, 1943: 9 x 6 in., x + 201 pp., 11 figs., 14 pls., 19 tables.

Since the publication of my treatise on the life history of the American Woodcock (Pettingill, *Mem. Boston Soc. Nat. Hist.,* 9, 1936:167–391), which was based chiefly on investigations in New York, two important papers have appeared dealing with activities centering about the Woodcock's singing fields in Illinois (Pitelka, *Wils. Bull.,* 55, 1943:88–114) and in Pennsylvania (Norris et al., *Jour. Wildl. Manag.,* 4, 1940:8–14). This new treatise is based on further investigation of the Woodcock's life history (although concerned primarily with matters that have a direct bearing on management). The bulk of the text consists, in fact, of life-history data and discussions of such topics as distribution and migration, food and feeding-habits, and cover-preferences. Only 60 pages deal with management as such.

Fortunately Mendall and Aldous were able to carry on their study in eastern Maine, which undoubtedly has the largest breeding population of Woodcocks in the United States. The results obtained, therefore, warrant some comparison with

the Pitelka and the Norris investigations, which were conducted among relatively small populations.

Mendall and Aldous agree with my concept of the breeding territory as consisting of two parts—the male domain and the female nesting territory. The former is divided into a diurnal territory (the male's chief abode) and a singing field (locality of his courtship performances), and "tendencies were shown for the singing grounds to be fairly close to both the diurnal territories and the nesting territories" (p. 74). Active defense of the singing fields was commonly observed. No evidence was found that the female nesting territory is, or is not, a defended area, but numerous instances were recorded of several males remaining on the diurnal territory in apparent harmony. It thus appears that where there is a large Woodcock population, territories are crowded, so that competition is noticeable on the singing fields though competition for nesting and diurnal territories does not seem to exist. In the light of these observations it is perhaps doubtful whether nesting and diurnal "territories" are indeed *territories* as defined by Nice and others (i.e. defended areas). Mendall and Aldous find, as did Pitelka, that the *cackling* note is given only by the male in the presence of another male, or males, as a form of intimidation; it was not found to be associated with the mating act. They doubt whether the females ever utter the *peent* calls. Fewer males are reported during the morning display periods than during the evening. In New York I found both periods equally well used, and I am under the impression that the activities of the morning periods were more vigorous. It is the opinion of Mendall and Aldous that the Woodcock is monogamous. However, monogamy might be characteristic of the population of one area, though not of the species as a whole; the type of territoriality shown by the male is conducive to polygamy in a degree equal to the type of territoriality (i.e. *crowing grounds*) in certain gallinaceous birds and I feel that polygamy will be found to be characteristic of at least some populations. Mendall and Aldous present new circumstantial evidence to support my statement (1936) that incubation "is carried on usually, if not entirely, by the female."

Careful studies of nesting conditions showed slight egg loss and low juvenile mortality. For a ground-incubating species, the figures are remarkable: successful hatches were recorded in 67.2 per cent of the 125 nests under observation; the rate of juvenile mortality did not exceed 10 per cent.

As in all investigations of well-known game birds, much ill-founded lore pertaining to the Woodcock has again been put to the test and "exposed": females were not observed to carry their young even though family groups were watched more than 400 times; there was no evidence whatever that the Woodcock raises more than one brood per year; and no facts were found to support the frequently repeated statement that the Woodcock is able to prevent the issuance of scent while incubating.

In the part of the paper preceding the life history section noteworthy information is given on distribution and migration. It is gratifying to learn that there is an unusually large breeding population on Prince Edward Island, where the Woodcock has always been considered uncommon. The bulk of the winter Woodcock population is now known to be restricted to the Lower Mississippi Valley (the northern three-fourths of Louisiana and a few localities of western Mississippi and extreme southeastern Arkansas). Only recently the bird was thought to be rather evenly distributed throughout the southeastern United States during the winter. Fairly direct flight lines seem to be established between the lower Mississippi wintering grounds and all northern points of the Woodcock's breeding range except in the Northern Atlantic States, where there is a distinct coastal route as far south as Cape May, New Jersey, and Cape Charles, Virginia, and then (supposedly) a cross-over from these coastal points to the Lower Mississippi.

In the last section of the paper, which is devoted to management, the authors discuss quite thoroughly the various techniques employed in carrying out their investigations. Of the census methods used, they recommend a yearly count of occupied singing fields as yielding the best index of breeding populations. The regularity of display in the evening and morning allows an accurate estimate of all males and (unless the Woodcock is polygamous) of all females in a given area. The best method to use in banding Woodcock is to capture juveniles after the broods of fledglings have been found by a trained dog. By this method Mendall and Aldous banded 485 juveniles in six years. They advise against the use of dogs for finding nests because, in their experience, a nesting Woodcock has greater fear of a dog than of man and is likely to desert the nest after being flushed by a dog.

Mendall and Aldous conclude that there are "but two limiting factors which are of very great importance to the Woodcock and which at the same time are readily controllable by man," namely, hunting and cover deficiencies. They suggest several possible counteractants. Among these is the creation, by artificial means, of singing fields. This has been experimented with successfully in Maine, but one wonders whether the great expense involved in the creation and yearly maintenance of singing fields would be justified by the results, since each singing field would be occupied by but one male.

This publication is an extensive contribution to our knowledge of an important game bird and will serve to guide those persons whose responsibility it is to effect a much-needed management program. It is well-organized, attractively published, and laudably free of typographical errors. There are numerous photographic illustrations (though many of these are not accredited). A bibliography concludes the work. There is, unfortunately, no index.—Olin Sewall Pettingill, Jr.

Cuban Ornithology. By Thomas Barbour. Memoirs of the Nuttall Ornithological Club, No. 9, August, 1943, 144 pp., 2 pls. Publ. by the Club, Cambridge, Massachusetts. $4.00.

This useful volume is a revision of Dr. Barbour's "Birds of Cuba," published in June, 1923, as Number 6 in this same series of Memoirs. The present work is completely reset, in a larger font of type, and includes much new material, so that in the opinion of this reviewer the author has acted wisely in giving the book a new title as an aid to students who need to cite passages in it. The original introduction has been omitted for a new one that outlines the influence of the well-known scientists, Brother Léon and Dr. Carlos de la Torre, in training students who have been active in furthering studies in the natural history of Cuba, and includes a summary of modern trends in conservation that have led to Cuba's participation in a convention for nature protection throughout the Americas and the establishment of reserves for the preservation of the fauna and flora of the Republic.

The annotated list that forms the body of the book covers 297 forms, an increase of 24 over the 273 listed in the earlier volume. The new material includes data obtained from banding records of migrants from the North, additional information on occurrences and habits, and discussion of the validity of some of the forms.

One of the principal additions is in the form of notes made in the gardens and grounds at the Atkins Institution of the Arnold Arboretum near Soledad, Santa Clara Province, which the author visited annually, and where he was instrumental in promoting protection for the birds.

It is interesting to note the recent change in status of the Herring Gull from rare to abundant, due apparently to actual increase of these birds in the North; equally of interest are the author's notes on the Florida Burrowing Owl at Grand Bahama with a reference to Bond's published record of the first specimen

reported from Cuba. Reading through the pages brings again to mind how little we know of the breeding of many West Indian birds; e.g., the eggs of the Little Pine Crow (the *Cao Pinolero* of the Cuban countryman) are said to be still unknown though it should not be difficult to discover the nest. (Bond's description in "Birds of the West Indies," 1936, p. 269, apparently refers to the eggs of *Corvus palmarum palmarum* of Hispaniola.)

To the student of the ornithology of Cuba this revised work will be invaluable, and it may be added that bird lovers in general will find this an interesting book because of the many fascinating passages in the graphic style that seems to flow so easily from Dr. Barbour's mind and pen.—Alexander Wetmore.

A Preliminary Life History Study of the Florida Jay, *Cyanocitta c. coerulescens*. By Dean Amadon. (Results of the Archbold Expedition No. 50). *Amer. Mus. Novit. No.* 1252. Jan. 24, 1944. 22 pp.

If proof were needed to demonstrate that opportunities for adding to our knowledge of birds exist all about us and only await our serious attention, this paper would serve to carry the point. Amadon spent about a month at Lake Placid, Florida, picked a bird quite new to his own field experience, and in that short space of time succeeded in adding more to what is known of its habits than one would have thought possible.

Although a denizen of bushy thickets, the Florida Jay was found to be bold and easily studied. It buries food by thrusting it beneath the sand and then placing dead leaves or other objects over the place. Later, when searching for buried food, the bird swings its head from side to side, throwing the sand to either side with the bill. Courtship feeding is a character of the species, and is continued throughout incubation and even after the young hatch out. Both sexes participate in nest-building, but only the female incubates. Incubation begins with the laying of the first egg. Both sexes help feed the young, but only the female broods. The number of feedings given the young birds increased from 2–3 times an hour during the first week to 5–12 by the second week.

That the author is candid about the indefiniteness of some of his observations is refreshing and gives all the more reliability to those about which he is more explicit. Thus, in writing of a "whisper song" given by both sexes, he states that it "seems to express either physical well being or mild perplexity." His field techniques are well planned and well carried out; the paper should be useful to others for these alone.—Herbert Friedmann.

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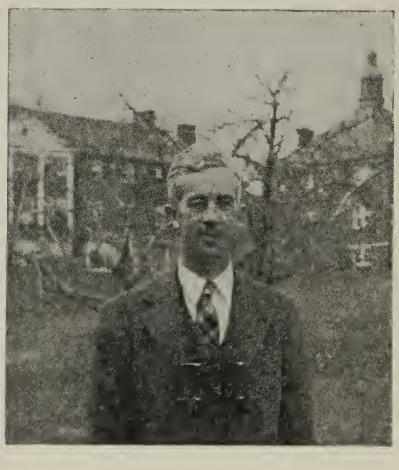

Oscar M. Root graduated from Harvard University and has done graduate work at the University of Michigan and Woods Hole. He is a very active bird bander and is a member of the Council of the Northeastern Bird-banding Association. Since 1933 he has taught biology and mathematics at Brooks School, Andover, Massachusetts. His particular interests have been natural history, conservation, and ornithology, with special emphasis on ecology, distribution, and populations of birds.

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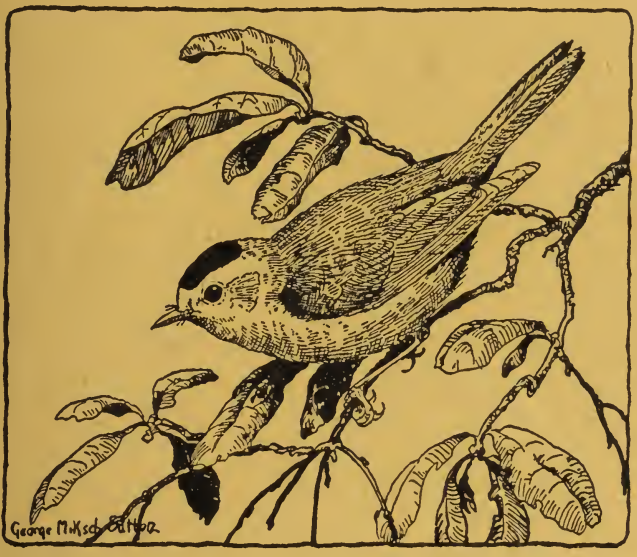

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PLATE 3

5:40 a.m., May 29, 1944 *Photo by Hal H. Harrison*

FEMALE COWBIRD ON SONG SPARROW NEST

THE WILSON BULLETIN

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Vol. 56 SEPTEMBER, 1944 No. 3

NOTES ON A COWBIRD PARASITIZING A SONG SPARROW

BY RUSSELL T. NORRIS

THE parasitic habit of the Cowbirds (*Molothrus ater*) has been known since the earliest ornithologists began studying the avifauna of the western hemisphere, and much has been written concerning these birds and their hosts. Very little, however, has been recorded of their laying habits, and the published observations of egg removal and egg laying by the Cowbird are few and scattered. They are summarized in the following paper, with my own observations, made in May, 1944.

Friedmann (1929:185) saw a Cowbird go to a Robin's nest and deposit an egg just after he had examined the nest (at about 7:30 A.M.). Until 1937 this was the only record of anyone observing a nest both before and after a Cowbird had laid her egg. Then Hann (1937:201; 1941:215) observed the actual egg-laying on five occasions (each time at dawn). In two instances he obtained photographs of a Cowbird in an Oven-bird's nest.

Friedmann (1929:186) found no conclusive evidence that the Cowbird usually punctures or removes eggs of the host when depositing one of its own, but a few people have since observed this phenomenon, and some have seen the Cowbird eat the stolen egg. Roberts (1932:325) obtained a photograph of a female Cowbird taking an egg from the nest of a Scarlet Tanager, and also observed a Cowbird taking a Chipping Sparrow's egg from the nest. Blincoe (1935:158) saw a female Cowbird remove a Robin's egg from the nest (at about 5:30 P.M.). Nice (1937:157) observed a Cowbird taking a Song Sparrow's egg on two occasions (at 9:15 A.M. and 8:45 A.M., respectively). In the first instance the Cowbird ate both shell and contents; in the second, the bird flew away with the egg. Hann (1937:203) recorded three observations of a Cowbird taking an egg from the nest of an Oven-bird. The first occurred at 9:01 A.M., and the bird flew away with the egg. In the second instance, the bird ate contents and shell. In the third instance Hann (1941:Figure 1) obtained a fine photograph of the Cowbird removing the egg (at 9:10 A.M.).

Hann (1941:220) stated that the Cowbird usually removes an egg of the host during the forenoon of the day previous to its own laying, sometimes during the day of laying, rarely on the following day. Olson (1943:195), however, reported a Cowbird carrying away and eating a small egg, resembling that of a Song Sparrow, at 5:15 P.M., and there is in addition Blincoe's observation (cited above) of egg removal at 5:30 P.M. My own observations, which follow, agree with Hann's findings.

On May 28, 1944, I was working at my home in the village of Meridian about four miles west of Butler, Pennsylvania. Along the edge of the yard there is a strip of uncultivated land some 10 feet wide on which there is a rank growth of grass about 18 inches high and a few briers, forming excellent cover for ground-nesting songbirds.

At 9:45 A.M. (E.S.T.) I noticed a female Cowbird flying from this strip of grass with a small white object, apparently an egg, in her mouth. She flew away at an angle and alighted in a neighbor's garden 30 feet from the point where I had first observed her. She did not put the egg down immediately, and when I got a little closer she flew 70 feet farther off and again alighted. During the flight I could see that she was holding the egg with partly open beak, each mandible piercing the eggshell. This time I was careful not to approach too closely. She placed the egg upon the ground and began to break the shell with her bill. After maneuvering around the egg for some time and occasionally picking something up, she flew away. I went to the spot immediately, and all that remained of the egg was the moist spot where some of the contents had spilled onto the ground. I found no trace of the shell.

Shortly after this happened, I returned to the spot where I had first observed the Cowbird flying with the egg and began to search for the nest. I discovered a nest of the Song Sparrow (*Melospiza melodia*) built in the base of some grasses. It contained but one egg.

I anxiously awaited the coming of dawn on May 29, for Hann (1941:213) stated that the Cowbird lays very early in the morning, and I wanted to record the egg-laying procedure. At 3:00 A.M., Hal H. Harrison, President of the Audubon Society of Western Pennsylvania, and an expert photographer of birds, whom I had asked to assist me, arrived at my home and immediately began to set up his equipment. He removed enough grass from around the nest to enable him to see the bird when she arrived, and placed his camera on a tripod 24 inches from the nest, running a wire from the battery case of the photoflash equipment into the blind (placed about six feet from the nest) to a supplementary battery used to take the picture. The camera was loaded with a sheet of professional kodachrome film, and Harrison and I retired to the blind at 3:30 A.M.

It was quiet near the nest, but many Robins were singing all around, and shortly after 4:00 A.M., a Song Sparrow sang nearby. Just before 4:30 A.M., about 22 minutes before sunrise, we heard the sputtering

note of a Cowbird, and a few seconds later a female Cowbird alighted on the camera. After looking around cautiously, she flew to the ground at the base of the tripod and began to walk nervously toward the nest. As she reached the rim of the nest, she paused and carefully surveyed the surrounding territory, then stepped into the nest, and turned about several times. Finally she settled down, and Harrison pressed the button on the battery. As the flash went off, the Cowbird flushed. She had been on the nest no more than 15 seconds and had not deposited her egg. She flew a short distance into the garden and walked about there, watching, while Harrison removed the color film and replaced it with black and white. I felt sure that the Cowbird would return, since Hann (1941:220) found that Cowbirds are very persistent when they are attempting to deposit an egg.

At 4:38 A.M. I noticed a movement in the grass behind the nest, and after a few seconds the Cowbird appeared. She approached the nest warily, stepped up onto the rim, and paused there. Then she entered the nest and began to turn about as she had on her previous visit. After a few seconds, she stepped back onto the rim and looked around. She three times repeated this procedure of standing on the rim, then uneasily turning about in the nest. In one instance she mounted the rear rim and looked back into the grass. At approximately 4:40 A.M. she settled on the nest, and Harrison released the shutter. The Cowbird raised herself slightly but remained a few seconds before flying away. Upon examining the nest I found a fresh Cowbird egg. Undoubtedly the egg was being laid as the picture was taken.

The resulting black and white photograph, the third ever taken of a Cowbird on a nest, is presented with this paper (Plate 3). Hal Harrison's camera is a Zeiss Maximar, and it was loaded with Eastman Super XX film. The camera lens was exactly 24 inches from the nest, and the film was exposed for 1/100 of a second, with a stop of f. 11. The photoflash bulb used was a G. E. No. 5.

The Song Sparrow deposited her third egg sometime between 4:45 and 5:45 A.M., when I returned to the nest; her fourth egg on the morning of May 30; her fifth and last egg on May 31. On the morning of June 5, I visited the nest and found only four eggs—three belonging to the Song Sparrow, and the one Cowbird egg. The remainder of the incubation period, however, was completed without mishap, and on the morning of June 11 the Cowbird egg hatched. At 4:30 A.M. on June 12 one Song Sparrow egg had hatched, and by 10:30 A.M. on the same day a second sparrow egg hatched. The remaining sparrow egg did not hatch.

All went well with the two young sparrows and the Cowbird for the first few days. I visited the nest on the evening of June 17, and all three birds (six and seven days old) were still there and almost fully fledged, the Cowbird being about twice the size of the sparrows. But the next morning I found the nest empty, the horsehair lining lying on

the ground a few feet away. The three nestlings had apparently fallen prey to a prowling house cat during the night.

Summary

The published observations of egg-laying (six instances) and of egg-removal (eight instances) by the Cowbird (*Molothrus ater*) are summarized.

A female Cowbird carried off and ate a Song Sparrow egg at 9:45 A.M. on May 28, 1944.

She returned to the nest at 4:30 the next morning to deposit her egg.

She was frightened from the nest when a photograph was taken, but returned after eight minutes and was photographed on the nest while depositing her egg.

The Song Sparrow laid three more eggs (five in all, including the one removed by the Cowbird).

Two sparrows and the Cowbird hatched and were reared successfully until the Cowbird was seven, the sparrows, six days old, when the nest was destroyed by a predator.

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LIFE HISTORY OF THE BLUE-THROATED TOUCANET

BY ALEXANDER F. SKUTCH

IN spite of the general interest toucans have attracted since the days of Humboldt and even earlier, their habits, especially their manner of breeding, are little known. This is not surprising to one familiar with the difficulty of finding toucans' nests in the lowland forests and the unbelievably high proportion of nests in this environment that are destroyed by predatory creatures. Beebe (1917:183–209) described the nests, and the eggs or nestlings, of several species that breed in British Guiana; and Wagner (1944) recently published an account of the general habits, nest, and young of the Emerald Toucanet (*Aulacorhynchus prasinus*); but the only comprehensive life history of any toucan that has come to my attention is Van Tyne's "Life History of the Toucan *Ramphastos brevicarinatus*" (1929), which follows the nesting stages of the Rainbow-billed Toucan from egg laying through care of nestlings (until these were 36 days old, when they were destroyed by a predator). In Costa Rica, from July, 1937, to August, 1938, I observed the Blue-throated Toucanet (*Aulacorhynchus caeruleogularis*), which is the subject of the present study.

Range

Most of the toucans, particularly the largest species, dwell in the warm forests at low altitudes. In Central America the big toucans of the genus *Ramphastos,* and the middle-sized aracari toucans of the genus *Pteroglossus,* are still fairly abundant in various localities at 3,000 feet above sea-level, and are found occasionally as high as 4,000 feet, but scarcely ever above this level. At the higher elevations, the toucan family is represented only by the little green toucanets, of which two species occur in the Central American region.

The white-throated Emerald Toucanet dwells in the mountain forests from southern San Luis Potosí to northern Nicaragua. In Guatemala, where the bird is called "cucharón," I found it ranging vertically from heavy, subtropical forests, 3,500 feet above sea-level, to the temperate-zone woods of oaks, pines, and cypress, and even up to 10,000 feet above the sea. Van Tyne (1935:25) encountered toucanets of this species, although of a distinct race (*virescens*), among the lowland forests of El Petén, less than a thousand feet above sea-level.

In southern Central America, the Emerald Toucanet is replaced by the Blue-throated Toucanet, which is similar in appearance but has a blue instead of a white throat. It ranges from northern Costa Rica to Veragua, Panama. In the former republic it is quite generally known by the name "curré." I have met it on rare occasions as low as 3,000 feet on both the Caribbean and Pacific slopes of Costa Rica. Carriker (1910:577) states that it ranges down "to about 2500 feet on the Carib-

bean slope and perhaps a little lower on the Pacific." I doubt the second part of this statement, at least in so far as it may refer to southern Costa Rica; for during five years in the Basin of El General, I have only very seldom met the toucanet (and then only in the non-breeding season) as low as 3,000 feet, and I have never seen it in the forests about my house, 500 feet lower. As to the upper limit of the bird's altitudinal range, I found it at 6,200 feet in the Tablazo Mountains, and at 7,600 feet on the forested northern slopes of the Volcán Irazú. Carriker states that it occurs up to "at least 6000 feet." The absence of records of the toucanet at higher altitudes is to be explained, I believe, by the meager amount of ornithological work that has been done there. I should not be surprised to find it even at 10,000 feet in the oak forests on the Cordillera de Talamanca.

Description

The Blue-throated Toucanet, smallest of the Costa Rican toucans, is a bird about the size of a pigeon. Its plumage is chiefly green, in moderately bright shades, but not glittering or metallic. The throat and lower cheeks are blue; the under tail-coverts and the tips of the rectrices, cinnamon. The bill, though far smaller than those of the big lowland toucans, is huge in proportion to the body and is adorned with four colors. The greater part of the upper mandible is yellow with a slight greenish tinge, but its base and cutting edge, as well as the entire lower mandible, are black. There is a small patch of dull red at the base of the culmen. The bill is outlined, where it joins the head, by a broad white line. In the Blue-throated Toucanet the sexes are too similar in appearance and voice to be distinguished in the field.

General Habits

The toucanets travel in small, straggling flocks, which rarely consist of more than six or eight individuals. Not infrequently a lone bird is met. Although the mossy mountain forest is their true home, they wander through adjoining clearings where there are scattered trees, and often nest in such situations. They are restless, excitable birds, and scold a human watcher in tones which at times resemble the chatter of an angry squirrel. Their language, although varied, is nearly always unmelodious—throaty croakings and harsh rattles are the utterances one most frequently hears from them. But during their nesting season, they at times give voice to softer, more appealing sounds. Their food is like that of other toucans, consisting of a number of fruits and insects, varied now and then with the nestling of some other bird.

Study Area

My study of the nest-life of the Blue-throated Toucanet was made between July, 1937, and August, 1938, near Vara Blanca, on the northern slopes of the volcanic Cordillera Central of Costa Rica, at altitudes

between 5,200 and 5,600 feet. The house which I occupied stood amid pastures on the back of a narrow spur; but the pastures were bordered on three sides by heavy forests which dropped off abruptly into profound ravines, the one to the east a gorge about 500 feet deep, with the rushing Río Sarapiquí at its bottom. In my life histories of two neighbors of the Blue-throated Toucanet, the Quetzal and the Prong-billed Barbet (Skutch, 1944 *a* and *b*), I have described the climate of this storm-beaten, mist-shrouded region of high humidity, and its lofty forest giants burdened with an incredible profusion of epiphytes ranging in size from mosses and liverworts, through ferns, orchids, and aroids, to shrubs and even fair-sized trees.

Population

When I arrived at Vara Blanca in July, I found the toucanets exceedingly abundant, roaming in small flocks through the forests and shady pastures about the cottage. But thereafter they became increasingly rare, and in September and October I saw very few. It is not impossible that they had dropped down to slightly lower elevations; my own experience in El General, where I have seen them between 3,000 and 3,500 feet during the non-breeding season, would lend weight to this supposition, and Wagner (1944:68) describes marked altitudinal migrations which the Emerald Toucanet makes to escape the extremes of the rainy season in Chiapas. But in a country where there are scarcely any observers of birds, and travel, in most directions, is slow and exhausting, variations in the local abundance of a species are difficult to interpret. Possibly the Blue-throated Toucanets, without going elsewhere, had merely become quieter and more retiring during the wet and gloomy closing months of the year. I was absent from Vara Blanca during most of November and December, 1937, and during the intervals I spent there the weather was most unfavorable for bird-watching. During the opening months of 1938, however, the toucanets gradually became more noticeable among the local birds, and by March, when their breeding season approached, they were once more abundant and conspicuous.

The Nest

All toucans, so far as we have accurate information, nest in unlined cavities in trees. The biggest toucans (*Ramphastos*) are forced to hunt out spacious natural hollows, since none of their hole-carving bird-neighbors are large enough to provide for them. The middle-sized aracaris sometimes take advantage for nesting—and frequently for sleeping—of the holes excavated in dead trees by the biggest of the woodpeckers, such as the Guatemalan Ivory-bill (*Scapaneus guatemalensis*) and the Pileated Woodpecker (*Ceophloeus lineatus*). The nest-cavity of one of these woodpeckers will accommodate five slumbering adult Frantzius' Aracaris (*Pteroglossus frantzii*). The little toucanets find ample room for rearing a family even in nest holes as small

as those of the Hairy Woodpecker (*Dryobates villosus*), though they must enlarge the doorway. Wagner (1944:71) reports that the Emerald Toucanet nests in holes of the Green Woodpecker (*Piculus rubiginosus*) in Chiapas.

I have been unable to make an exhaustive search through the literature; but so far as I know, the only previous record of the nesting of the Blue-throated Toucanet is found in the following brief paragraph by Carriker (1910:577): "They breed in holes in trees, usually abandoned nests of *Campephilus* [*Scapaneus*] *guatemalensis buxans* or even *Chloronerpes yucatanensis* [=*Piculus rubiginosus*]. I have not seen the eggs, but nests examined at Juan Viñas in May each contained two young."

The six occupied nests of the Blue-throated Toucanet that I found at Vara Blanca were placed at heights ranging from 7 to about 90 feet above the ground. Five were in dead or dying trees standing in clearings with woodland near by; the sixth was in the woods near the edge of a clearing. In this connection it should be noted that, since the nests in the clearings were so much more readily found and so much more satisfactory for watching, I made no thorough search for others in the forest, where many were undoubtedly located. Apparently all six nests were in holes made by woodpeckers. The entrances were oval in form, considerably wider than high. The doorways of the three low nests ranged from 2⅛ to 2½ inches in width and from 1¾ to 2 inches in height. The one nest for which I have a measurement of internal capacity extended to a depth of 18½ inches below the lower edge of the doorway. In none of the accessible nests was there any lining; the eggs rested upon a layer of fine wood particles in the bottom.

My first nest was found on April 17, 1938. It was situated about 30 feet above the ground, in what appeared to be an old woodpecker hole in a barkless trunk of a cecropia, just within the edge of the forest, close by a pasture. Since the tree was unsafe to climb, I made no attempt to examine the interior of the nest; but I repeatedly saw the male and female replace each other in it, and judged that incubation had already begun. By May 6, the parents were taking food into this cavity for the nestlings.

Another nest was found on May 5, when three of the four eggs had just hatched, and the fourth was on the point of hatching. Since the incubation period (as subsequently determined) is about 16 days, and the eggs are laid on successive days, egg-laying in this nest must have begun about April 16. These two nests, then, indicate that in 1938 the nesting season at Vara Blanca began about the middle of April.

I was able to watch a third nest from the beginning of egg laying. I passed the morning of April 23 in my brown wigwam blind, which was set in the pathway that went round the ridge, with the pasture above it and the forest below. The purpose of my vigil was to record the activities of a Collared Redstart (*Myioborus torquatus*) in a nest

set in a niche in the mossy bank beside the pathway. On the steep slope above the bank stood an old decaying stub, in the side of which, only seven feet above the ground, was an old hole, possibly the work of the Green Woodpecker. A pair of toucanets were interested in the cavity; and while the warbler sat quietly on her eggs, I could watch their activities at close range.

From time to time during the morning, one of the toucanets went to cling before the doorway of the hole and look in; it would sometimes remain in this position for several minutes, sometimes for less than a minute. While one of the pair was at the woodpecker hole, the other sometimes clung to a vine that dangled from a leaning trunk close by. On these occasions, the toucanets uttered very soft, low, murmurous sounds quite different from their usual frog-like croaks and dry rattles. The murmurs were produced in the throat, with the bill quite closed, and when I first heard them I was puzzled to account for them, since I had never heard a toucanet deliver such sounds. They voiced these soft, amorous notes not only while one was at the hole, but also while they rested in the low trees above me.

When a squirrel climbed over the base of a large trunk near by, one of the toucanets flew at it with angry sounds and drove it away. But when the rodent, after retreating a short distance, returned to the same place, the toucanets ignored it. One of the birds alighted upon the ground, apparently to pick up something edible—the first time that I ever saw a toucan of any kind actually upon the ground.

In the afternoon, my vigil over, I brought a ladder and examined the hole in which the toucanets were interested. It had never been completed by the woodpecker that began it, and seemed far too shallow to serve as a nesting cavity for the toucanets. Apparently they had been trying to enlarge it by tearing out the extremely soft, decaying wood from its bottom. I found a good many large flakes on the ground below; and their freshness was evidence that they had just been removed, but I did not actually notice the toucans pull out any wood.

During the following days, I sometimes found one of the toucanets in this cavity, with its head in the doorway. There followed a period of about two weeks, during which I failed to see either bird at the hole. Then they returned, and on May 13 the first of a set of three eggs was laid. This was the nest that I chiefly studied during the period of incubation.

Toucanets do not always content themselves with old abandoned woodpecker holes such as this; sometimes they wrest newly completed nests from the industrious carpenters. At the end of April, I watched a pair of Hairy Woodpeckers taking turns at carving a hole, only 14 feet above the ground, in an old, decaying trunk that stood in the pasture hard by the forest. An oven-bird (*Pseudocolaptes lawrencii*) was nesting in a higher cavity in the same trunk. The wood was soft, and the woodpeckers (which had already lost an earlier, higher nest)

worked hard, rapidly enlarging their chamber. On the afternoon of April 30, when I went to visit the nests of the oven-bird and of the woodpeckers, to my great surprise a toucanet flew out of the latter. The following afternoon, a toucanet again emerged from this hole upon my approach. The woodpeckers could hardly have completed it before the larger, stronger birds took possession. Upon finding the toucanet in the woodpeckers' cavity the second time, I constructed a rustic ladder and approached the nest. I found that one of the toucanets had meanwhile returned to occupy the interior, but when I climbed up to look in with light and mirror, I failed to see the expected eggs on the bottom. It seemed that the invaders were keeping their captured citadel almost constantly garrisoned even in advance of laying their eggs, lest it be retaken in a counter attack by the rightful owners.

Although I did not actually witness the work, I have little doubt that the toucanets enlarged the woodpeckers' doorway, for it now measured 2⅛ inches in width by 1¾ inches in height. The entrance of a neighboring Hairy Woodpecker nest, still occupied by its makers, was only 1⅜ inches in width and 1½ inches high. Possibly the toucanets also somewhat enlarged the interior of the cavity, as they had in the old, low woodpecker hole that I had watched earlier. Although their great bills are not well adapted for wood-carving, they can tear away wood that has been thoroughly softened by decay.

The toucanets also attempt at times to capture the nest-cavities of the Prong-billed Barbet (*Dicrorhynchus frantzii*), which resemble those of woodpeckers with one important difference: barbets carve horizontally into the wood for several inches before turning downward, leaving around the tubular entranceway a greater thickness of wood than is usually found around the doorways of woodpeckers. These thick walls, coupled with the soundness of the trunks that the barbets select for their nests, sometimes at least, prove too strong for the clumsy carving tool of the toucanet. Fernando Gómez, my assistant, told me that he saw a pair of Blue-throated Toucanets tearing at the entrance of a barbet's nest containing eggs, while the owners flitted about and protested; but the pirates made so little headway that they soon gave up, leaving the barbets in possession.

The Eggs

The three nests that I could reach contained respectively four, four, and three, pure white eggs, laid in two of the nests at least, at one-day intervals. Wagner (1944:71) found two young in his nest of the Emerald Toucanet. Very little is known about the number of eggs laid by toucans, but four appears to be the maximum so far recorded. I have seen the eggs of only one other species of toucan, Frantzius' Aracari: the completed set consisted of two white eggs; in another, inaccessible, nest two young were fledged. In an unapproachable nest of the Collared Aracari (*Pteroglossus torquatus*) three young were reared. Van Tyne (1935:25) reports a nest of the same species from El Petén, containing

three eggs; and in British Guiana, Beebe (1917:199) found a nest of *P. aracari* with two young. Van Tyne (1929:24) records three nests of *Ramphastos brevicarinatus* with one, three, and four eggs; and Beebe (1917:192) found a set of two eggs of the Red-billed Toucan (*R. monilis*).

Since it was impossible to reach the eggs without making an opening in the wall of the chamber, which would have decreased the birds' chances of bringing forth a successful brood—and mine of completing my study—I did not remove the eggs for measurement, but viewed them in a small mirror placed in the top of the cavity, while the interior of the nest was illuminated with a small electric bulb let down on the end of a flexible cord, attached to the socket of a small electric torch. I observed the nestlings in the same fashion, never handling them. Such indirect examination of the young does not permit the study of certain points—the exact form of the heel-pads, for example—but it greatly increases the probability that the student will be able to follow the nestlings' development until normal nest-leaving age.

Incubation

The newly completed hole of the Hairy Woodpeckers captured by the toucanets at the end of April was occupied by one or the other member of the pair much of the time during the following days. Yet it was not used for sleeping even as late as the night of May 5. On May 6 the first egg was laid, and on that night one of the toucanets slept in the nest. The next day the second egg was laid, and the two eggs were apparently incubated more or less during the day, although two more were to be laid on the ensuing days. At the low nest on the bank, in which the completed set consisted of only three eggs, one of the parents was also found in the hole on several visits during the day the second egg was laid. But since a continuous watch was not kept, I do not know whether the eggs were kept covered for a substantial portion of the time before the sets were complete.

At my first nest, in the dead cecropia tree, I had seen that the male and female alternated in incubating the eggs. But I thought it would be of interest to make an actual schedule of the movements of a pair during incubation, and for this purpose I chose the low hole in the stub on the bank above the Collared Redstart's nest, which I had found on April 23. The toucanets were tardy in using this hole, and fully three weeks elapsed from the time I first watched them examining it and murmuring softly (April 23) until the first egg was laid there (May 13). By May 15 the set of three was complete, and on May 22—that is, about the middle of the incubation period—I devoted the morning to watching continuously from my wigwam, set in the pathway below the nest. The record follows:

5:25 A.M. Daybreak. I begin to watch the toucanets' nest.
5:37 A toucanet leaves the nest.

5:53 One enters, but leaves after a few seconds.
6:11 One enters.
6:41 It flies forth when a large dry leaf falls loudly to the ground in the woods near by.
6:53 One enters.
7:06 It leaves when it hears the voice of another toucanet (its mate?).
7:23 One enters.
8:29 It leaves.
8:33 One enters.
8:36 It leaves for no apparent cause.
8:50 One enters.
9:12 The mate flies up and clings before the doorway. The toucanet in the nest looks out. They utter low, rattling notes. The bird in the nest pushes past and flies away. The newcomer enters.
10:33 It looks out, leaves.
10:45 One enters.
11:35 It looks out, leaves.
11:36 One enters.
11:37 I depart.

Since I could not distinguish the sexes, it was not possible to determine the exact share of incubation taken by each sex; but the change-over observed at 9:12 proved that they took turns on the eggs, as the pair had done at the higher nest. The toucanets' sessions on the eggs varied from less than one minute to 81 minutes. As a rule, one member of the pair did not continue at its post until relieved by its mate, but the longest period that they left the nest unattended during the morning was 18 minutes. The average length of eight sessions on the eggs was 33.3 minutes; the average of eight periods of neglect was 11.9 minutes. During the first six hours of the day (5:37 to 11:37), counting from the early-morning departure of the bird which was apparently in charge of the nest during the night, the pair incubated a total of 266 minutes, and left the nest unattended a total of 94 minutes.

Thus the pair of toucanets kept their eggs covered only 73.9 per cent of the morning. When parents alternate on the nest, as for example, pigeons, trogons, woodpeckers, jacamars, and antbirds do, the eggs are as a rule kept almost or quite constantly covered, and the continuous sessions of each bird are usually very much longer than those recorded for the toucanets. But inconstant sitting seems typical of the toucan family. In two successive years, I made records of what I believed to be the same pair of Frantzius' Aracaris, and their schedules were very similar to those of the smaller toucanet, with (usually) short sessions and frequent periods of neglect, since one member of the pair did not continue on duty until its partner came to take over. The first year, the aracaris kept their eggs covered only 63.6 per cent of eight hours' observation; and the second year, 65.9 per cent of five hours. One of them took one long session of 102 minutes; but their other sessions were all shorter than the longest of the toucanets', the average for the first year being 25.6 minutes, for the second, 28.1 minutes.

Even the big Rainbow-billed Toucans show the same lack of pa-

tience in incubation. According to Van Tyne (1929:28), the sexes share this duty and relieve each other often. He found that "they were surprisingly restless and frequently stayed on the nest only twenty minutes to an hour before being relieved, or left without being relieved. They were clearly not alarmed about anything, but seemed merely to be bored with the unaccustomed monotony."

The way a bird incubates is determined to a large degree by its temperament, whether phlegmatic or mercurial. Watching a kingfisher perching quietly for hours above a waterway, digesting its latest catch, or a trogon resting upright with calm dignity among the forest boughs, one is soon convinced that these birds' long periods of immobility upon the eggs are entirely in keeping with their character. The restless toucans, however, rarely remain long in one spot, but are constantly flying from place to place and disporting with their fellows.

At the low nest in the stub on the bank where the three eggs were laid from May 13 to 15 inclusive, two hatched on May 30 and the third on May 31. The distribution of hatching lends weight to the conclusion, drawn from casual observations, that fairly constant incubation began with the laying of the second egg. The incubation period was 16 days (if we assume that the last egg laid was the last to hatch). I am not aware of any other determination of the incubation period of any species of toucan.

The Newly Hatched Young

The nestlings in this low nest died when about two weeks old, apparently as a result of the seepage of rain-water into the somewhat dilapidated chamber. The toucanets who stole the nest from the Hairy Woodpeckers also had bad luck; a few days after they began to incubate their four eggs, I found only broken shells in the bottom of the cavity. I believe that one of the weasels that lurked in the pasture grass was responsible for the destruction.

But the nest found on May 5 fared better. It was situated 15 feet above the ground, in a slender, rotting stump in the pasture, near the edge of the forest. To prevent the access of snakes and small mammals to the nest, I encircled the trunk, at a height of about six feet above the ground, with a metallic band 14 inches wide (a 5-gallon kerosene tin flattened out). This is the method commonly employed in tropical countries for the protection of the open-air hen-roosts, and I can recommend it to bird-watchers. Above this metal guard, which gave no purchase to the sharp claws of weasels, squirrels, or tayras, nor to the scales of serpents, the young toucanets remained safe in the low, exposed cavity through all the six weeks of their nest life.

When first examined on May 5, this nest contained three newly hatched toucanets, and one egg that did not hatch until the following day. The day-old toucanets bore so close a resemblance to the newly hatched nestlings of the Prong-billed Barbet which I was studying at

the same time, that had the two broods been mixed together, it would have required close scrutiny to separate them. They also resembled day-old woodpeckers and kingfishers, but not quite so closely. The young toucanets were pink-skinned, with no slightest trace of feathers. Their eyes were tightly closed, their bills short and somewhat flattened, with the lower mandible both longer and broader than the upper (as in the hole-nesters mentioned above and the nestlings of jacamars). The heel-pads, studded with high, prominent papillae, were grotesquely large in comparison with the tiny feet, which seemed mere appendages to the pads. During many days these pads were to bear a far larger portion of the young birds' weight than the toes themselves, and they would prevent abrasion of the heel-joint as the young toucanets shuffled about over the rough nest-floor. Wagner (1944:72) describes and figures the similar nestling of the Emerald Toucanet.

Whenever I looked in at them with electric light and mirror, I found the infant toucanets huddling close together on the floor, their long, scrawny necks usually interlocked. One of the four vanished before it was five days old; the remaining three often arranged themselves in a symmetrical pattern, each with the head of a nest-mate resting on its neck, and its own head supported on the neck of the other nest-mate. They were noisy, uttering a variety of little squeaks and squeals, especially if I lightly shook the nest trunk as though one of the parents had alighted upon it, returning with food. During their first days, they were brooded much by both parents. When one parent arrived with food, it clung beside the doorway until the other came out. I did not see both adults together in the hole at any time, and only one stayed with the nestlings during the night—not both parents, as with Frantzius' Aracaris, or a flock of five grown birds, as was the custom at a nest of Collared Aracaris I watched in Panama. I was never able to determine whether the toucanet which attended eggs and nestlings during the night was the female, as with most birds, or the male, as with woodpeckers and anis—or indeed, whether it was always the same parent.

At this low nest the parents were amazingly fearless, in striking contrast to toucans of other kinds that I have watched attend far higher nests. While studying a nest of the Collared Aracaris, situated a hundred feet above the ground in a huge tree amid the forests of Panama, I found it desirable to conceal myself; but the toucanets would enter their low hole with food while I stood close beside the rotting stub. When I wished to watch their activities for extended periods, I had only to seat myself on a stump at a convenient distance, with no attempt at concealment. In fact, most of the birds of this wild region would go about the business of their nests while I looked on from no great distance, and in plain view.

Food

From the age of a few days onwards, the nestling toucanets were nourished principally with fruits, small at first, gradually increasing in

size as the birds grew larger. The fruits were carried in the tips of the parents' great bills. After the young were full-grown, they received many of the big, hard, green fruits of a tall tree of the laurel family that grew near the nest. These measured about 1½ inches in length by ¾ inch in diameter, and had a thin, olive-colored flesh between the green skin and the single large seed. It must not have required many such fruits to fill up a nestling, but each could have yielded only a relatively small amount of nourishment, since the hard seed was indigestible. Rarely the parents came with articles so small that they were nearly or quite enclosed in the bill and hence difficult to distinguish. Some at least of these small morsels were insects. Several times I watched the adults try to catch insects on the wing, within the edge of the neighboring forest. At times their clumsy efforts seemed to be successful. Once a parent entered the hole with a naked passerine nestling, apparently a Cabanis' Thrush (see below).

The nestling toucanets received rather infrequent meals. During the first four hours of their forty-second day, food was brought to the two surviving nestlings only 16 times, making an average of one feeding for each nestling every half-hour. Although the young toucanets now spent considerable time looking out through their doorway, usually their parents pushed inside to feed them. But on several occasions the parents delivered the food while clinging in front of the entrance. Then I could see that, when smaller fruits were brought, in addition to the one held visibly in the tip of the bill, the parent brought to light others—usually two—that it had carried out of sight in its bill or mouth.

Early one morning, one of the parents arrived with one of the big lauraceous fruits described above. It entered the nest, and after a minute or so started to come out, but when halfway through the doorway it stuck and could go no farther. With its head and breast outside, and its big bill wide open in a ludicrous attitude, it struggled to squirm through, but in vain. Finally it regurgitated the big fruit, which it had apparently swallowed inside the nest when it found that the nestlings could not. Holding the fruit in its bill, as it had done upon entering, it now came through the doorway without difficulty, since it was considerably thinner. For about 25 minutes the toucanet continued to hold the big fruit, resting most of this time on the end of a low stub near the nest. At intervals it went to the nest to offer the fruit once more to a nestling; and finally, on the third offering, one of the young managed to swallow it—or so I infer, for the parent entered the nest with the fruit in its bill and came out without embarrassment, with no fruit visible. Later in the morning, a parent again took in a big fruit, which the nestlings were too full to swallow just then, got stuck in the doorway as it tried to come out, and was obliged to regurgitate the fruit in order to reduce its girth. This time, it carried away the fruit for its own consumption. These laughable incidents demonstrated that the doorway of the nest was barely large enough to allow the adult toucanets to pass

through. One could also see this plainly by watching from directly in front while the bird emerged. The form of the aperture, an oval wider than high, matched the shape of the bird's body and left no room to spare.

Nest Sanitation

Unlike the Frantzius' Aracaris that I had watched the preceding year and the Rainbow-billed Toucans studied by Van Tyne, the parent toucanets did not allow regurgitated indigestible seeds of the fruits they ate to accumulate in the nest. Whether or not they regurgitated such seeds while incubating it was impossible to see, but if so, they did not allow the mouth-castings to remain in the cavity. The parents also removed the empty shells within a day or two after the young hatched. The parents were always careful of sanitation, carrying away a large billful of waste on leaving the hole at daybreak, and again at intervals through the day. In this process all the loose chips on the floor of the nest were eventually removed. Only during the nestlings' last few days in the hole did the parents relax their attention to cleanliness and allow waste material to accumulate.

Growth of Nestlings

The young toucanets developed with extreme slowness—more slowly even than woodpeckers, kingfishers, and motmots, which for small birds have a notoriously long nest-life. They were two weeks old—an age at which many passerine birds are feathered and can fly—when with the mirror I detected the first traces of the feather sheaths. The difference in length between the two mandibles, which a few days earlier had still been conspicuous, now began to disappear. When the nestlings were 20 days old, the sheaths of their contour feathers were just beginning to break through, while those of the remiges had grown distinctly longer. The bill was now becoming somewhat like that of the adult toucanet in shape. It was not until May 30, when they were 25 days old, that I saw the nestlings with open eyelids, but the eyes still appeared cloudy, as though covered by a delicate membrane. By June 1, however, the eyes were both open and clear. The remiges and the contour feathers (except those of the head) were then beginning to break forth from the ends of their sheaths, though these had not yet become so long and conspicuous as those of kingfishers, motmots, jacamars, or lowland trogons. From their very first appearance, the feathers were green like those of the adults. At this age the nestlings were very noisy, uttering a variety of little grunts and squeals, so that their nursery reminded me of a piggery in miniature.

Even after the feathers began to expand at the ends of their sheaths, the young toucanets were long in acquiring a complete covering. On June 5, when they were a full month old, much of their skin was still exposed. By June 9, when they were 35 days of age, they were fully clad

(at least on their upper parts, which alone I could see), but their tails were still very stubby. Even now, they were not ready to venture forth into the world. They were 39 days old before I saw one with its head in the top of the chamber, looking out through the doorway. And still they lingered a few days longer.

Before they took flight, the young toucanets began to resemble their parents closely in plumage, even to their blue throats. But their eyes were still surrounded by rings of light-colored bare skin, and their bills, though gradually approaching adult dimensions, were still much smaller, and somewhat different in coloration. The upper mandible was much like that of the adults—black at the base and along the lower edge, elsewhere light yellow—but it lacked the red area at the base of the culmen. The lower mandible was black only along the cutting edge; elsewhere it was yellow clouded with black. The white line around the base of the bill, so conspicuous on the grown birds, was lacking in the young.

Departure of the Young

The two young toucanets left the nest on June 17 (at 43 days of age) before nine o'clock in the morning. Upon my arrival at that hour, I found one of them perching in a low tree at the edge of the woods, where the parents brought it food. It was nearly as big as they. It took a leaf in its bill, as though to test its edibility, but decided that it was not good to eat. I failed to find the other fledgling, which had apparently wandered farther into the woods.

A nestling period of 43 days is amazingly long for so small a bird, but other toucans remain in the nest as long, or longer. Wagner (1944: 73) estimates a nestling period of at least six weeks for the Emerald Toucanet. On Barro Colorado Island, in 1935, I watched a nest of the Collared Aracari situated high in a forest tree in a perfectly inaccessible position. The first of the young birds did not emerge until 44 days after I first saw food taken into the hole, and it is probable that I overlooked the first tiny morsels, and that the nestlings were already a few days old when I found evidence that they had hatched. Van Tyne (1929: 34) lost his brood of Rainbow-billed Toucans to some predacious animal when they were 36 days old, and was unable to determine the nestling period by direct observation. But from the known rate of growth of the young toucans, and the measurements of fledglings collected immediately after they left the nest, he estimated that if undisturbed they would have flown at the age of about 45 days. This is certainly a conservative estimate. In other families, as, for example, woodpeckers, kingfishers, and the Icteridae, the nestlings of big species depart later than those of small ones, and I think it likely, therefore, that these big toucans would remain in the nest at least five or six days longer than the toucanets or the aracaris.

Sleeping Habits

A single parent continued to sleep nightly with the nestling toucanets until they were at least 41 days old. I have no observations on this point for their next-to-last and final nights in the nest; unfortunately, I did not know exactly when they would depart. At the close of their first day among the trees, I watched for their return to the nest, but none of the family came near it, and thereafter the hole was abandoned. The same was true of a second, high, nest that I watched later. A slight litter of droppings in the bottom of the cavity at the time of the fledglings' departure was not subsequently removed by the parents.

The toucans' ways of sleeping are of considerable interest. Wagner (1944:69) apparently found the Emerald Toucanet roosting in holes in trees. Collared Aracaris and Frantzius' Aracaris regularly lodge in such holes, either natural cavities or abandoned nests of the larger woodpeckers. I have known as many as seven of the former, and five of the latter, to pass the night in the same hole. Male and female may sleep in the nest cavity before the eggs are laid; during the period of incubation, a single parent attends the eggs by night; but after the nestlings hatch, both parents sleep with them. Among Collared Aracaris, I have known as many as three other grown birds to take shelter with the parents and the nestlings. The newly departed fledglings return to sleep in the cavity where they were reared.

With these facts in mind at the time I studied the Blue-throated Toucanets, I made every effort to learn whether they used holes in trees as dormitories. Although I spent many an evening watching promising holes, I did not once see a toucanet enter one before the breeding season began. The birds would vanish through the foliage as darkness deepened, and I never succeeded in learning exactly where they roosted. The fact that the second parent did not sleep in the chosen nest before the eggs were laid, or spend the night with the nestlings, in the fashion of the aracaris, also weighs against the supposition that these toucanets use holes as dormitories. Even the parents' neglect, after the departure of the nestlings, to remove the last vestiges of excrement from the hole, suggests that the former nest is not employed as a dormitory—woodpeckers and barbets that continue to use the nest as a family dwelling after the young are a-wing, are careful to clean it thoroughly upon their exit. Of course, the young toucanets might have been led to take shelter in other cavities; but weighing all the evidence, my conclusion is that Blue-throated Toucanets do not lodge in holes, but rather roost among the foliage. The toucanets were no less abundant, and far more conspicuous, than the Prong-billed Barbets, the Hairy and the Green Woodpeckers, and the Allied Brownies (*Lepidocolaptes affinis*) among which they dwelt. During my year at Vara Blanca, I found several dormitories of each of these species, but not one of the toucanets.

Similarly, I have never been able to discover dormitories of the big toucans of the lowlands, the Rainbow-billed and Swainson's Toucans (*Ramphastos swainsonii*). I have often watched in the evening while these great, yellow-breasted birds sang their vespers among the tree-tops, hoping that I might at last follow their flight to their sleeping quarters. But usually they continue their monotonous singing until the light grows dim and practically all other diurnal birds have sunk into drowsy silence. Then they fly off through the dusk, baffling any attempt to keep them in view until they reach their destination. I am familiar with no definite record of their lodging in hollow trees, although Van Tyne (1929:20) surmises, largely from analogy with the aracaris, that they do so.

The Second Brood

Of the three accessible nests, two, as already recorded, were prematurely destroyed. If the parents in the third nest, whose nestlings departed on June 17, attempted a subsequent brood, I was unable to discover their second nest. Each of two pairs that nested in holes high out of reach reared, or tried to rear, two broods in the same cavity. One of these pairs incubated in April and fed nestlings during May; in late June they appeared to be incubating once more, and through much of July they were again taking food into the hole. At the other nest, 90 feet above ground, to which I gave only casual attention, the parents were bringing food on May 15 and again on July 6. The spread of these dates makes it practically certain that they were not feeding the same nestlings on both occasions.

It was unexpected to find these highland toucans raising two broods in a season. The pair of Frantzius' Aracaris that I watched for two years, at lower altitudes, lost young nestlings the first year, while in the second their eggs were destroyed. On neither occasion could I find evidence of a second attempt to nest (which, of course, would not have been a true second brood). Van Tyne (1929:34) concluded that the Rainbow-billed Toucan raised only a single brood in a season. In this connection, it is of interest that the Quetzals, neighbors of the Blue-throated Toucanets in the highland forests, quite generally reared second broods at Vara Blanca in 1938; but I have yet to find unequivocal evidence for a true second brood among the lowland trogons.

Relations with Other Birds; the Significance of the Bill

The boy who helped me to find nests saw a Blue-throated Toucanet fall prey to a White-throated Falcon (*Falco albigularis*), a hawk scarcely larger than its victim, but fierce out of all proportion to its size. Aside from this, I discovered no dangerous enemies of the adult toucanet. But if it has few enemies, it has likewise few friends. Its nest-robbing habits cause it to be intensely disliked by the small birds

among which it dwells. The Costa Rican Wood Pewees (*Myiochanes lugubris*) have a particular antipathy to the toucanets, and become greatly excited whenever one appears anywhere in the vicinity of their mossy nest.

I actually witnessed nest robbery by the toucanets on only one occasion. One afternoon in May, my attention was drawn by a Cabanis' Thrush (*Turdus plebejus*) which was very much upset. She perched on the ends of the branches of a wide-spreading, dense, shrub-like epiphyte attached high above the ground to the trunk of a lofty tree, where she nervously twitched her wings and uttered sharp, Robin-like calls of distress. She flew back and forth around the shrub in which she doubtless had her nest, darting at something that was screened from my view by the compact foliage and by the mist that shrouded the trees. Presently a toucanet flew out of the shrub, with the thrush in hot pursuit. I then went to the toucanets' nest where I had been observing the nestlings, and which was situated at no great distance from the scene of this episode. Presently one of the parent toucanets arrived there with the legs of a passerine nestling dangling from its bill—the body of the victim was largely concealed, but I assumed that it was a nestling taken from the thrush.

There has been a good deal of conjecture as to the significance of the huge, usually brightly colored, bills of the toucans. Some of the conflicting opinions are summarized by Van Tyne (1929:38). Belt (1888: 197) believed that the great size of the toucan's bill made it more effective as a weapon with which to defend itself, its eggs, and its young. He thought that the big bird, surrounded by the solid wooden walls of its nest-chamber, could ward off the attacks of monkeys, raccoons, opossums, and other small animals that might seek to force an entrance through the narrow doorway. My own experience with toucans of several kinds is essentially that of Van Tyne (1929:28), that they forsake their nest-holes upon the approach of real or fancied danger, making slight effort to defend them, either from within or without. Once at dawn, I surprised a kinkajou at the nest of the biggest toucan of Central America (*Ramphastos swainsonii*), high up in a great trunk at the edge of the forest. The toucan was not within, presenting its supposedly formidable beak to the foe, but was darting at the kinkajou from the outside. The quadruped scrambled down the trunk; but if it had not already devoured the eggs, it probably came back for them later; for soon after this the nest was abandoned.

Doubtless toucans do well to escape from the cavity when an arboreal mammal approaches. I do not believe that even Swainson's Toucan could face on equal terms such animals as the white-faced monkey, the coatimundi, the tayra, or even the kinkajou, all of which enjoy an occasional bird's egg or nestling. Even the little toucanet can put a squirrel to flight—as do many birds with far smaller bills—but for all its formidable appearance, the great bill of the toucan is of slight, hollow

construction, likely to be broken if put to too strenuous use. A Swainson's Toucan, with the terminal inch or two broken from its maxilla, has frequented this vicinity for the past two years. It appears to keep well nourished, but leads a solitary existence, apart from its fellows.

Van Tyne (1935:24) wrote: "It appears that length, as such, is the significant feature of its [the toucan's] bill." That the long bill brings within the toucan's reach edible objects that would otherwise be inaccessible to a bird so heavy and so clumsy upon the wing, such as fruits at the tips of weak and slender twigs, and eggs in nests attached to the drooping extremities of twigs, must be clear to anyone who has devoted much attention to the habits of these birds in their native forests. But it is obvious that a slender bill of the same length, soberly colored, would serve equally well for this purpose. As I watched the Blue-throated Toucanet despoiling the nest of the Cabanis' Thrush, while the owner flitted about in helpless indignation, it occurred to me that the great beak served yet another function; and during subsequent years, after watching Swainson's Toucans on their marauding expeditions, I have become convinced that this function is important to the toucans: I believe that the huge, boldly colored beak intimidates other birds and prevents their attacks. To any bird of the toucan's size, or smaller, this bill must seem indeed a formidable object. Bright coloration heightens the psychological effect that any object tends naturally to produce; it makes agreeable things more pleasing, but augments the fearsome aspect of objects that inspire dread. The bright colors of the toucan's bill doubtless make it appear more terrible to other birds than it would if more soberly tinted.

When a toucan alights near the nest of a small bird, the distressed owners merely dart back and forth above it, fearing to come within range of the terrifying bill, while the marauder snaps at them as they swoop past, sometimes voicing harsh, angry notes at the same time. Even the bigger and more aggressive flycatchers are afraid to attack a perching toucan. The Boat-billed Flycatcher (*Megarhynchus pitangua*), a giant in its family, has a strong antipathy to the Swainson's Toucan; a nesting flycatcher will leave eggs or young and fly a thousand feet to meet and worry a toucan that comes within sight of the nest; yet it dares not actually attack until the toucan begins to fly. On the wing, the toucan cannot defend its back, and the flycatcher pounces upon it to relieve its feelings by tearing out feathers. The Costa Rican Wood Pewee behaves similarly when the Blue-throated Toucanet comes near its nest.

Briefly, the length of the toucan's bill brings within reach food that might otherwise be inaccessible; its bulk and brightness make it appear more formidable than it actually is and serve to intimidate the birds whose nests the toucan loots. In these ways the immense beak is undoubtedly of use at the present day. But I do not, of course, claim that these uses are sufficient to explain its evolutionary development.

Summary

A study was made of the Blue-throated Toucanet (*Aulacorhynchus caeruleogularis*) near Vara Blanca, Costa Rica, from July, 1937, to August, 1938.

This toucanet dwells in the mountain forests of Costa Rica and western Panama. Its recorded altitudinal range is from 2,500 to 7,600 feet above sea-level.

These birds nest in woodpecker holes and similar cavities, which they sometimes slightly enlarge. The doorway of the nest is barely large enough to permit the passage of the adults through it.

Six occupied nests were found; these were placed at heights ranging from 7 to 90 feet above the ground.

Even before the first egg was laid, one or the other member of a pair of toucanets spent much time by day in a newly carved hole they had stolen from Hairy Woodpeckers.

Of three accessible nests, two contained four eggs and the other, three eggs. The eggs were white, laid on successive days, and rested upon wood fragments in the bottom of the unlined cavity.

Incubation was carried on by both sexes. The toucanets were restless on the nest, often going off without awaiting relief, leaving the eggs uncovered.

At one nest the incubation period was 16 days.

The young are hatched blind, perfectly naked, and with the lower mandible both longer and broader than the upper. They are equipped with large heel-pads upon which they rest during the long nestling period.

Both parents brooded and fed the nestlings. Their food consisted chiefly of fruit, varied with small insects, and now and then the nestling of some other species.

The parents kept the nest perfectly clean until just before the young were ready to depart.

The nestlings developed with extreme slowness. Their eyes did not open until they were about 25 days old, and they were not completely clad with feathers until 35 days old.

One or the other of the parents stayed with the nestlings each night, at least until two days before nest-leaving.

The young toucanets left the nest when 43 days old, before 9 A.M. They now resembled their parents in plumage and color of bill, with certain minor differences, but their bills had not yet reached full adult size.

Two pairs reared two broods in a season.

Blue-throated Toucanets were not found sleeping in holes.

The Blue-throated Toucanet sometimes falls prey to the White-throated Falcon (*Falco albigularis*). Aside from this, the adult appears to have few harmful enemies.

The length of the toucan's bill is important in bringing within reach food that would otherwise be inaccessible. The bulk and bright coloration of the bill intimidate the small birds whose nests they despoil, thereby preventing attacks on the toucans by angry parents.

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EASTWARD MIGRATION THROUGH THE GULF STATES

BY W. L. MC ATEE, THOMAS D. BURLEIGH, GEORGE H. LOWERY, JR., AND HERBERT L. STODDARD

A VAST movement of birds from northwest to southeast is a recognized feature of the autumnal migration in North America. It brings to New England moderate numbers of Holboell's Grebe, Bonaparte's Gull, the Redhead, Canvasback, and the Lesser Scaup; to the middle Atlantic States, larger flights of those species, as well as the Baldpate, Shoveller, Black Tern, and the Western Palm Warbler; and to more southern states, the Gadwall, Western Sandpiper, Orange-crowned Warbler, Scissor-tailed Flycatcher, Arkansas Kingbird, Brewer's Blackbird, and Leconte's and Nelson's Sparrows. There are, for some species in the last group, a few scattered records in the Northern States (a result of occasional movement of individuals from southwest to northeast), but the regular group migrations of these birds in the Gulf States are predominantly eastward. Arkansas Kingbirds (*Tyrannus verticalis*) are sometimes common in Florida, and as many as 15 Scissor-tailed Flycatchers (*Muscivora forficata*) have been seen together on Key West (Greene, 1944:304).

Certain birds whose southeastern courses, if continued, would carry them south of the Gulf States, are deflected by the Gulf of Mexico, and follow it for varying distances, some to the very tip of Florida and even to the West Indies. They are joined by others moving more directly eastward and by a trickle of wanderers from Texas and (possibly) northern Mexico.

This flow across the Gulf States of birds of western and southwestern origin is sufficiently strong and regular to call for more general recognition. Little known as it still seems to be, this flight was, nevertheless, discussed by Robert Ridgway in 1874. Writing of the eastern and western forms of the Burrowing Owl, Aphelocoma Jay, Loggerhead Shrike, and the Dwarf Nuthatch, he said, "Not only with these stationary birds is there a near relation between the western region and Florida, but there is also a connection between them by the migratory ones, no less than five western species not found elsewhere in the Atlantic States, having been recorded from that peninsula" (1874:217).

Subsequent observations have added considerably to the evidence adduced by Ridgway. The published as well as numerous unpublished records, bearing on a Gulf Coast line of eastward flight, are summarized in Tables 1 and 2. It is fortunate for this presentation of the subject that for the avifaunas of three of the four states involved there are fairly recent books that can be used as key bibliographic sources. Information for Alabama is not so plentiful, because less intensive field work has been done there. For this reason, as well as on account of geographical propinquity, non-peninsular Florida and Alabama are herein considered as

a unit. The results of nearly 30 years' field investigations by Francis M. Weston in extreme western Florida, added to the data available from Alabama, place the combined areas on a level comparable with that of the well-worked regions of Louisiana, southern Mississippi, and Florida.

The state and regional lists used in compiling Table 1 are: for Louisiana, Oberholser (1938); for Alabama, Howell (1924); for Florida, Bailey (1925), and Howell (1932); for the West Indies, Bond (1936 and 1940). Mississippi records are based almost exclusively on the observations and collections of Burleigh, who is now preparing a manuscript, "The Bird Life of the Mississippi Gulf Coast," for publication. The Georgia records have been compiled from a number of sources, including the personal observations of Burleigh and Stoddard. Much additional information has been drawn from the records and extensive collections in the Louisiana State University Museum of Zoology, assembled largely since the publication of Oberholser's book (to which Lowery is now compiling a supplement), and from statements kindly furnished us by several ornithologists who have done intensive work in the regions under consideration. Among these, we are particularly obliged to Earle R. Greene, Robert Norris, and Francis M. Weston. The state lists mentioned may be consulted for the names of the original authorities as well as for details about the occurrence of many of the birds listed in our tables. Other sources, particularly publications issued since the comprehensive works cited, are listed at the end of this paper. For the purposes of this study, the occurrence of a species or subspecies in a given region is considered established only when at least one specimen of the form has been collected there.

A factor that may well be taken into consideration in appraising the significance of bird records such as form the basis of this paper, is the large number of observers in the North, particularly in the North Atlantic States, which makes bird stragglers there, as reported in the literature, seem more common than they are, while in the South, bird students are so few that their records may make comparatively common birds appear to be stragglers. To put the situation in other words, there might be a hundred times as many individuals of a given species in a southern area as in a comparable tract in the Northeast, yet due to the inverse ratio of observers, reports eventually finding their way into print might give just the opposite impression.

No problem has been more troublesome to us than that of deciding what to include in, and what to omit from, Table 1. Readers may wonder why they do not find certain forms listed, but in most cases we believe these will prove to be species that breed so far to the eastward that their representatives collected in the Gulf States could have reached that area by a southward movement with little or no eastward trend. The greater part of the breeding range may lie to the west or northwest, and the bulk of the migration may be eastward or southeastward; yet the fact that this is not true of all, counsels against inclusion of the

TABLE 1

BIRDS WHICH MIGRATE EASTWARD IN THE GULF STATES

Species	Louisiana	Mississippi	Alabama and non-peninsular Florida	Georgia	Peninsular Florida	West Indies
White Pelican (*Pelecanus erythrorhynchos*)	F	Occ.	F	R	F	R
Cinnamon Teal (*Querquedula c. cyanoptera*)	Occ.	—	—	—	R	—
Western Red-tailed Hawk (*Buteo jamaicensis calurus*)	Occ.	—	—	—	—	—
Fuertes' Red-tailed Hawk (*Buteo jamaicensis fuertesi*)	R	—	—	—	—	—
Texas Red-shouldered Hawk (*Buteo lineatus texanus*)	Occ.	—	—	—	—	—
Swainson's Hawk (*Buteo swainsoni*)	—	—	—	—	F	—
Sennett's White-tailed Hawk (*Buteo albicaudatus hypospodius*)	R	—	—	—	—	—
Harris's Hawk (*Parabuteo unicinctus harrisi*)	R	—	—	—	—	—
Western Snowy Plover (*Charadrius nivosus nivosus*)	F	Occ.	—	—	—	—
Mountain Plover (*Eupoda montana*)	—	—	—	—	R	—
Long-billed Curlew (*Numenius americanus*)	F	R	R	R	R	R
Western Willet (*Catoptrophorus semipalmatus inornatus*)	F	F	R	F	F	R
Long-billed Dowitcher (*Limnodromus griseus scolopaceus*)	F	—	R	Occ.	Occ.	—
Avocet (*Recurvirostra americana*)	R	—	—	R	R	Occ.
Franklin's Gull (*Larus pipixcan*)	Occ.	—	—	—	R	R
Mexican Ground Dove (*Columbigallina passerina pallescens*)	Occ.	Occ.	—	—	—	—
Inca Dove (*Scardafella inca inca*)	R	—	—	—	—	—
Groove-billed Ani (*Crotophaga sulcirostris sulcirostris*)	F	R	—	—	R	—
Western Burrowing Owl (*Speotyto cunicularia hypugaea*)	F	F	R	—	—	—
Howell's Nighthawk (*Chordeiles minor howelli*)	Occ.	R	—	—	—	—
Cherrie's Nighthawk (*Chordeiles minor aserriensis*)	Occ.	R	—	—	—	—
Western Nighthawk (*Chordeiles minor henryi*	R	—	—	—	—	—
Sennett's Nighthawk (*Chordeiles minor sennetti*)	R	—	—	—	—	—
Pacific Nighthawk (*Chordeiles minor hesperis*)	Occ.	—	—	—	—	—
Texas Nighthawk (*Chordeiles acutipennis texensis*)	R	—	—	—	—	—

TABLE 1 (*Continued*)

Species	Louisiana	Mississippi	Alabama and non-peninsular Florida	Georgia	Peninsular Florida	West Indies
Vaux's Swift (*Chaetura vauxi*)	Occ.	—	—	—	—	—
Rufous Hummingbird (*Selasphorus rufus*)	R	—	R	—	—	—
Vermilion Flycatcher (*Pyrocephalus rubinus mexicanus*)	F	R	F	—	—	—
Western Brown Thrasher (*Toxostoma rufa longicauda*)	Occ.	R	—	—	—	—
Palmer's Thrasher (*Toxostoma curvirostre palmeri*)	—	—	R	—	—	—
Sage Thrasher (*Oreoscoptes montanus*)	R	—	—	—	—	—
Mono Hermit Thrush (*Hylocichla guttata polionota*)	—	R	—	—	—	—
Pacific Pipit (*Anthus spinoletta pacificus*)	R	R	—	—	—	—
Sprague's Pipit (*Anthus spraguei*)	Occ.	R	—	R	Occ.	—
White-rumped Shrike (*Lanius ludovicianus excubitorides*)	R	—	—	—	—	—
Alaska Yellow Warbler (*Dendroica aestiva rubiginosa*)	F	R	—	—	—	—
Hoover's Warbler (*Dendroica coronata hooveri*)	Occ.	Occ.	—	—	—	
Townsend's Warbler (*Dendroica townsendi*)	—	R	—	—	—	—
Northern Pileolated Warbler (*Wilsonia pusilla pileolata*)	—	R	—	—	—	—
Western Yellow-throat (*Geothlypis trichas occidentalis*	R	—	—	—	—	—
Gray Ovenbird (*Seiurus aurocapillus cinereus*)	R	R	—	—	—	—
British Columbia Waterthrush (*Seiurus noveboracensis limnaeus*)	F	Occ.	—	—	—	—
Rio Grande Meadowlark (*Sturnella magna hoopesi*)	R	—	—	—	—	—
Thick-billed Red-wing (*Agelaius phoeniceus fortis*)	R	—	—	—	—	—
Bullock's Oriole (*Icterus bullocki*)	R	—	—	—	—	—
Mesquite Great-tailed Grackle (*Cassidix mexicanus prosopidicola*)	F	—	—	—	—	—
Nevada Cowbird (*Molothrus ater artemisiae*)	Occ.	—	—	—	—	—
Western Tanager (*Piranga ludoviciana*)	R	R	—	—	—	—
Western Savannah Sparrow (*Passerculus sandwichensis anthinus*)	—	R	—	—	—	—

TABLE 1 (*Continued*)

Species	Louisiana	Mississippi	Alabama and non-peninsular Florida	Georgia	Peninsular Florida	West Indies
Nevada Savannah Sparrow (*Passerculus sandwichensis nevadensis*)	F	Occ.	—	—	—	—
Texas Seaside Sparrow (*Ammospiza maritima sennetti*)	—	—	R	—	—	—
Western Vesper Sparrow (*Pooecetes gramineus confinis*)	R	R	—	—	—	—
Western Lark Sparrow (*Chondestes grammacus strigatus*)	R	R	—	—	—	—
British Columbia Junco (*Junco hyemalis cismontanus*)	R	—	—	—	—	—
Gambel's Sparrow (*Zonotrichia leucophrys gambeli*)	—	R	—	—	—	—
Golden-crowned Sparrow (*Zonotrichia coronata*)	R	—	—	—	—	—
Dakota Song Sparrow (*Melospiza melodia juddi*)	R	R	—	R	—	—
Alaska Longspur (*Calcarius lapponicus alascensis* [>*lapponicus*])	Occ.	—	—	—	—	—

R = rare (a few records over a number of years); *Occ.* = occasional (several records); *F* = frequent (of regular occurrence in appreciable numbers). These designations represent our interpretation of the available data. Records of subspecies are based entirely on collected specimens which, except for *Calcarius lapponicus,* are all perfectly typical examples.

species in the table. Examples are the Yellow-headed Blackbird, Giant Redwing, Western Meadowlark, Western Henslow's Sparrow, Clay-colored Sparrow, Bell's Vireo, Willow Thrush, and Grinnell's Water-thrush.

Frederick C. Lincoln informs us that banding records show that the Canada Geese and Ring-necked Ducks that winter in Florida come from the Mississippi flyway, but they are, of course, not included in the table since both species breed east to the Atlantic coast.

There are a number of Gulf States records of species that occur to the west and southwest but also in the West Indies; and it is probable that at least some of these records are of west-to-east travelers; they are, however, excluded from the tables because the birds may reach the Gulf Coast from the Bahamas, Cuba, and Puerto Rico. The species thus eliminated are the Mexican Cormorant, the Masked Duck, Mexican Jacana, Black-necked Stilt, and Eastern White-winged Dove.

The Arkansas Kingbird and Scissor-tailed Flycatcher, mentioned in the opening paragraph of this paper, may be regarded as regular west-to-east travelers in the Gulf States, but the number of scattered records

for these two flycatchers over the eastern states in general is so great that it was thought inadvisable to include them in the table.

The frequency of occurrence of western birds eastward across the Gulf States is about that which on geographical grounds would be expected. Excluding breeding forms, there are 49 for Louisiana; 27 for Mississippi; 9 for Alabama and non-peninsular Florida; 7 for Georgia; 11 for peninsular Florida; and 5 for the West Indies (Table 1). Adding to the 54 migrant species (including the two flycatchers mentioned above) the 11 resident species probably derived from eastward wanderers (Table 2), we have 65 species, a significant fraction of the total North American avifauna (some 700 species, excluding stragglers). In spite of deficiencies in available information, the statement is probably justified that, measured by the number of kinds of birds that reach the various states, the west-east flight along the Gulf Coast is about three times as strong in Louisiana as it is in peninsular Florida, and that between these points, it decreases in strength more or less in proportion to its eastward extension.

TABLE 2

Birds of Probable Western Origin *
Now Resident in the Gulf States (east of Texas)

White-faced Glossy Ibis, *Plegadis guarauna* (La., Fla.)
Fulvous Tree-duck, *Dendrocygna bicolor helva* (La.)
Florida Duck, *Anas fulvigula fulvigula* (Fla.)
White-tailed Kite, *Elanus leucurus majusculus* (Fla.)
Audubon's Caracara, *Polyborus cheriway audubonì* (Fla.)
Attwater's Prairie Chicken, *Tympanuchus cupido attwateri* (La.)
Florida Crane, *Grus canadensis pratensis* (Miss., Ga., Fla.)
Eastern Willet, *Catoptrophorus s. semipalmatus* (Miss., Ala., Fla.)
Florida Burrowing Owl, *Speotyto cunicularia floridana* (Fla.)
Texas Horned Lark, *Otocoris alpestris giraudi* (La.)
Florida Jay, *Aphelocoma coerulescens* (Fla.)
Brown-headed Nuthatch, *Sitta pusilla* (La., Miss., Ala., Ga., Fla.)
Boat-tailed Grackle, *Cassidix mexicanus major* (La., Miss., Ala., Fla.)

The chief interest of this eastward flow of birds is its significance in relation to theories of bird distribution. As Ridgway pointed out in 1874, we have here a clue to the origin of eastern colonies of western birds. In contrast to Ridgway's four, we are now able to list ten, Floridian (as well as three Louisianian) forms of probable western derivation (Table 2). The proximate cause of their settling in the East seems to be their becoming acquainted with the country by participating in the west-east migration; the ultimate cause of the migration itself is, of course, unknown.

The fact that the connection between western and Gulf Coast avifaunas can be traced even through forms that are now locally extirpated,

* The shrike (*Lanius ludovicianus*), although included in Ridgway's list of western birds in Florida, is omitted from this table because we consider that it has a northern rather than a western origin.

or entirely extinct and known only as fossils, is also relevant. One of these is the Painted Vulture of Bartram (1773–74 [1943]: 165), which in all probability was a form of the species *Sarcoramphus papa* (Bonaparte, 1826–28; Lesson, 1831; Harper, 1936; McAtee, 1942).

The Pleistocene bird life of Florida (see Wetmore, 1940) was much like that now existing, but it included some notable strangers, and in nearly every case these were forms with western relationships. An observer then could have seen the Anhinga, the White Ibis, and most of the herons, egrets, and shoal-water ducks that are now present; also certain cranes and rails, the Coot, and Common Gallinule; various vultures, hawks and eagles (including the Osprey and Bald Eagle), the Bob-white, Wild Turkey, owls, crows, blackbirds, and grackles. The remains of small birds are not so susceptible of preservation in the fossil state (though they doubtless were in general of about the same species as we now find in Florida). The known Pleistocene birds with western affinities were mostly large birds and included the California Condor and the Whooping Crane, as well as two extinct raptors known both from California and from Florida fossil beds (*Teratornis merriami* and *Polyborus prelutosus prelutosus*).

These facts regarding the fossil avifauna of Florida are of the greatest interest in connection with the strong present-day tendency of western birds to push to the eastward along the Gulf of Mexico. This avian stream, evidently the source of the western element in the bird fauna of the Southeast, has been flowing for geologic time, but we are only beginning to realize its importance as a subject of ornithological inquiry.

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WEIGHT RECORDS FOR SOME ATLANTIC ALCIDAE

BY R. A. JOHNSON

THE need for weight records of birds to show individual and geographical variation as well as yearly, daily, sex and age variations has been pointed out by Nice (1938). Amadon (1943 *a* and *b*) has discussed the mathematical analysis of weight data, particularly the relationship of egg weight to body weight and body weight to "general size."

During the breeding seasons of 1931, 1934, and 1938, while working on a general study of the Murre in the Cape Whittle region, I recorded weights of the various species of Alcidae nesting there. This region, on the north shore of the Gulf of St. Lawrence, offers the greatest concentration of alcid breeding colonies on the Atlantic coast of North America. In the vicinity of Wolf Bay, a few miles west of the Cape, and on the St. Mary Islands, a few miles to the east, a great number of small colonies and a few large ones occupy the favorable breeding sites on the small and rocky offshore islands. They are here well isolated from the dogs and other enemies on the mainland; also, many of these islands are within a Government sanctuary system which is excellently patrolled, and I believe it is largely due to this system that the main populations have survived. Weight data on five species—Razor-billed Auk (*Alca torda*), Atlantic Murre (*Uria aalge*), Dovekie (*Plautus alle*), Black Guillemot (*Cepphus grylle*), and Atlantic Puffin (*Fratercula arctica*)—are presented in this report. An attempt was made to secure a series of weights for each species: of the eggs, of the growing young, and of the adults. It is not possible to handle one of these birds frequently (Johnson, 1938:162); in fact, one such disturbance early in the incubation period may cause the entire colony to abandon the site. The weights of the growing young are especially affected by repeated fright of the adult colony, and I took great care to minimize this disturbance factor. Hence, much time is required to secure an adequate series of representative weights. It will be long before we have sufficient data to determine accurately the average weight or daily weight rhythm of these sea birds, or their geographical, seasonal, and other variations, and although my data are in some instances very meagre, it seemed wise to make them available to other students at the present time.

The weight data presented here should be considered in relation to feeding and incubating habits of the birds. Baldwin and Kendeigh (1938:463), for example, found a daily rhythm in the weight of birds they investigated, "with the greatest weights being reached in the late afternoon or early evening and the lowest weights early in the morning." But this conclusion is based chiefly on data from passerine species, which feed largely on insects and seeds and thus accumulate their daily

food requirements gradually over a feeding time of considerable length. Whereas fish-eating birds, such as the Alcidae, by consuming one or more whole fish at a feeding, greatly alter their total weight in a short space of time. Also, the feeding day in northern latitudes is much longer than in middle latitudes and needs to be considered as a factor in the study of weights. (I have observed Murres, for example, feed young until 9:30 P.M. and resume feeding at 3:00 A.M. And it is possible that adults feed at sea during any hour of the night.) Furthermore, some species, like the Murre, often remain on the eggs during incubation for many hours and are sometimes without food for 15 to 24 hours.

In considering the growth of the young it is well to note that the young of Guillemots and Puffins (both burrow nesters) remain at the nest site much longer than the young of the related Auks and Murres (both surface nesters). When we have adequate data on a larger number of species, we may find that the growth curve of one burrow nesting species is more closely comparable with that of another burrow nesting species, whether of the same or a different family, than with that of a surface nesting species of the same family. I believe that, during the time the bird spends at the nest site, its environment, behavior patterns, and growth curve are closely correlated.

The factor of evaporation from eggs was ignored in this study and records made regardless of the stage of incubation. Addled eggs were readily detected and were discarded. In making the growth-study, young birds were marked by colored glass beads in different combinations, strung on soft copper wire and placed around the tarsus, where they remained until the young were old enough to carry an aluminum band. To secure the weight record, birds were placed in a cloth bag and weighed on scales sensitive to one tenth of a gram. The weight of the bag fluctuated in the field and had to be redetermined frequently. Except for some of the data relating to adult Murres and Black Guillemots, it was not possible to distinguish sexes. Table 2 appears to indicate a sex difference in the weight of Murres. Wing measurements are also included in the table for the Murre.

All the species studied were well started in the incubation period. The general condition of all birds weighed appeared to be good and was probably typical of the average breeding season. Food was abundant during June and July of 1934 and 1938, when this study was made. No evidence of disease was noted in any of the colonies. However, young birds in the Murre and Auk colonies were sometimes parasitized by ticks and lice. Because the present study was, for the most part, conducted within the confines of a Government sanctuary, it was not possible to record significant data relating to the role of internal parasites in relation to the health of these birds. So far as the adults are concerned, probably only healthy birds would be found in the breeding colonies. But the growth curve of young birds may at times be affected by such parasites. I have found downy young of the Red-breasted Merganser

taken in the region heavily infested with tapeworm (Johnson, 1937). I am certain that a weakened condition of many young birds of these colonial species is followed by a greater incidence of ticks and lice. It is not possible to show that such a weakened condition is always a result of starvation—internal parasites may be a factor. In the Murre, the care of young, so far as food is concerned, is certainly after the first few days, dependent upon a vigorous ceremonial response from the young. A weakened condition due to internal parasites would inhibit this response and thus perhaps lead to the neglect of the young by the parent birds.

Razor-billed Auk. Thirty-eight eggs of the Auk varied in weight from 73.5 grams to 100 grams (average: 85.4 grams). Two young Auks observed before their first feeding, weighed 57 and 60 grams. One juvenile, approximately three weeks old, leaving the nest site to go to the water (they do not return to the nest site as young birds), weighed 167 grams. The average weight of seven adult birds taken at the nest was 686 grams (extremes: 608 and 740 grams).

Figure 1. Young Murre and pipped egg.

Atlantic Murre. Fifteen eggs of the Murre varied in weight from 83 to 117 grams (average: 103.4 grams). One egg that weighed 113 grams when fresh lost 8 grams in weight in 10 days of incubation. (The incubation period, which I determined by giving Murre eggs to a domestic chicken to hatch, is 30 to 32 days.)

The true picture of the growth of the young Murre on the nest site is not easy to secure. Attempts to approach the breeding colonies more often than at three- to four-day intervals usually resulted in disturbing

TABLE 1
WEIGHTS (IN GRAMS) OF YOUNG MURRES

	1931														1934							
Bird	A	O	B	N	C	D	E	F	G	L	H	I	J	K	P	Q	R	S	T	U	V	W
Egg wt.	89												93									
1 day																72	80	75	80	80	75	
2 days			101					102													98	
3 days	116.5										116		115.5					92	115	105		92
4 days				124											120				110			
5 days				110			119			126											102	
6 days	134							127		147					145			104		118		
7 days				dead	143						168		dead						120			
8 days	140					160				dead											101	
9 days							168								180			133		116		113
10 days								196			191											
11 days					154							176.2								123		
12 days	148					169	187				192				187							
13 days								185	186					179							dead	
14 days					156		183	210												132		
15 days		156				186					gone	222			187							
16 days														227								
17 days														220	195							
18 days		187			199		gone	gone	213			222		187								
19 days						188			162											135		
20 days					170				190			235		205								
21 days						190								gone	235							
22 days		gone				gone			182			gone			230							
23 days					141				gone						gone							

the adult birds to the extent that the young were either abandoned or so neglected that the data could not be considered representative (Johnson, 1938). But by selecting small colonies which could be approached somewhat under cover, a series of weights of young birds was secured (Table 1).

The records of individual young birds show that some lose weight a few days before leaving the nest site. Some lose weight at an earlier age, and these usually die at the nest. Emaciated young birds in a colony are generally the result of the adults abandoning the nests. If a young bird has reached the age of 16 to 18 days before such starvation begins, it usually responds to the calls of the adults at sea and breaks away from the nest site.

TABLE 2

Adult Breeding Murres: Weight Distribution and Wing Length

No. of birds	Weight (in grams)	Wing length		Sex, when known	
		range	average	male	female
1	1100–1125	.....	225.0	?	?
1	1075–1100	.....	....	1	0
1	1050–1075	.....	214.0	1	0
7	1025–1050	197–222	211.0	2	1
15	1000–1025	203–246	215.3	2	4
16	975–1000	208–218	213.4	5	3
13	950– 975	203–246	213.3	4	7
8	925– 950	210–218	215.3	3	0
13	900– 925	200–212	206.5	2	4
6	875– 900	203–216	208.3	?	?
3	850– 875	.....	....	1	?
4	825– 850	205–212	208.0	1	3
1	800– 825	.....	....	0	1

Table 2 gives the data on 89 adult breeding Murres taken at the nest during banding operations. During the 1938 season I discovered that the sexes could be distinguished in living Murres by an examination of the vent, and the sex, when known, is given in the table. The average weight of the 89 adults was 964.7 grams. The heaviest bird (a male not included in the table) weighed 1,150 grams; the lightest breeding bird, a female, weighed 815 grams.

Dovekie. In late fall and early winter many Dovekies come to these islands. Weights of eight wintering Dovekies, taken by Donald Osborne, of Harrington Harbor (Johnson, 1935), averaged 162.5 grams (extremes: 127 and 188 grams).

Black Guillemot. Twenty-three eggs of the Guillemot varied in weight from 42 grams to 65 grams (average: 49.2 grams). The difference in weight between the two eggs of single sets varied from .5

TABLE 3

WEIGHT DISTRIBUTION OF ADULT BLACK GUILLEMOTS

Weight range (in grams)	Graphic picture	Number of birds
470–480	★★	2
460–470	★	1
450–460		0
440–450	★★★	3
430–440	★★★★★	5
420–430	★★★★★★★★★★	10
410–420	★★★★★★★★★★★★	12
400–410	★★★★★★★	7
390–400	★★★★★★★★★★★★	12
380–390	★★★★★★★	7
370–380	★★★★	4
360–370	★★	2
350–360	★★	2
340–350	★	1
330–340		0
320–330		0
310–320	★	1

gram to 3 grams. Three newly-hatched birds had an average weight of 34.3 grams. Table 3 shows the weight distribution of 69 breeding adults. In 1938, I weighed seven Guillemots which were known to be four or more years of age. Their weights were: 437, 389, 358, 394.5, 404, 382, and 416 grams. The average for these seven birds was 398.5 grams, whereas the average weight for all breeding Guillemots was 419 grams.

TABLE 4

FLUCTUATIONS IN WEIGHT (IN GRAMS) OF INDIVIDUAL BLACK GUILLEMOTS WEIGHED ON DIFFERENT DAYS AND AT DIFFERENT HOURS OF THE DAY.

Interval between weighings	8 A.M.	10 A.M.	2 P.M.	4 P.M.	Difference
6 days	462			398	64.0
4 "	314	398.5			84.5
3 "	419		419		0
1 "		428			
		417			11.0
5 "	436	431	425		5.0
3 "	416				6.0
	403				13.0
3 "	380	394.5			14.5
2 "	396	406			10.0
11 "		416		415	1.0
5 "	399			399	0

Two birds known to be in their first breeding year weighed 414 and 417 grams, which is about the size of the average breeding bird of the species.

Table 4 gives data on daily and hourly fluctuations in the weight of individual Guillemots. The two weights (taken at 8:00 A.M. and 10:00 A.M. respectively) of the second bird recorded in the table show a difference of slightly over 26 per cent. This may have been due to an unusual quantity of food in the gullet at the second weighing, since no such extreme fluctuation was shown by the other birds recorded.

Atlantic Puffin. Thirty eggs of the Puffin varied in weight from 54.5 to 73.2 grams (average: 55.9 grams). One newly hatched young weighed 42 grams. Twenty-nine breeding birds of both sexes taken at the nest site varied in weight from 407 to 542 grams (average: 476.1 grams).

Summary

During the breeding seasons of 1931, 1934, and 1938, weight data were collected during field work on the north shore of the Gulf of St. Lawrence on four species of Alcidae: Razor-billed Auk (*Alca torda*), Atlantic Murre (*Uria aalge*), Black Guillemot (*Cepphus grylle*), and Atlantic Puffin (*Fratercula arctica*).

The average weight of 38 eggs of the Auk was 85.4 grams; for 15 eggs of the Murre, 103.4 grams; for 23 eggs of the Black Guillemot, 49.2 grams; for 30 eggs of the Puffin, 55.9 grams.

The average weight of adult breeding birds were as follows: Auk (7 adults), 686 grams; Murre (89 adults), 964.7 grams; Black Guillemot (69 adults), 419 grams; Puffin (29 adults), 476.1 grams.

Seven Black Guillemots known to be four or more years of age averaged 398.5 grams in weight, which is less than 5 per cent below the average of all adults weighed.

Adult banded Black Guillemots recaptured on different days and at different hours of the day showed great fluctuation in weight, obviously a reflection of their feeding habits. One bird showed a fluctuation of 26 per cent between the two weights listed.

The growth of young Murres is shown in relation to the length of time spent at the nest site. These young normally leave the nest between 18 and 24 days of age. They are likely to leave earlier if a food shortage comes after they are 14 days of age. If the shortage comes before that, the young die at the nest site.

The supply of food to the young is intimately tied up with feeding ceremony. When this relationship is not going well (possibly due to internal parasites weakening the young) the role of external parasites becomes significant to an undetermined degree.

Wing measurements of adult Murres showed no close correlation with weight.

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GENERAL NOTES

Summer occurrence of Holboell's Grebe in Ohio.—On the morning of August 9, 1943, a Holboell's Grebe (*Colymbus grisegena holböllii*) was seen feeding in one of the large ponds at State Fish Farm No. 1, Auglaize County, Ohio. The grebe remained on the pond four days, but was then shot as a fish predator. The Farm is near the eastern shore of Lake St. Marys, and the bird was probably first attracted to the larger body of water.

The specimen has been placed in the collection of the Ohio Division of Conservation and Natural Resources. It was a male, in molt, and its stomach contained one crayfish (probably *Orconectes i. immunis*), 6 cm. in length, and a mass of its own feathers. No signs of injury were present.

I am aware of no previous record of the species summering in Ohio, but according to Trautman ("Birds of Buckeye Lake, Ohio," 1940:156–157, and *in litt.*), it is apparently an uncommon transient throughout the state.—Clarence F. Clark, *Ohio Division of Conservation and Natural Resources, St. Marys, Ohio.*

The American Egret breeding in Ohio.—The first sizable invasion of Ohio by American Egrets (*Casmerodius alba egretta*) occurred during the summer of 1930 (July 17 to October 14), when reports received of 755 individuals representing occurrences in 47 counties, indicated that probably at least 3,000 egrets reached the state (Hicks, *Wils. Bull.*, 43, 1931:268–281). Since then a considerable number of egrets has been present each summer, and in several years their numbers have approached or perhaps exceeded the 1930 population.

Until after 1930 there were no known occurrences of American Egrets during spring or early summer—nearly all records falling after July 10, with a few individuals tarrying into November or even early December. Each year since 1930 American Egrets have been reported during the breeding season (2 to 16 individuals in one to five localities). The earliest arrival date was March 16 (1934, at Grand Reservoir, Mercer County), although most of the birds have appeared in mid- or late April, or during May, and remained through June and July, when their identity was lost in the regular late summer invasion. During 13 of the last 14 years (1931–1944) I have recorded a total of 39 egrets in 9 localities, all before July 1. Including reports contributed by other observers, egrets seen during the breeding seasons totalled 64 (in 14 localities). These breeding season records were mostly in western and northern Ohio. They were confined to counties in which the other two large herons breed (there are 33 counties with a total of 61 Great Blue Heron colonies, and 15 counties with a total of 19 Black-crowned Night Heron colonies). Except for the breeding records listed below, association of egrets with these two herons has been very limited.

In 1939 a pair of American Egrets was reported by members of the Winnous Point Duck Club to be present along with Great Blue Herons in a sizable herony on Eagle Island in Sandusky Bay, Ottawa County. Accordingly I checked this colony the next year and on May 18, 1940, collected a set of 4 fresh eggs of the egret. These, now in the Ohio State Museum collection, represent the first Ohio breeding record. In 1941, two pairs of egrets were present, but only one nest was found. On the last visit of the season (July 5) this contained three large young. In 1942 no egrets were present at this colony, but another pair had a nest with four young in a small, newly established colony of Black-crowned Night Herons located near the south shore of Grand Reservoir, Mercer County.

Little publicity was given to these finds in the hope that freedom from disturbance would encourage more extensive nestings. A few egrets were present elsewhere in Ohio during the 1943 and 1944 breeding seasons, but difficulties of transportation have made it impossible to check on any new developments.—Lawrence E. Hicks, *Ohio State University, Columbus, Ohio.*

A mouse eaten by a Wood Duck.—A gizzard of a Wood Duck (*Aix sponsa*) sent to the U. S. Fish and Wildlife Service by Mrs. Albert F. Haspeslagh, of Galion, Ohio, in the fall of 1943, contained the partly digested remains of a white-footed mouse (*Peromyscus* sp.). The mouse, whose tail protruded from the gizzard, had apparently been swallowed whole. It made up about two-thirds of the gizzard's contents. The remaining third consisted of fragments from normal components of a Wood Duck's diet—pieces of hickory-nut shell (*Carya* sp.) and several grape seeds. The duck had been shot in late October, 1943, in Crawford County, Ohio.—A. L. Nelson, *U. S. Fish and Wildlife Service, Bowie, Maryland.*

The sex ratio in Wilson's Snipe.—The importance of a knowledge of the sex ratios of birds is well shown in the excellent summary recently published by Mayr (*Amer. Nat.*, 73, 1939:156–179), but ornithologists do not often have the opportunity to determine the sex of large numbers of birds, and even when such figures are secured their validity is often impaired by the operation of such factors as differential migration or unconscious selection by the observer. Museums contain large numbers of specimens of known sex, but the report of Pelseneer (*Mem. Acad.Roy.Belg.*, 8, 1926:3–258) showed the danger of depending too indiscriminately on museum series and threw the whole method into disrepute. The specimens in any good-sized museum collection of Henslow's Sparrow and the Clay-colored Sparrow furnish extreme examples of misleading series. They consist largely of males because the persistent singing of the males provides collectors with the only easy way of finding specimens.

On the other hand, it seems to me that the collector's sample might be a fair one in the case of certain species in which the plumage and the reaction to human intrusion are alike in the two sexes, and the number of specimens in museums is large enough to be statistically significant. For instance, David E. Davis (*Auk*, 57, 1940:179–218) found 401 males to 328 females in the museum specimens of the Smooth-billed Ani—a sex ratio which was corroborated by his own field data. The danger of depending on any but very large samples is well illustrated by the report of Imler and McMurry (*Wils. Bull.*, 51, 1939:244) on the sex ratio of ten 100-bird lots of Crows killed by bomb explosions in a winter roost in Oklahoma. The ratio among the 1,000 birds was 52.6 per cent males to 47.4 per cent females, but among the ten 100-bird lots the per cent of males varied from 41 to 65.

The sex ratio in shorebirds is of particular interest because of the remarkable diversity of breeding habits which we are beginning to find among the different species studied. In the case of the Painted Snipe, *Rostratula benghalensis* (Rostratulidae), Stuart Baker (Fauna Brit. India, Birds, 6, 1929:47) reports that males greatly outnumber the females and that the females display and fight for the males.

Little seems to be known about the breeding habits of the once common game bird, Wilson's Snipe (*Capella delicata*). Even the incubation habits are somewhat uncertain. Bent (*U. S. Nat. Mus. Bull. No.* 142, 1927:86) states that both sexes incubate but specifically cites only Philipp (*Canad.-Field Nat.*, 39, 1925:76), who says that three incubating birds collected were all males. Jourdain (in Witherby *et al.*, Handbook Brit. Birds, 4, 1940:200) says that in the closely related Common Snipe (*Capella g. gallinago*) of Great Britain only the female incubates.

The present survey summarizes the specimens of Wilson's Snipe in 23 public and private collections: Academy of Natural Sciences, Philadelphia; American Museum of Natural History; California Academy of Sciences; Carnegie Museum; Chicago Academy of Science; Chicago Natural History Museum (including the Conover Collection); Cleveland Museum of Natural History; Colorado Museum

of Natural History; Cornell University; Harvard, Museum of Comparative Zoology; Stanley G. Jewett; Los Angeles Museum; Ohio State Museum; Max M. Peet; Princeton Museum of Zoology; Royal Ontario Museum of Zoology; University of California at Los Angeles; University of California Museum of Vertebrate Zoology; University of Kansas Museum of Birds and Mammals; University of Michigan Museum of Zoology; University of Minnesota Museum of Natural History; U. S. Fish and Wildlife Service; U. S. National Museum. I recorded most of the specimens myself, but in a few cases the figures were prepared for me by the curators in charge. I am grateful for their assistance and for permission to use the figures from all of these collections.

These combined collections contained 1,163 specimens of Wilson's Snipe that had data on sex, locality, and date of collecting. The specimens were taken in every month of the year and in all parts of the range, from Alaska and northern Canada to the wintering grounds in Central and South America. With such a large sample made up of specimens taken at all seasons we are presumably justified in believing that we have eliminated any error that might come from differences in migration habits between the sexes. There are no sexual differences in plumage in the Wilson's Snipe nor, so far as we know, in habits or behavior, except at the height of the breeding season.

This series of 1,163 specimens consists of 678 males and 485 females, a ratio of 58.3 per cent males to 41.7 per cent females. It is interesting to note that only two of the 23 separate collections failed to show an excess of males, and these were two of the smallest (8 and 21 skins)—too small to provide a representative sample. When we analyze these 1,163 specimens by months (Table 1)

TABLE 1

Sex of 1,163 Wilson's Snipe Specimens in Museum Collections

	♂	♀	Total		♂	♀	Total
January	49	36	85	July	31	16	47
February	36	20	56	August	18	24	42
March	48	30	78	September	64	53	117
April	105	90	195	October	98	93	191
May	61	47	108	November	72	41	113
June	33	11	44	December	63	24	87

we find that eleven of the twelve months show an excess of males; only August, with the smallest sample of any month, shows an excess of females. The only other evidence I can find of an excess of females in this species at any season is provided by manuscript data which A. William Schorger has generously permitted me to use. He sexed 143 Wilson's Snipe taken in the fall (mainly in October) near Madison, Wisconsin; 65 (45.5 per cent) were males, 78 (54.5 per cent) females. Thinking that this might indicate something unusual about the fall flight in eastern United States, I tabulated the October museum specimens from the northeastern states (east of the Mississippi and north of the Ohio rivers and north of the southern border of Pennsylvania), but the result was still an excess of males (48 males to 38 females).—Josselyn Van Tyne, *University of Michigan Museum of Zoology, Ann Arbor, Michigan.*

History of a Mourning Dove nest.—A Western Mourning Dove (*Zenaidura macroura marginella*) built its nest behind the bronze grill over the entrance of Phipps Auditorium, The Colorado Museum of Natural History, in Denver, in the spring of 1941 and raised four broods during the year; the nest was again occupied and four broods raised in 1942; in 1943 three broods were raised; and in 1944 a crippled bird arrived early in May and raised one brood.

I made no attempt to keep close record, but in 1941 the first brood of young left the nest on May 28. Eggs appeared in the nest almost immediately afterwards, and the young left while I was on a field trip. The third family was well grown before my return; the two young departed on August 16 and 17. There were two eggs in the nest to start the fourth brood on August 20, and the young seemed nearly grown by September 12; they were gone three days later.

In 1942, eggs were first noted May 15, and the young left June 8; the second set of eggs was in place June 11, and one egg hatched June 25. Both young were gone by July 8. There were two more eggs in the nest on July 13 for the start of the third brood, and both young were on the wing August 6. The first egg of the fourth set was laid August 12, and the young were large on September 4.

An adult bird was seen on the nesting ledge of the Auditorium on April 2, 1943, to start the third season, but for some reason nesting was delayed, and the first set of young did not leave until the latter part of June. Two eggs were in the nest July 1, and the young of the second brood left July 24. The third set was observed July 28, and both eggs were hatched on August 10.

In 1944, a crippled bird was seen on the ledge on May 4; two eggs were in the nest May 19, and the young left 24 days later. We have no way of knowing whether the same birds used the nesting place, but 12 sets of young were raised in four years time. Incubation seemed to take between 12 and 14 days, and the young remained in the nest for a like period.—Alfred M. Bailey, *The Colorado Museum of Natural History, Denver, Colorado.*

Crow feeding from the surface of water.—On July 3, 1944, while we were on a high bluff overlooking Lake Michigan, about eight miles south of Saugatuck, Allegan County, Michigan, Robert Hale called my attention to a Crow, some 300 yards from shore, "diving" into the lake, evidently for food. When I turned to observe the bird, it was rising from the surface of the lake, with apparently some sort of food in the bill. The lake was calm at the time. Older summer residents stated that the Crow did this daily during the summer unless the lake was rough. We again observed this behavior on July 4, July 9, and July 16 during the early morning (and once late in the evening), always when the lake was calm or covered with long sweeping swells.

Crows (*Corvus brachyrhynchos*) were rather plentiful in the beech-oak woods on the bluff overlooking the lake, and we regularly observed a family group nearby. Apparently one or both of the parents made these flights out over the lake searching for dead fish or refuse. When these were observed the Crow would drop to the water, seize the food with its bill, then immediately rise to bring it back to the clamoring young in the bordering trees. The Crows usually managed to get the food by barely touching the surface of the water, but once one produced a considerable splash with its wings, immediately rising again into the air. Food was also taken from the water's edge, where it had been left by the incoming waves.—Lawrence H. Walkinshaw, *1703 Central Tower, Battle Creek, Michigan.*

Notes on the Arrow-headed Warbler.—There are two resident warblers on the Island of Jamaica, the familiar Yellow or Golden Warbler (*Dendroica petechia*) of the coastal mangroves, and the little known and odd-appearing Arrow-headed Warbler (*Dendroica pharetra*) of the mountain forest. The latter was discovered and described by Gosse, who obtained a single specimen on the summit of Bluefields Peak in western Jamaica. Subsequently it was found to range widely through the higher parts of Jamaica, but, except in the Blue Mountains, where it may be said to be fairly common, it is a rare bird.

This warbler is for the most part a silent bird. When not breeding it utters a weak *git,* readily distinguishable from the *chip* of migrant species. In the nesting

season, during May and June, one may hear the territorial song of the male, a rapidly uttered trill much like that of a Worm-eating Warbler (*Helmitheros vermivorus*). I also heard on one occasion its protracted, rather canary-like "whisper song." This was given by a male just prior to copulation, so that it would seem that song plays a part in courtship in this species. The "whisper song" of the Arrow-headed Warbler resembles that of the Prothonotary Warbler (*Protonotaria citrea*) as described by Brewster (*Bull. Nutt. Ornith. Club,* 3, 1878: 157), although the latter "is apparently uttered only while on the wing." I have also heard similar canary-like whisper songs—though never when the bird was in flight—from the Oven-bird (*Seiurus aurocapillus*), Yellow-throat (*Geothlypis t. trichas*), and Gray-crowned Palm Tanager (*Phaenicophilus poliocephalus coryi*). All were uttered by males during the nesting season and were so low as to be barely audible at a distance of 30 feet. The tanager sang while approaching the female with outstretched wings, but no female was seen near the Oven-bird or Yellow-throat.

Usually the Arrow-headed Warbler is found in, or about the edge of, humid mountain forest where it does not have to compete with the hosts of migrant warblers, which prefer the more open, sunnier parts of the island at lower elevations. During my exploration of the Blue Mountains in 1931, I found three nests of the Arrow-headed Warbler. These were placed at elevations of from 5 to 12 feet above the ground. Two were old, disused nests; the third, which contained two slightly incubated eggs when discovered on June 24, was described in my "Birds of the West Indies" (1936:315).—James Bond, *The Academy of Natural Sciences of Philadelphia.*

The Cardinal's period of dependency.—Gaps in a table on the development of young birds in the new Song Sparrow volume of Margaret M. Nice (*Trans. Linn. Soc. N.Y.,* 6, 1943:70) indicate that data are lacking on the age at which the Richmondeninae attain the power of flight, and independence.

Recent observation of color-banded young Cardinals (*Richmondena cardinalis*) showed weak but effectual flight on the day of nest-leaving, at about 10 days of age, the birds being able to keep in cover well above the ground; strong flight by the age of about 19 days, partial independence at about 38 days, complete independence at 45 days, and severance of family ties at 56 to 59 days. The findings in detail are:

♂ AW-0: Hatched June 16–18, 1942; banded in nest; next seen July 29, partly dependent; last seen fed by parent July 31, age 43–45 days; last seen with parent August 12, age 55–57 days.

♂ A-W2J: In nest with 2 other young, estimated age 4 days, found August 3, 1943; young left nest August 9, age about 10 days; A-W2J and at least one other flew weakly same day. A-W2J alone: flying strongly August 18, age about 19 days; first seen to forage September 6, age about 38 days; last seen to be fed by parent September 12, age about 44 days; last seen with parent September 26, age about 58 days.

The 45-day age of attaining independence thus determined for the Cardinal is a higher one than Mrs. Nice gives (p. 70) for any temperate zone passerine of comparable size, and is closely approached only by the "40 plus" of the Cinclidae. However, in view of her comment (p. 253) that with multiple-brooded birds the bond between parents and young may be longer than usual in the case of the final brood, and that "this is certainly true of Cardinals," I should add that I believe my 1942 nest to have been a final one, and know that the 1943 nest was that.

In the presence of a parent both of the juveniles that I kept under observation begged for food to the very end of their association, although during the final

12 or 14 days the begging was always futile. The way in which the parent's presence stimulated this begging was interestingly shown by AW-0 when he was 49–51 days old and had been independent for 6 days. He and his female parent flew into the same tree, then the adult went on deeper into the wood; while thus left alone the juvenile foraged and uttered *tsik* notes just like an adult's; when later the female flew back to a comparatively distant part of his tree he changed to the juvenile *tih* call; and when still later the parent went close to him, he not only gave the juvenile calls but intermittently fluttered his wings.—Hervey Brackbill, *4608 Springdale Avenue, Baltimore 7, Maryland.*

Blue Grosbeak breeding in West Virginia.—On June 22, 1944, while accompanied by George H. Breiding, I found a pair of Blue Grosbeaks (*Guiraca c. caerulea*) three miles southwest of Shepherdstown, Jefferson County, in the eastern panhandle of West Virginia. The male sang repeatedly, and the female carried food, but it was only after considerable searching that I found the nest in a roadside fencerow. The nest, bulky and well built, was supported at a height of 30 inches by a clump of 40 green sprouts of osage-orange hedge. It contained two young about six days old.

The adults were left to re-nest, but we collected the two young and the nest to substantiate the record. One nestling, a male of 15.2 grams, is in the writer's collection; the other, a female of 14.8 grams, has been given to the West Virginia University Museum.

In West Virginia, as in most northern states, a number of questionable "sight records" of the Blue Grosbeak have been reported during the migration periods. But there are also the following reliable records of occurrences during the breeding season and late summer: (1) Monongalia County, during the summers of 1911 and 1923 (A. B. Brooks and Maurice Brooks); (2) a singing male during June, 1923, near Clifty, Fayette County (Maurice Brooks); (3) a male near Huntington, Cabell County, on May 29, 1925 (William Waldron, *Redstart,* 7, 1940:51); (4) an adult female at Bethany, Brooke County, July 6, 1929 (George M. Sutton, *Cardinal,* 3, 1933:121); (5) an adult male seen by Sutton and Karl Haller near Bethany, August 28, 1935 (*Auk,* 53, 1936:90); (6) a female at Jackson's Mill, Lewis County, August 28, 1936 (Roger T. Peterson); (7) a male at Oglebay Park, Ohio County, August 25, 1938 (I. B. Boggs, *Redstart,* 6, 1938:12); (8) a singing male seen on several occasions during May and June, 1944, at Jackson's Mill (Maurice Brooks).

The present record, however, according to Maurice Brooks, is the first specimen collected and the first nesting record in West Virginia.—Lawrence E. Hicks, *Ohio State University, Columbus, Ohio.*

Bachman's Sparrow taken in Michigan.—On April 29, 1944, Harold Mayfield and I collected a male Bachman's Sparrow (*Aimophila aestivalis bachmani*) near North Cape, Erie Township, Monroe County, Michigan. It was in rather poor condition, with practically no fat, but acted normally. The specimen has been given to the University of Michigan Museum of Zoology.

Bachman's Sparrow has never been reported before for Michigan. Maurice Brooks (*Wils. Bull.,* 50, 1938:86–109) described the recent northward extension of the range of this species in Ohio but mapped no records nearer Michigan than southern Wayne and Ashland counties. W. E. Saunders (*Canad. Field-Nat.,* 33, 1919:118) collected the first Canadian specimen on April 16, 1917, on Point Pelee.—Louis W. Campbell, *4531 Walker Avenue, Toledo, Ohio.*

EDITORIAL

The Council of the Wilson Ornithological Club met in Put-in-Bay at the F. T. Stone Laboratory of Ohio State University on August 11 and 12. In spite of transportation difficulties there was a good attendance at the meeting. Officers, and committee chairmen reported on their work, and some very fruitful discussions followed. Plans were studied for an annual meeting of all the members next year, and preliminary work was undertaken on a much-needed revision of the Club's constitution. The proposed changes will be published in the December issue of the *Bulletin* and will be brought up for action at the 1945 annual meeting.

We continue to receive letters from members who do not know how to borrow, or even whether they may borrow from the Wilson Club Library. For the benefit of new members and of old members who may have missed the explanation published in the September 1943 *Bulletin* (p. 208) we should point out that all members of the Club are entitled to borrow publications from the Library. The University of Michigan will pay transportation one way. Members are expected to return borrowed publications as soon as they are through using them so that they may be available to others, but it has not yet been necessary to set any definite time limit on loans. Requests for loans or questions about the library holdings should be addressed to "Wilson Ornithological Club Library, Museum of Zoology, Ann Arbor, Michigan." A list of the Club's books was published in the September 1943 *Bulletin* and a second, supplementary list appears in the present issue (p. 181).

The Wilson Ornithological Club is indebted to its distinguished member and former president, Margaret M. Nice, for an important recent gift to the Library. The bare totals reported in the Bulletin will make it clear to members that this is numerically the largest single gift so far received, but the true importance of these accessions can be best understood by those who have seen them and noted the number of unusual and valuable publications included which are not found in most ornithological libraries. The book titles appear in our published lists; the pamphlets and periodicals will be listed later.

OBITUARY

J. Fletcher Street, well-known Philadelphia architect and ornithologist, died September 18, 1944, at the age of 64. He was the author of many scientific papers and of a book of more popular character, "Brief Bird Biographies." For the past two years he had been Treasurer of the American Ornithologists' Union.

E. C. Stuart Baker, foremost authority on the birds of India, died on April 16, 1944, in Upper Norwood, England, at the age of 79. In addition to his famous eight-volume work on the birds of British India, he published several books on Indian game birds and on the nesting habits of Indian birds. His last book, a notable study of "Cuckoo Problems," appeared in 1942.

William Lutley Sclater, distinguished British ornithologist, died in London June 6, 1944, in his eighty-first year. He edited *The Ibis* from 1913 to 1930 and wrote many important works on Old World birds, including the check-list of the birds of Africa. Students of American birds knew him best for his "History of the Birds of Colorado."

Ornithological News

After an association of 28 years with the Fish and Wildlife Service and its preceding agencies, W. B. Bell retired on August 1 as principal biologist and chief of the Division of Wildlife Research. His place has been taken by Clarence Cottam.

Several Canadian parties were actively engaged in faunal reconnaissance in northwestern Canada during the past summer. A. L. Rand, of the National Museum of Canada, headed a party which covered a route through the mountains between Yukon Territory and the Mackenzie River. C. H. D. Clarke, of the Lands, Parks and Forests Branch of the Department of Mines and Resources, accompanied by T. M. Shortt, of the Royal Ontario Museum of Zoology, carried on investigations in various parts of Yukon Territory. V. C. Wynne-Edwards, of McGill University, conducted faunal explorations along the Mackenzie River under the auspices of the Canadian Department of Fisheries.

Jean Delacour and William Beebe are revising the latter's monograph on the pheasants. It is expected that the new work, which will include Delacour's valuable experiences in collecting and rearing the rarer species, will not appear until some time after the war.

Harrison F. Lewis has succeeded Hoyes Lloyd as Superintendent of Wildlife Protection for Canada. Dr. Lewis, who for more than 20 years has been district officer in charge of migratory bird protection in Ontario and Quebec and is currently second vice-president of the Wilson Ornithological Club, thus takes full charge of the work by which a Canadian statute implements the Migratory Birds Treaty throughout the Dominion.

Oliver H. Hewitt, who obtained his doctoral degree at Cornell University last spring, has been made Chief Federal Migratory Bird Officer for Ontario and Quebec.

A. Starker Leopold of the Missouri Department of Conservation has been engaged by the Pan-American Union to make a two-year game survey of Mexico. The project is being financially supported by six American organizations. The Mexican government, which is actively cooperating, will aid Dr. Leopold by supplying two field assistants.

Publication date on Ernst Mayr's *Birds of the Southwest Pacific* (Macmillan, New York) has been set as November 7, 1944. This handbook will stress field identification and is intended especially for the use of the many servicemen now stationed in that region. New Guinea and the Bismarcks are considered outside the scope of the volume.

Margaret M. Nice and Alden H. Miller have been elected Foreign Members of the British Ornithologists' Union.

The University of Minnesota's Museum of Natural History completed a Swallow-tailed Kite habitat group during the past summer. The background, a view from a high bluff overlooking the broad Mississippi River bottomlands below Winona, was painted by F. L. Jaques on a grant to the Museum made by Major George M. Sutton in memory of his mother.

The Wildlife Society, at its annual meeting in Chicago last spring, voted *The Wild Turkey in Virginia* by H. S. Mosby and C. O. Handley the outstanding paper published in 1943 in the field of wildlife ecology and management.

James L. Peters has completed the manuscript of Volume 5 of his *Check List of the Birds of the World*. Twelve families, from the Trochilidae through the Bucerotidae, are covered. It will probably be published in 1945.

Upon the resignation of C. G. Abbot last June, Alexander Wetmore assumed the duties of Acting Secretary of the Smithsonian Institution on July 1.

REPORT OF THE NOMINATING COMMITTEE

For the third year the Wilson Ornithological Club must conduct its annual election of officers and members of the Council by mail. Your Committee offers the following nominations for 1945:

President: S. Charles Kendeigh
First Vice-president: Olin Sewall Pettingill, Jr.
Second Vice-president: Harrison F. Lewis
Secretary: Maurice Brooks
Treasurer: Milton B. Trautman
Councillors: Burt L. Monroe, Eugene P. Odum, Lawrence H. Walkinshaw

In addition to the slate offered above, any Active, Sustaining, or Life member of the Wilson Ornithological Club is eligible for office. You are urgently requested to mail your votes to the Secretary, whether you choose to support the slate given above, or whether you choose to write in the names of other eligible members for one or all of the offices.

Paul L. Errington
Lawrence E. Hicks, *Chairman*

AFFILIATED SOCIETIES

The Kentucky Ornithological Society was organized in Louisville on April 19, 1923, by Gordon Wilson, B. C. Bacon, and L. O. Pindar. In 1924 the Society held a program meeting in conjunction with the Kentucky Educational Association in Louisville, and at the same time arrangements were completed for affiliation with the Wilson Ornithological Club. The two-day spring meetings have become so popular among Kentucky teachers that since 1939 the cost of an outstanding lecturer on ornithology has been borne by the Educational Association. Annual fall meetings have been held since 1925 in various parts of the state.

In 1925 Gordon Wilson began publishing a quarterly journal, *The Kentucky Warbler*. This journal is now in its twentieth volume and has increased in size from 16 to 52 pages per year. Articles range from accounts of trips, field days, and bird experiences to carefully prepared analyses of bird habitats, distribution, and life histories.

In 1942 the Kentucky Junior Academy of Science became affiliated with the Kentucky Ornithological Society. By the offer of a prize the high school students who compose its membership are encouraged to study and write about birds. The prize paper is published in the *Kentucky Warbler*.

The officers for the current year are: President, H. B. Lovell; Vice-president, Victor K. Dodge; Secretary-treasurer, Helen Browning; Editor, Gordon Wilson.—Harvey B. Lovell, *President*.

WILDLIFE CONSERVATION

Grazing in National Parks

A bill (H.R. 5058) introduced in the United States Congress by Congressman Clair Engle of California on June 19, 1944, is intended: "To provide for the issuance of grazing permits for livestock in the national parks and monuments." The bill proposes that ". . . until the cessation of hostilities in the present war as determined by proclamation of the President or concurrent resolution of the Congress, and for a period of six months thereafter, all national parks and national monuments shall be open to grazing of livestock and permits shall be issued for grazing of livestock therein, any statute, policy, or regulation to the contrary notwithstanding. The Secretary of the Interior is hereby directed to issue such permits. The area in all national parks and monuments to be subject to grazing, the conditions under which such grazing is to occur, and the length of time each year of such grazing, shall be determined jointly by the Secretary of the Interior and the Secretary of Agriculture. It shall be the responsibility of the Secretary of Agriculture to represent the applicants for such grazing permits and the national interest in increased food production."

This proposal is contrary to the basic purposes and policies established by the Congress relative to the national parks and monuments. These policies were reiterated early in the war by the Secretary of the Interior, as follows: "The National Park Service will continue to hold grazing to a minimum and eventually eliminate it from the national parks. Grazing will not be extended or increased in the major scenic areas where it is now being carried on by permits inherited when the areas were established. Concessions authorizing grazing may be issued in the discretion of the Director, as a wartime emergency measure to meet critical demands for food and fiber in certain types of areas such as historical units wherein livestock may have historical significance and recreational areas where it does not interfere with human use."

It has been the policy of the National Park Service to permit stockmen who held privileges at the time of park establishment to continue grazing their stock in these areas until they retire from the business. This avoids undue hardship to individuals and provides an automatic method of eliminating livestock from park areas. Livestock grazing has been provided in 43 National Park areas, totaling 1,300,000 acres. It was estimated, in 1942, that these areas furnished forage to 20,000 cattle, 74,000 sheep, more than 1,500 horses and several thousand head of pack and saddle stock. Early in 1943 an increase of 20 per cent in cattle and 10 per cent in sheep grazing was authorized, as a contribution to the war effort, in several historic areas and marginal sections of certain parks.

This relaxation of normal standards apparently has not provided sufficient appeasement for some livestock interests, which continue to press for additional privileges. The proposed legislation is apparently aimed at providing these added privileges by directing that existing policies be discarded and the decision as to how much grazing should be permitted in the national parks be made jointly by the Secretary of the Interior and the Secretary of Agriculture. The Secretary of Agriculture is specifically directed to represent applicants for grazing permits.

The importance of increased food production is almost everywhere appreciated at this time, but there is danger that in our efforts to expedite food production irreparable damage may be done to certain national interests. This is particularly applicable to grazing in national parks.

Grazing means the selective elimination of interesting and valuable parts of the native flora and often an unnatural encouragement of thorny and unpalatable plants. It carries with it the threat of reduced cover for many native animals, increased foraging competition for our native herbivores, and long-term damage to shrubs and young trees. If America is to preserve these natural areas as a part

of its heritage, its great national parks and monuments should no more be turned into pastures for steers than the Lincoln Memorial be used as a garage for jeeps.

The first question that conservationists are likely to raise concerning this proposed legislation is whether it may be used as an entering wedge to secure continued grazing of national parks and monuments after war.—C.A.D.

Waterfowl

The Fish and Wildlife Service in a recent news release reported an increase of nearly 400 per cent in the population of game species of migratory waterfowl in North America during the past nine years. The estimated population is 125,350,000 birds. This is a considerable rise from the low point during the years 1934-35 when the population was estimated at approximately 27,000,000. The largest increase is reported in Mallards and Pintails. Third place is given to Scaups (Greater and Lesser together). Redheads, Baldpates, and Black Ducks are said to follow in that order. It is believed that Canvas-backs and Ruddy Ducks also increased but that Gadwalls, Green-winged and Blue-winged Teal, Ring-necked Ducks, and Shovellers decreased to some extent. Populations of geese are said to have exhibited no important changes.

The 1944 waterfowl regulations have been liberalized on the basis of this report and evidence of crop damage by ducks. The new regulations provide an open season of 80 days instead of the 70-day season of recent years. They permit also the taking of Redheads and Buffleheads in the legal bag of 10 ducks. An additional bag of 5 Mallards, Widgeons, and Pintails singly or in the aggregate may be taken. The daily bag limit on geese remains at 2 except that 4 Blue or Snow Geese may be taken singly or in the aggregate in the Pacific coast states. Except for Snow Geese in Idaho, 3 Montana counties, and on the Atlantic coast, these regulations apply elsewhere in the country. In issuing these regulations the Director of the Fish and Wildlife Service stated that ". . . the present liberalized bag is an effort to so scatter and control these species that agricultural losses may be cut down. It is purely a temporary expedient and the extra bag limit will be permitted only long enough to alleviate the present crop-damage situation."

Another regulation provides for a bag of 25 American and Red-breasted Mergansers singly or in the aggregate. This is due to reports that they are becoming so abundant as to constitute a menace to fish production.—C.A.D.

Conservation Education for Rural Leaders

The 4-H Club conservation camps that are held annually in 28 mid-western and eastern states constitute an educational program about which little is known outside of agricultural circles. The objective of these camps is to bring together for a week of training in conservation older farm boys and girls who show outstanding promise as leaders in their home communities. The present year marks the tenth anniversary of these camps.

The program presented varies in different states but is directed in all cases to give a well-rounded picture of conservation problems from a national, state, and local point of view. In the Ohio camp, for example, the subjects of human, soil, water, forest, wildlife, and habitat conservation are given major consideration. Elective activities offered are designed to give training in outdoor living. These include: safe use of firearms, swimming, archery, photography, bait casting, bird hikes, and nature study.

In recent years 35 such camps have regularly been held in 28 states. Between 3,500 and 4,000 rural youth attend them each year. The camps are directed by the agricultural extension service in the states and partly financed by Charles L. Horn of Minneapolis.—C.A.D.

Status of the Whooping Crane

The overlooked status of the Whooping Crane continues to be one of the most appalling aspects of bird protection today. Although migration counts are not an accurate index of population, we view with apprehension the trend in spring numbers of this species in Nebraska since 1934:

1934—134+	1939— 11
1935— 40±	1940— 31
1936— 82	1941— 3
1937— 64	1942— 3
1938— 49	1943— 1

During the past spring Whooping Cranes were reported as follows. On March 10 a flock of 15 seen by George Eggleson near Kearney, Nebraska. Additional records of presumably the same birds were made in the same region on March 12 (flock of 12) and April 2 (group of 3). In Saskatchewan 8 were seen on May 1, and 10 on May 11 by J. K. Wiebe at Amiens; 7 on May 13 by W. G. Karstad at Pontrilas; and one on May 10 by C. S. Francis at Torch River.

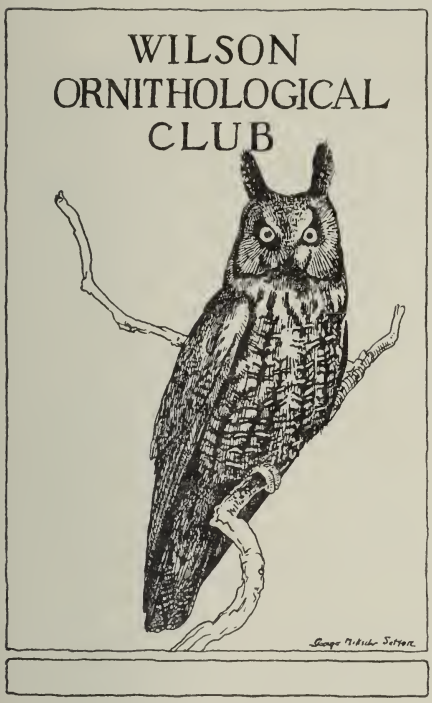
It is worth noting that the fine protection afforded Whooping Cranes on the Aransas National Wildlife Refuge in Texas has successfully sustained one remnant of the crane population, but this remnant has not significantly changed in numbers within the past 5 years. Philip A. DuMont, R. E. Griffith, and J. O. Stevenson of the U. S. Fish and Wildlife Service report these maximum numbers:

Winter	*Adults*	*Young of the year*
1938–39	10	4
1939–40	16	6
1940–41	21	5
1941–42	13	2
1942–43	15	4
1943–44	16	5

What practical help can be given the Whooping Crane at this eleventh hour? The species' breeding grounds are virtually unknown; its wintering areas are apparently limited. Before special protection can be rendered in the field, a careful survey and census of both regions are needed. Louisiana was surveyed last winter when Robert Smith of the Fish and Wildlife Service made an airplane check-up on waterfowl. Mexico will be covered during the next two years by A. S. Leopold. Texas, including the King Ranch, still needs a careful census. It can be made quickly and efficiently by plane. Because the crane is in some regions still famed for the value of its meat, refuges should—if possible—be set up wherever additional birds are found in winter. Possible, although not necessarily practical, is a special patrol like that provided for the Blue Goose to follow the crane on its migration. The flight of the crane north appears to be a leisurely one, and perhaps without particular danger; but its migrations south must be subject to the vagaries of early hunters and may involve hunting losses. In recent years Game Management Agent C. L. Licking, who has headquarters in Nebraska, has been instructed by the Fish and Wildlife Service to give this species special attention. Last spring Licking was handicapped by gasoline rationing and he could not follow the birds.

In Canada somewhat parallel measures could be undertaken. It would be worth some effort to ascertain whether nesting cranes are molested by Indians and to insure their safe flight over the guns of persons who shoot at every flying thing that is big.—A. M. Brooking and J. J. Hickey.

Wildlife Conservation Committee
Charles A. Dambach, *Chairman*



BOOKS: List 2

Books added to the Wilson Ornithological Club Library since the publication of List 1 (*Wilson Bulletin*, 55, No. 3, September, 1943: 209).

Baker, John H., The Audubon guide to attracting birds. 1941.

Baldwin, S. P., and S. C. Kendeigh, Physiology of the temperature of birds. 1932.

Barrows, W. B., The English Sparrow in North America. 1889.

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Bent, A. C., Life histories of North American cuckoos, goatsuckers, hummingbirds, and their allies. 1940.

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Harry A. Beatty—1 reprint
Frank C. Bellrose, Jr.—1 pamphlet
Jean Delacour—1 reprint
Leon Kelso—5 journals and pamphlets
S. Charles Kendeigh—2 reprints
Amelia R. Laskey—2 reprints
F. Carlos Lehmann—1 reprint
Harold Mayfield—1 book
Margaret M. Nice—1,096 journals and reprints
Humphrey Olsen—354 journals and pamphlets
Miles D. Pirnie—1 book
Minnie B. Scotland—1 reprint
J. M. Winterbottom—1 reprint

To the Members of the Wilson Ornithological Club:

The Endowment Fund Committee wishes to bring to your attention once again the desirability of increasing the funded income of the Club. Under the capable leadership of its officers and council members the Club is carrying on as usual in spite of difficult conditions; but to enable it to be of even greater service in its field and to establish its finances on an even firmer base, its Endowment Fund should be increased.

The Club's outstanding contribution to ornithology is, of course, the publication of *The Wilson Bulletin*. Through this medium are presented the most recent observations and results of research in our field. In addition, through its reviews and bibliography the *Bulletin* helps members to know and evaluate the ornithological work being published elsewhere. It is highly desirable that after the war the *Bulletin* should be able to increase the number of printed pages per volume and to publish additional illustrations, including colored plates. Other activities of the Club could also well be expanded.

This calls for additional income, which in turn means an increase in endowment. Such additional endowment can come only from the following sources:

Life Memberships ($100.00)
Outright gifts
Bequests

The Committee urges your consideration of this matter. Whatever extra assistance you see fit to render at this time will aid in the furtherance of the aims and purposes of your Club.

Respectfully yours,
The Endowment Committee
George B. Thorp, *Chairman*

ORNITHOLOGICAL LITERATURE

THE CANVASBACK ON A PRAIRIE MARSH. By H. Albert Hochbaum. Illustrated by the author. Amer. Wildl. Inst., Wash., D.C., 1944: 6 × 8⅝ in., xii + 201 pp., 19 pls. (1 col.). $3.00.

A notable book, characterized by careful observation, brilliant discoveries, and excellent writing. For the first time we now have an adequate account, based on both wild and captive birds, of territory in ducks.

"This report attempts to describe, in chronological sequence, what the Delta Station has learned since 1938 about the principal events of the duck summer. . . . the Canvasback is used as a 'base-datum,' and the other nine ducks which breed at Delta are compared with it" (Leopold, Pirnie, and Rowan in the Introduction).

A vivid description is given of the flora and fauna of the Delta Marsh, 36,000 acres in size, just south of Lake Manitoba, "a naturalist's paradise," "the *home* of wildfowl from the first break of ice in spring until ice comes again in autumn." Although the Canvasback (*Nyroca valisineria*) is the central figure in the book, comparisons are continually made with the many other nesting ducks of the Marsh. Courtship in all the ducks breeding in the Delta region falls into three periods: pre-nuptial, when the drakes display to a hen, which "chooses" one, and a pair is formed; a period of non-display (corresponding to the cessation of song after pair-formation in many passerines); nuptial courtship, when the territory is selected. The first period is the most intense; the last serves as mutual stimulation and a challenge to intruders.

"At the time the pair is ready to nest it takes title to a small water area of the breeding marsh—a pothole, the corner of a slough, or a portion of bay edge. Day after day, as long as drake and hen remain together as a pair, they may be found on this water area. Here the pair obtains most or all of its food. Here the drake and hen loaf and preen together, and here the drake waits for his hen while she is occupied at the nest. Here the drake serves the hen. This water area occupied by the pair is the 'territory' " (p. 56). The female selects the territory, and the nest is usually located beyond its borders. The author believes that the "primary function of territorial defense behavior in ducks is to establish isolation from sexually active birds of the same species during the copulation link of the reproductive cycle." He continues: "Territory in ducks is defense behavior plus a special plot of marsh. It is these together by which a drake, through his dominance, establishes his isolation. On his own small portion of this world with which he is familiar, and to which he has become conditioned, a drake is 'king of the mountain.' Beyond his own domain he is no longer a dominant individual" (p. 87).

Much valuable information is given on the nesting of the various ducks. "Injury feigning" is most intense in the Pintail, Blue-winged Teal, and Lesser Scaup; the Pintail and Teal perform as vigorously when their young are full-grown as when they are newly hatched (p. 106), whereas Canvasbacks and Redheads feign only with a newly hatched brood. Dogs and coyotes were observed to be lured away from the young by this protective behavior. When danger threatens Blue-winged Teal, the young dash to cover; under like circumstances, young of the diving ducks make for open water and dive.

Ducks recognize a species or an individual at great distances (as much as 300 yards) by sight, and also recognize their mates by voice. Adult captive ducks remembered each other for a month (pp. 36–38).

In the final chapter, on Management, one of the most interesting problems discussed is that of sex ratio. The excess of males in our waterfowl populations is most marked in the diving ducks, where the ratio averages 60:40 in most species—a very disturbing situation. All evidence points to a nearly balanced sex ratio at hatching, while the Delta bag tally showed "the kill of juveniles for all species was 1,502 males and 1,522 females, almost a perfect 50:50 sex ratio."

More adult females than males are shot on the breeding grounds, due to "their delayed wing molt which, under some conditions, makes the hen more vulnerable to gun pressure" (p. 151).

Three appendices are devoted to acknowledgements; scientific names of birds, plants, and mammals mentioned in the text; and a bibliography. A good index completes the volume. The numerous sketches by the author add to the value and charm of the publication. To the serious bird student, the "bird lover," the game manager, and the sportsman, the book will prove a mine of information on the biology and behavior of the prairie-nesting ducks.—Margaret M. Nice.

American Gamebirds: Color Plates and Text. By Louis Agassiz Fuertes. American Wildlife Institute, Investment Building, Washington 5, D.C., 1943: 14 x 12 in., 1 color pls., 5 pp. $2.50.

These colored plates and the accompanying brief text by the artist, apparently first published as a game calendar about 1906, are now being given wider circulation in a more permanent form by the American Wildlife Institute. The species treated are: Ruffed Grouse, Willow Ptarmigan, Upland Plover, Wild Turkey, Canvasback, Wood Duck, Mallard, Sandhill Crane, Bob-white, King Rail, and Canada Goose. At least two of these, the Wood Duck and Bob-white, are already familiar to bird students because of their publication in well known books by Forbush and by Roberts.

The paintings are, of course, not equal to the best work of Fuertes' later years, but they still rank high among modern bird paintings. Probably the Turkey and the Sandhill Crane will meet with the most general approval. The text contains some interestingly "dated" statements. The artist held small hope of any comeback of the Upland Plover, and he recommended protection of the Wood Duck from spring shooting because of the "imminent danger" of its "complete extinction."—J. Van Tyne.

The Illustrated Encyclopedia of American Birds. By Leon Augustus Hausman. Garden City Publishing Co., N.Y., 1944: 5½ × 8¼ in., xix + 541 pp., 707 illustrations. $1.98.

A more accurate title for this book would be "An Illustrated Dictionary of the Families and Species of North American Birds," for there are no articles on the various branches of ornithology such as would be necessarily included in any true encyclopedia. The publishers, rather than the author, are probably to be blamed for the quite unjustified claim that this book contains "everything you want to know about the birds of North America." However, by printing two columns of small type on each page a tremendous amount has been compressed into a moderate-sized book. For each bird in the A.O.U. Check-list the author gives a very brief description, a condensed statement of the range, and in most cases a short account of its habits. There is also a brief account of each of the 75 families of birds found in North America. Unfortunately, the condensation of many of the bird descriptions has been carried so far that they are quite useless for any purpose of identification.

The alphabetical system of arrangement is not without its drawbacks. Unless the beginner constantly refers to the systematic list at the back of the book, he is almost sure to acquire many wrong ideas and unfortunate mental associations. For example, he will find most of the Compsothlypidae grouped together, though a few, such as the Redstart, are, of course missing from that section. On the other hand, he will find there members of the Sylviidae such as the Willow Warbler and Grasshopper Warbler.

Apparently the only bird included which is not North American is Archaeopteryx—entered, strangely enough, under the name "Lizard-tailed Bird."

The black and white illustrations by Jacob Bates Abbott are surprisingly successful. In spite of their small size—most of them are two inches square or less—a large proportion of them will be quite useful to beginners in identifying birds. (In the absence of the text, however, a number of the pictures would defy identification by the most expert ornithologist.)

Also, for a book that purports to be a reference source, the text contains a disturbing number of errors. Many of the mistakes are merely misspelled words, but an occasional whole passage, such as the paragraphs on the ranges of Harlan's Hawk and Kirtland's Warbler, are entirely incorrect. One also finds Kennicott's Willow Warbler described in the text as "in reality a Thrush. . . . Family *Turdidae*," though in the systematic list it appears correctly under the Sylviidae.

The volume concludes with a synonymy of common names, and a bibliography of 88 books "useful to the layman in the study of birds."

If the title and the publisher's claims do not mislead people too much, the book may prove to be a very useful reference volume for a considerable public not reached by any other bird book.—J. Van Tyne.

Natural Principles of Land Use. By Edward H. Graham. Oxford University Press, New York, 1944: 5½ × 8⅜ in., xiv + 274 pp., 32 pls., 8 figs. $3.50.

Dr. Graham here introduces a new technician in the "land management biologist" and presents an up-to-date review of progress in conservation on the land. Through his experience and travel as an ecologist for Carnegie Museum and more recently as chief of the biology division of the United States Soil Conservation Service, Graham has seen the growing need of applying ecological principles to conservation. This experience has led him to conclude that "it is the particular responsibility of a new technician—the land management biologist—to look to the relation between the management of rural land, whether it be cropland, pasture, range, woodland, or wildlife land, and the complex of plants and animals which attend such management. . . . His task is (1) to increase populations of species that are esteemed for their economic, recreational, aesthetic or other values, (2) to decrease populations of those species that are harmful to useful plants and animals or otherwise injurious, and (3) to maintain a reasonable balance between communities of living things and land use practices."

The function of this new technician is illustrated by selected examples of actual land management problems which are being met and solved daily by the application of ecological principles. Among the tools of the land management biologist are: a knowledge of succession and of indicator species, knowledge of cycles, recognition of growth forms and habitat niches, land use classification, census methods, food chains, and predator control.

Ecological principles of land management as they apply to farms, forests, range, wildlife, waters, exotics, and control methods, are treated in separate chapters. Throughout these chapters and elsewhere in the text is evidence of the material advances made in conservation theory and practice in the United States. These advances are illustrated in the 32 full-page plates of photographs which show conditions before and after conservation principles were applied. The pictures and their accompanying legends alone tell a well knit story of conservation progress and applied ecology. The freshness of the material and the recentness of the progress is illustrated by the bibliography. Of the more than 200 titles, only 13 per cent appeared before 1920, 12 per cent between 1920 and 1930, 75 per cent during the last 14 years. A list of common names used, with their scientific equivalents, and an index complete the book.

The vocabulary is non-technical, the style direct. The book should appeal to a wide range of readers including biologists, foresters, professional land use planners, and land owners, but especially to ecologists and wildlife managers.—Charles A. Dambach.

The Social Behavior of the Laughing Gull. By G. K. Noble and M. Wurm. Annals N. Y. Acad. Sci., 45, art. 5, Dec., 1943:179–220. $.50.

This article is a well illustrated and relatively objective account of the social behavior of the Laughing Gull (*Larus atricilla*) as observed in the field at Muskeget Island, Massachusetts, and at Stone Harbor, New Jersey, as well as in a large flying-cage. A somewhat detailed description of the behavior of the Australian Silver Gull (*Larus novae-hollandiae*) as observed at the New York Zoological Park is included. Specific comparisons are made with the social behavior patterns of other species of gulls as recorded in the literature. Interpretation of the results of the study and preparation of the manuscript were carried out by the junior author following the death of Dr. Noble.

It is stated that "captive gulls exhibited the identical behavior pattern of free birds" (p. 208); this may be something of an overstatement, but it promises much for the validity of controlled studies made on birds under convenient laboratory conditions. Identification of sex of birds in the field was based mainly on behavior criteria. Aggressive-submissive behavior was found to play a very important role in sex recognition and pair formation and in territorial maintenance and defense. Numerical data are not presented on the relative frequency of various specific behavior patterns during different phases of the breeding cycle. Though the authors were able to mark a number of incubating individuals in the field, they were not able to establish conclusively the existence of a social hierarchy by which territorial relationships appeared to be modified. A more intensive and prolonged observation of fewer birds might settle this question.

One of the express motives in making this study was to determine the role of the nuptial dress of a black-headed species of gull. Unfortunately, birds whose head plumage the authors disturbed in the field were not seen again, and no extensive laboratory analysis of the problem seems to have been accomplished. With one possible exception, all of the displays which could be presumed to be emphasized by the black head (or vice versa) seem also to be found in white-headed species of gulls. The exception is the behavior described as "head flagging," which often accompanies erect posturing with smooth feathers in the Laughing Gull. But the exact significance of head flagging does not seem to be very clearly established, though it possibly helps to inhibit attack from other Laughing Gulls. The authors cite Kirkman's study (1937) of the Black-headed Gull (*Larus ridibundus*) and conclude that since the nuptial hood of this species is not employed by any special ceremony it is vestigial (p. 214). Nevertheless, the erect posturing of this species often involves "a sudden jerk of the beak to one side," an action which could be interpreted as a ceremony emphasized by the hood just as clearly (or unclearly) as the head flagging of the Laughing Gull could be interpreted as a ceremony emphasized by its black head. The omission of page numbers for references to Kirkman's and other books makes checking of comparisons a rather laborious task.

The authors conclude that communal display in Laughing Gulls serves "to provide the maximum number of contacts between many birds that are in an optimal physiological state for reproduction" (p. 217); they disagree with Darling's thesis (1938) that group display increases reproductive success in gulls by increasing general sexual activity and synchronization, on the grounds that "a variety of sexual behaviors . . . . performed by one pair provoked aggression in neighboring birds" (p. 209). No data are presented on fecundity or reproductive success in relation to size of groups, and it would seem that although Darling's evidence in itself was inadequate he had more data in favor of his hypothesis than Noble and Wurm have presented against it.

On the whole, this paper does not measure up to the previous excellent work by these authors on the Black-crowned Night Heron (*Auk*, 1938, 1942), but it is nevertheless a very valuable study.—Nicholas E. Collias.

Aves. By W. L. Sclater. Zoological Record, 79, Sect. 17, 1942. Zool. Soc. London, 1944. 6 *s.* (Obtainable from: Natural History Books, 6843 Hobart Avenue, Chicago 31, Ill. $1.55.)

William L. Sclater has again performed a great service to ornithologists by preparing the *Aves* section of the Zoological Record. For those unfamiliar with this invaluable index we should perhaps explain that it is an annual list of the ornithological titles—books, articles, and notes—published throughout the world. The list is fully cross-indexed taxonomically, geographically, and by 114 logically arranged subject headings.

The wartime retrenchment in printing and distribution of the results of scientific work is evident in the present list, which comprises only 1,076 titles—the smallest number for any peace-time year since 1925.—J. Van Tyne.

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ADULT CHIPPING SPARROW, JULY 21, 1941

NESTLING COWBIRD AND CHIPPING SPARROW, JULY 26, 1941

Photographed at Battle Creek, Michigan, by E. M. Brigham, Jr.

THE WILSON BULLETIN

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THE EASTERN CHIPPING SPARROW IN MICHIGAN

BY LAWRENCE H. WALKINSHAW

THE Eastern Chipping Sparrow (*Spizella passerina passerina*), although one of our more common birds, has been comparatively little studied. The following paper on the migration and breeding habits of this sparrow in Michigan, particularly at Battle Creek, is based on data collected over a period of some 25 years and on a detailed study of six nests made in 1944.

Migration

On May 7, 1940, I observed 15 to 20 Chipping Sparrows feeding together along an old roadway, but as a rule in the spring the species is observed singly. During the autumn the species is regularly found feeding along fence-rows or roadsides, grouped in flocks which are often rather large (sometimes containing up to 30 individuals).

Compared with the Eastern Field Sparrow (*Spizella pusilla pusilla*), to which it is closely related, the Chipping Sparrow is a rather late migrant. At Battle Creek since 1918 I have made my first spring observation once as early as March 25 (1939), once as late as April 27 (1940), other years on dates between April 6 and 22. In 1937 I recorded the species on November 1, but it usually leaves during October. The Chipping Sparrow is present at Battle Creek for an average of 186 days of the year (174 to 199 days). Seasonal dates for the years 1918–25 and 1929–44 are listed in Table 1.

Territory

When first observed each spring male Chipping Sparrows have been already attached to certain territories, which they proclaimed by singing from some tree perch during most of the daylight hours. In Battle Creek they were not always completely surrounded by other Chipping Sparrows, so that their territories, although limited on one or more sides, were quite flexible on the others. Territorial defense consisted chiefly in chasing intruders, which then usually left at once. I have often observed a trespasser depart on the mere approach of the resident male with wings slightly lowered and feathers slightly raised. Trespassing birds were usually perched in a tree or bush on the other bird's

TABLE 1

MIGRATIONS OF THE CHIPPING SPARROW, BATTLE CREEK, MICHIGAN

Year	First record	Second record	Species common	Last record	Days present
1918	April 11				
1919	April 10				
1920	April 22				
1921	April 6				
1922	April 6				
1923	April 21				
1924	April 18				
1925	April 14				
1929	April 6			October 20	197
1930	April 10			October 12	185
1931	April 9	April 12	April 19	October 25	199
1932	April 15	April 17	April 24	October 9	177
1933	April 12	April 15	April 15	October 8	179
1934	April 9	April 15	April 18	October 21	195
1935	April 19	April 20	April 19	November 1	196
1936	April 15	April 16	April 19	October 18	186
1937	April 17	April 18	April 18	October 24	188
1938	April 13	April 14	April 14	October 21	191
1939	March 25	April 21	April 21	October 5	194
1940	April 27	April 28	May 5	October 18	174
1941	April 12	April 13	April 13	October 6	177
1942	April 13	April 14	April 13	October 5	175
1943	April 8	April 16	April 18	October 21	196
1944	April 20	April 27	April 27	October 18	181
Av.	April 13	April 17	April 19	October 19	186

territory. On one occasion a resident male drove away a trespassing female. (The two sexes often cannot be distinguished by plumage, but these observations were made on birds marked with colored bands.)

In 1944 three pairs of Chipping Sparrows built their first nests about 140, 180, and 220 feet apart, one in front of our house, the others in neighboring yards. The second nests were all built in our yard, in a small triangular area whose sides measured respectively 48, 33, and 20 feet. Often two pairs would sit on opposite sides of a small mountain ash or sumac bush. Two pairs used the same part of the street as a feeding area and frequently fed in close proximity to each other. Yet each male defended a definite territory around his nest (from an acre to an acre and a half in area) from other males. After the young left the second nests (August 8 to 14), they sometimes wandered across territorial boundaries, and at first the parents (which were now banded and seemed to know their own young) coaxed or led them back. But after mid-August no territorial behavior was observed; although each family group remained separate from the others, all three pairs and their young roamed over the same fairly large area.

Mating

In 1944 the first female was observed on May 4, 14 days after the first male. Accompanied by her mate she was examining the small arbor vitaes and a common juniper in our yard. The male and female of Chipping Sparrows remain almost constantly together between mating and nesting, as Field Sparrows and Clay-colored Sparrows (*Spizella pallida*) do. The pair in our front yard during May, 1944, were always feeding together, hopping along the ground searching for insects or seeds, usually in the driveway or along the weedier portion of a near-by roadside. After mating, the male very seldom sang until incubation started.

Copulation, which usually takes place on the ground, but sometimes on a horizontal branch, wire, or roof, is frequent during the days preceding egg laying and often occurs several times in succession. The female assumes a crouching posture with head and tail slightly raised and wings rapidly vibrating; the male approaches and hovers over her for a few seconds. During copulation the female (and perhaps the male) utters a rapid call, *see-see-see-see-see.*

Nest Building

The female did all of the nest building. The male usually accompanied her on her trips for nest material, which she gathered within 100 or 150 yards of the nest, but sometimes he merely remained near-by and sang. Most of the nest building was done in the early morning hours, and the nest was completed in three or four days. Dates for the beginning and completing of a number of nests are as follows: May 1–4, 1932; May 13–16, 1933; May 11–15, 1934; July 1–2, 1935; May 12–14, 1936; May 16–18, 1937; May 10–12, 1944 (average: 3.4 days). The completion of the July nest in two days would seem to indicate that later nests are constructed more rapidly than early ones as is often the case with other species.

The nests, made of dead grasses and rootlets, are lined sometimes with very fine grasses but oftener with very fine rootlets and hair. The hair is usually horsehair, but deer hair, human hair, and other kinds are also used. One typical nest had a lining of 752 horse and human hairs, an inner lining of 182 rootlets, and an outer cup of 145 pieces of grass, larger rootlets, and tumble weeds. The majority of the rootlets were less than three or four inches long; some of the hairs were more than a foot in length, but most of them ranged between two and five inches. The total number of pieces in this nest was 1,079, yet the nest was less bulky than many Clay-colored Sparrow nests (Walkinshaw, 1939*a*:18), and more compactly built than Field Sparrow nests (Walkinshaw, 1939*c*:110). The average weight and measurements of eight Chipping Sparrow nests are given in Table 2.

TABLE 2

Size of Eight Chipping Sparrow Nests

	Exterior diam. at top	Interior diam. at top	Exterior depth	Interior depth	Weight (grams)
Av.	112 mm.	48.3 mm.	56.8 mm.	37.3 mm.	4.7
Max.	150 mm.	60.0 mm.	75.0 mm.	50.0 mm.	5.8
Min.	80 mm.	40.0 mm.	45.0 mm.	30.0 mm.	3.0

In the more settled areas of southern Michigan, Chipping Sparrows build their nests in a variety of places. Of 51 nests I have found near dwellings, one was on a mowing machine in a semi-open tool shed, and one on the ground in dead grass; two on the sides of old strawstacks; five in rose or spirea bushes; seven in the horizontal branches of horse-chestnut, pear, or apple trees, 12 to 15 feet above the ground; eight in grapevines. But by far the most were in common juniper (five nests), arbor vitae (eight), and spruce (fourteen) in the yards of residences, often very close to a porch. In the pine areas of northern Michigan (Crawford and Oscoda counties), I have found one nest in dead grass, two in white pine, and two in jack pine. In Crawford County, Edward M. Brigham, Jr., and William Dyer showed me a nest they had found in a small hawthorn, but the Chipping Sparrow does not use hawthorns nearly so often as the Clay-colored and Field Sparrows.

I have found nests during May as well as during July at least 305 cm. from the ground, but the average becomes progressively higher during the summer. The elevation of 15 nests in May averaged 109 cm.; 5 nests in June, 153 cm.; 7 nests in July, 229 cm. Some nests are built adjacent to the tree trunk, others far out on a horizontal branch. One built in a pear tree in 1944 was 305 cm. from the ground and 352 cm. from the trunk. All nests were well concealed in a dense mass of leaves or needles.

The Eggs

Chipping Sparrow eggs are a beautiful greenish-blue with a wreath, usually at the larger end, of black or reddish-brown spots or scrawls. On some eggs in addition to the wreath there are a few spots scattered over the entire egg, and on some there are spots in a dense cap at the larger end. Twenty-four eggs (from May, June, and July clutches) averaged 17.23 x 12.82 mm. in length and diameter, 1.6 grams in weight. The largest egg measured 18.5 x 13.7 mm.; the smallest eggs, 16 x 13 mm. and 17 x 12.3 mm. Roberts (1932:413) gave .72 x .51 inches [18.28 x 12.95 mm.] as typical measurements; Bradley (1940: 37) gave "about 18 by 13 mm." (five eggs).

Eggs are laid at daily intervals, usually very early in the morning (between 5:00 and 7:00 A.M.), though the first egg of one set in 1936

was laid very close to 12 o'clock noon (May 16). The second egg of this set was laid before 6 A.M., E.S.T., on May 17, the third by 8 A.M., and the fourth by 6 A.M., on the following days.

In southern Michigan the Chipping Sparrow lays three or four eggs. Forty-five complete clutches averaged 3.62 eggs; these included one clutch of two eggs, but none over four, though Roberts (1932:413) lists a nest found in St. Louis County, Minnesota, May 4, 1902, which contained five eggs. As with other Fringillidae the average number of eggs per set becomes progressively smaller as the season advances (Table 3).

TABLE 3

Sizes of Chipping Sparrow Egg Sets (Michigan)

No. of eggs per set	No. of sets				
	May	June	July	August	Total
2	—	—	1	—	1
3	4	4	6	1	15
4	17	11	1	—	29
Total sets per month	21	15	8	1	45
Av. no. eggs per set per month	3.81	3.73	3.0	3.0	3.62

Nesting usually starts in May and continues into August. In my records the earliest laying was May 8 (1938); the earliest hatching, May 21 (1938); the earliest fledging, May 27 (1922). Undoubtedly weather conditions affect the beginning of nesting. For example, the spring of 1938, when I made my earliest records for laying and hatching, was exceptionally warm (Walkinshaw, 1939*b*:64). I have recorded 13 other nests in which the first egg was laid on dates in May. At eight of these nests the date was known from direct observation: May 13, 14, 16 (two nests), 17 (two nests), 18, and 20; at the other five nests the date of the first egg was calculated on the basis of observations made later in the nesting cycle: May 10, 11, 18, 19, and 26. My latest record for the laying of the first egg in a set is July 26 (calculated date), but I have noted other nests where laying was almost as late: July 20 and 22 (calculated dates), and July 25. My latest record of hatching is August 7, and of nest-leaving, August 15.

Of 66 nests only three were parasitized by Cowbirds. Two of these were deserted immediately after the Cowbird egg was laid. In the third, a young Cowbird was raised alone; the Chipping Sparrow eggs had been removed or destroyed. Only one of the nests built in the shrubbery of our yard was parasitized.

Incubation and Care of Young

The female incubates the eggs, but on one occasion, on a cool morning, I found the male incubating. The male of the Clay-colored Sparrow occasionally incubates and broods (Walkinshaw, 1939*a*:20), and on one occasion I found a male Field Sparrow brooding the young at night when they were several days old.

Incubation began the night before the laying of the last egg and required 11 days at the four nests where the period was exactly determined: Nest 27, 1933 (Walkinshaw, 1934:304); Nest 54, 1938; Nests 1 and 4, 1944. At Nest 1, 1944, incubation began at 8 P.M., May 15, the night before the last egg was laid. Three eggs hatched during the day, May 26, the fourth egg on May 27. At Nest 4, 1944, incubation began July 26, when the nest contained two eggs. The third egg was laid July 27 between 6 and 8 A.M. Two eggs hatched at 6:50 and 8:00 A.M. August 6; the third, about 6 A.M. (down still wet) August 7.

I watched Nest 4, 1944, the day the first two eggs hatched, from 5:00 A.M., 67 minutes before night incubation ended, to 9:30 A.M. (a total of four hours and 30 minutes). The first young hatched at 6:50, and the female immediately ate the shells. She fed this young at 7:18. The second young hatched at 8, and she fed it at 8:20.

Both male and female approached the nest cautiously, usually alighting on several successive perches before entering the nest tree from

TABLE 4

Frequency of Brooding of Chipping Sparrows
1944, Nests 4 and 5

Date:	August 6 (N. 4)	August 8 (N. 4)	August 6 (N. 5)
Period of observation:	270 min.: 5–9:30 A.M.	115 min.: 5–6:55 A.M.	210 min.: 5–8:30 A.M.
Age of nestlings:	hatched	1 day (1) 2 days (2)	2 days (1) 3 days (2)
No. of brooding periods:	6	4	9
Av. length of brooding period:	41.1 min.	14.25 min.	11.1 min.
Av. length of interval:	3.83 min.	12 min.	13.7 min.
Brooding periods (extremes):	20–67 min.	5–25 min.	4–24 min.
Intervals (extremes):	1–7 min.	3–20 min.	2–53 min.
Total time brooded:	247 min.	57 min.	100 min.
Total time not brooded:	23 min.	58 min.	110 min.

below and working up through the foliage to the nest. Their flight away from the nest, however, was direct. Both chipped softly when approaching the nest and often chipped rapidly when leaving.

The female did most of the brooding, but on cool mornings the male occasionally brooded for a very few minutes. At Nest 5 on August 6, the male brooded from 5:45 to 5:48 A.M. while the female was away. Often one or both parents would stand on the edge of the nest examining the young or the bottom of the nest, where they sometimes tugged at things I could not see. As the young grew older, brooding decreased (Table 4); they were not brooded after they were six and seven days old. On the night of August 9, when the young of Nest 4 were only two and three days old, the female did not brood. She had apparently been kept from the nest at roosting time by a disturbance in the yard. The young were thoroughly chilled by morning but took food from the male at 5:32 after the female had brooded them for 10 minutes (5:15 to 5:25).

At Nest 5 the female's feedings decreased from an average of 3.2 per hour when the nestlings were one and two days old to an average of 2.77 per hour when the nestlings were two and three days old. But except for this, both male and female increased the frequency of their

TABLE 5

FREQUENCY OF FEEDING OF YOUNG CHIPPING SPARROWS
1944, Nest 4

Date:	August 6[1]			August 8			August 13		
Period of observation:	185 minutes: 8–9:50 A.M.; 10:45 A.M.–12 M.			90 minutes: 5:25–6:55 A.M.			278 minutes: 12 M.–1 P.M.; 4:20–7:58 P.M.		
Age of nestlings:	hatched			1 day (1) 2 days (2)			6 days (1) 7 days (2)		
No. of nestlings:	2			3			3		
Parent:	Both	♂	♀	Both	♂	♀	Both	♂	♀
Total feeding visits:	6	1	5	12	7	5	52	24	28
Av. no. feeding visits per hour:	1.95	.32	1.62	8	4.7	3.33	11.2	5.18	6.04
Av. length of interval (minutes):	23.7	—	26	7.72	12.5	18.7	5.28	10.9	9.76
Extremes of intervals (minutes):	13–45	—	13–45	0–23	5–23	5–25	0–12	3–24	2–20

[1] The nest was under observation from 5:00 A.M. (see Table 4), but this table covers only the period following the hatching of the second young.

TABLE 6

FREQUENCY OF FEEDING OF YOUNG CHIPPING SPARROWS
1944, NEST 5

Date:	August 5			August 6			August 8		
Period of observation:	75 minutes: 7–8:15 A.M.			260 minutes: 5:35–8:30 A.M. 10:45 A.M.–12:10 P.M.			90 minutes: 5:30–7 A.M.		
Age of nestlings:	1 day (1) 2 days (2)			2 days (1) 3 days (2)			4 days (1) 5 days (2)		
No. of nestlings:	3			3			3		
Parent:	Both	♂	♀	Both	♂	♀	Both	♂	♀
Total feeding visits:	8	4	4	28	16	12	20	13	7
Av. no. feeding visits per hour:	6.4	3.2	3.2	6.46	3.69	2.77	13.33	8.66	4.66
Av. length of interval (minutes):	6.71	13.33	11	9.61	17.8	16.3	4.15	6.91	12.83
Extremes of intervals (minutes):	2–12	5–18	10–12	2–25	7–35	7–25	0–15	3–15	6–19

feedings as the nestlings grew older (Tables 5 and 6). At Nest 4, for example, the nestlings were fed an average of 1.95 times per hour on the day the first two hatched (185 minutes observation); 8 times per hour when they were one and two days old (90 minutes observation); 11.2 times per hour when they were six and seven days old (278 minutes observation).

Both male and female took part in nest sanitation. They often swallowed the smaller fecal sacs, but they always carried away the larger ones, dropping them about 100 or 150 feet away from the nest, though once a male dropped one within 12 feet of the nest.

DEVELOPMENT OF YOUNG

A newly hatched Chipping Sparrow is quite different from the young of the closely related Clay-colored Sparrow and Field Sparrow. Its down is much longer and darker, described by Dwight (1900:198) as "mouse gray," though it seems to me darker than that and rather to be described as "Deep Mouse-Gray." The skin and legs are pinkish, the bill a darker pink, with yellowish tomia. There is a small egg tooth, white in color, at the tip of the maxilla. No feather tracts are visible. When first hatched the nestlings lay curled up in the bottom of the nest in a position similar to that assumed in the egg, but they raised their heads and opened their mouths at the slightest movement or noise made near them, using their wings to help support them.

TABLE 7

Average Measurements of Nestling Chipping Sparrows

No. of birds	Age	Weight (grams)	Wing (mm.)	Tarsus (mm.)	Culmen (mm.)
7	hatched	1.28	5.66	5.08	3.25
6	1 day	2.10	7.33	7.00	4.00
6	2 days	3.25	9.08	8.81	4.91
6	3 days	4.51	12.16	10.91	5.16
5	4 days	5.80	15.40	13.00	5.60
4	5 days	7.63	22.33	14.66	6.00
4	6 days	8.75	27.25	16.12	7.00
4	7 days	9.72	32.16	16.83	7.30
4	8 days	9.30	35.25	16.87	7.30
2	9 days	8.75	38.00	17.25	7.50
2	10 days	10.30	46.00	17.00[1]	7.00[1]

[1] The birds measured at the age of 10 days were not the same individuals measured at the age of 9 days.

The dorsal, ventral, and alar tracts began to show when the young were two days old, appearing as dark dots underneath the skin. The sheaths of the primaries protruded 2 mm. at three days of age, 9 mm. at five days, and 18 to 19 mm. at seven days, when the feathers began to unsheath. The rectrices began to show at three days, but had grown to only five or seven mm. at seven days. By 9 and 10 days of age the young were well covered with unsheathed feathers. Sutton (1935:28; 1937:2) has summarized plumage changes and plumage coloration in the Chipping Sparrow. The streaking present on the breast of the nestling disappears in the fall, and the young of the Chipping Sparrow, except for its shorter tail and longer wings, resembles the young of the Field Sparrow for a time. The crown is striped before the birds leave in the fall.

Average weights of nestlings increased from 1.28 grams at hatching (seven individuals) to 10.3 grams at 10 days old (two individuals). During the same period average wing length increased from 5.66 mm. to 46 mm.; average length of tarsus, from 5.08 mm. to 17 mm.; average culmen, from 3.25 mm. to 7 mm. (Table 7). These measurements are close to those recorded by Weaver (1937:104). Bradley (1940:42) also gave measurements for the Chipping Sparrow, but the exact ages of her birds were not known. All the weights averaged in Table 7 were taken in the early morning. Several young while still wet from hatching weighed 1.1 grams. Wing measurements were taken with a straight-edge ruler from the bend (wrist) to the end of the longest feather.

When only two or three days old, the young uttered a low *zeee-zee-zee-zee* call when they were fed. On leaving the nest they immediately began to use a *zip-ip-zip-ip-zip-ip* or *chip-chip-chip* call.

The nestlings began to show fear when they were six days old. Before this they paid no attention to me when I removed them from the nest, often opening their mouths for food, but at six days they cowered in my hand or tried to escape. On the seventh day they were hard to keep in the nest after removal. On the eighth day it was impossible to keep them in the nest.

The young left the nest when they were seven and eight days old. They hopped to the edge of the nest and remained there for some time. Then they moved gradually out into the branches of the nest tree. Sometimes one fell to the ground, and it was then led by one of the adults, usually the male, into a brushy area. By 10 days of age they could hop into the lower branches of bushes, where they sometimes remained for long periods on one perch. By 12 days of age they could fly a few feet, and at 14 days of age they were capable of sustained flight.

The adults from Nest 5 were observed feeding the young when they were 24 days old (August 27). I did not see this family again. The young from Nest 4 were still fed on September 9, when they were 33 days old. By September 20 they were foraging for themselves, though they were still accompanied by their parents. The male from Nest 4 fed a full-grown young (at least 35, perhaps 40, days of age) from an earlier nest on August 13, when the young in the second nest were 7 days old.

Nesting Success

The outcome of 50 nests (mostly in city yards or near farm houses) was known. Young hatched in 33 (66 per cent) of these, and young were fledged in 31 (62 per cent). Of 152 eggs, 104 (68.42 per cent) hatched, 93 (61.18 per cent) produced fledged young. Kendeigh (1942: 20) found that young were fledged in 59 per cent of 174 nests, and that 40 per cent of all Chipping Sparrow eggs laid developed into fledglings. Of my 31 nests which produced fledged young, 11 had broods of four; 13 had broods of three; 3 had broods of two; and 4 had one young each.

Food

In the spring Chipping Sparrows feed on small weed seeds along roadsides. In the summer they feed on larvae and grasshoppers, which they also feed to the young. The adults mash the grasshoppers on some hard surface before offering them to the young. In September they again feed on weed seeds. Forbush (1907:303) and Judd (1901:76) give excellent reports on the food of Chipping Sparrows.

Roosting

When not brooding, the female from Nest 6 spent the night in a thick globe arbor vitae four feet from the nest; the female from Nest 4,

in a thick clump of lilacs 45 feet from the nest. The males often roosted in arbor vitaes. Time of roosting was recorded for one female: 8:10 P.M. to 5:15 A.M. (August 7-8). A male began singing that morning at 5:12, half an hour before sunrise. Occasionally males sang during the night.

Response to Danger

The regular alarm note of Chipping Sparrows is a sharp rapid chipping. They are fearful of cats and squirrels, responding to their presence with persistent chips from some high perch. For hawks they give a special alarm call, a sibilant *zeeeeeeee,* similar to the hawk call of the Field and Clay-colored Sparrows. Even when this call is given by only one Chipping Sparrow, all the others in the vicinity dive into the nearest vegetation and remain there for several minutes.

Summary

The migration and breeding habits of the Eastern Chipping Sparrow (*Spizella passerina passerina*) in Michigan, particularly at Battle Creek, were studied from 1918 to 1944, and a detailed study of six nests was made in 1944.

This sparrow is usually observed singly during the spring, in flocks during the fall.

It usually arrives at Battle Creek during the second and third weeks of April and leaves in October, being present an average of 186 days of the year.

Territory is taken up immediately on the male's arrival. An area around the nest from an acre to an acre and a half is defended against other male Chipping Sparrows, but pairs often feed side by side outside these areas. Territorial behavior stops about mid-August.

The male sings almost continuously from arrival until mating but sings very little between mating and the beginning of incubation.

The female builds the nest (usually during the early morning), taking (as a rule) three or four days to complete it.

For eight nests the average weight was 4.7 grams; average diameters at top, 48.3 mm. (interior) and 112 mm. (exterior); average depths, 37.3 mm. (interior) and 56.8 mm. (exterior). Nest materials were dead grasses, rootlets, and hair. In one nest 1,079 pieces were used.

Favorite nesting sites were conifers. Nests were found placed progressively higher from the ground as the summer advanced (averaging 109 cm. from the ground in May, 229 cm. in July).

Eggs were greenish-blue, spotted in a wreath or cap at the larger end. Twenty-four eggs averaged 12.82 x 17.23 mm. in diameter and length, 1.6 grams in weight.

Eggs were laid at daily intervals, usually between 5 and 7 A.M.

The average number of eggs per set (45 clutches) was 3.62.

The earliest laying recorded was May 8; the earliest hatching, May 21; the earliest fledging, May 27. The latest record for laying the first egg of a set was July 26 (calculated date); the latest for nest-leaving, August 15.

Of 66 nests, only three were parasitized by Cowbirds.

The male was once found on the eggs, but as a rule the female alone incubates. The incubation period was 11 days.

The young were fed less than an hour after hatching.

The male occasionally brooded for a few minutes on cool mornings.

Brooding decreased as the young grew older and stopped when they were six and seven days old.

Male and female shared in feeding the young and in nest sanitation.

Feedings increased in frequency as the young grew older.

The down of the Chipping Sparrow is longer and darker than that of the Clay-colored and Field Sparrows. Feather tracts began to show at two days of age; sheaths of primaries protruded 2 mm. at three days, 9 mm. at five days, and 18 to 19 mm. at seven days. Rectrices began to show at three days.

Average weights of nestlings increased from 1.28 grams at hatching to 10.3 grams at 10 days of age.

The nestlings began to show fear when they were six days old.

At 10 days of age the nestlings could hop to low branches of bushes; at 12 days they could fly a few feet; at 14 days they were capable of sustained flight.

Young were fed by their parents until they were 33 (perhaps 35 or 40) days old.

Of 50 nests (mostly near dwellings), 33 (66 per cent) produced young; 31 (62 per cent) produced fledglings. Of 152 eggs, 104 (68.42 per cent) hatched; 93 (61.18 per cent) produced fledglings.

In spring and fall, Chipping Sparrows feed on weed seeds; in summer, on larvae and grasshoppers, which they also feed to the young.

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HOLBOELL'S GREBE NESTING IN SOUTHERN ONTARIO

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DURING most summers since 1930 Holboell's Grebes (*Colymbus grisegena holböllii*) have been seen at various localities near the western end of Lake Ontario, and in 1943 they were found nesting in the region. The A.O.U. Check-List (1931) defines the breeding range of Holboell's Grebe as: "Northeastern Siberia, northwestern Alaska, and northern Canada south to northern Washington, North Dakota, and southwestern Minnesota." Forbush (1925:5) was more specific about localities in northern Canada, mentioning northern Mackenzie, Ungava (northern Quebec), and Hudson Strait, and he added southwestern New Brunswick to the regions mentioned in the Check-List. Since these publications were issued, Holboell's Grebes have been reported nesting at Fish Lake, near Madison, Wisconsin (Jones, 1938: 666). Baillie and Harrington (1936:5) described the summer status of Holboell's Grebe in Ontario as follows: "This species is a rare summer resident of extreme western Ontario, west of Lake Superior. Actually it has been found breeding only at Whitefish Lake, some fifty miles west of Port Arthur." These authors also mentioned summer occurrences at James Bay, and eggs from the Lake-of-the-Woods (possibly the Ontario shore).

Summer occurrences on western Lake Ontario. Holboell's Grebes have been observed by G. W. North in the vicinity of Burlington during the summers of 1931 to 1933, inclusive; and the summers of 1938 to 1944, inclusive (that is, during 10 of the 14 summers between 1931 and 1944). The numbers observed varied from 6 to 48 in May and June, with smaller numbers in July; and 2 to 4 in August (during the years 1939 to 1944). On July 1, 1934, two were observed on Lake Ontario near Sunnyside Beach, Toronto, by J. M. Speirs. G. W. North counted 46 Holboell's Grebes between Burlington and Lorne Park (the majority at Lorne Park), on July 12, 1942, and 48 at Burlington on June 18, 1944. (Lorne Park is 14 miles from Toronto and 18 miles from Burlington—see Figure 1.)

Nesting at Burlington in 1943.[1] On June 9, 1943, a pair of Holboell's Grebes was seen on Lake Ontario at Burlington. They were taking an active interest in a floating mass of vegetation which was attached loosely to a small, partly submerged willow. One of the pair poked with its bill in the floating nest, while the other sat up in the water, puffed out its horns and uttered its loonlike call. On June 11 the pair was seen

[1] The following observers contributed data on these nests: Jack Campbell, William Cudmore, Barbara and N. J. Hearn, Carol Proctor, and Doris Huestis Speirs.

at the same spot. Copulation occurred, and the male was observed carrying sticks to the nest. On June 12 the grebes added sticks and water weeds to this nest, and started to build a second nest about 100 feet from the first, in a submerged crotch of a small willow. On June 13 courtship activities were observed at Nest 2. Nest 1 was still intact. On June 23 one of the pair was sitting on Nest 2, poking underneath itself at intervals as if turning an egg or eggs, while the other grebe swam near-by. Nest 1 had disappeared. On June 26 there was one egg in Nest 2, and on July 4 a grebe was observed sitting on the nest. The egg was still present on July 11, but had disappeared by July 18. The grebes were not seen at this nest again.

Nest-building was observed at a third nest on June 23: it contained at least one egg on July 18, which was still there on July 25. Nest 4, containing one egg, was found on July 10. Nest 5 (containing two eggs, which were still in the nest on August 2), Nest 6 (containing three eggs), and Nest 7 (which was empty), were all found on July 18.

Of the seven nests found at Burlington in 1943, three were built in submerged crotches in willows, four (of which at least two were attached to willows) were floating.

So far as we know, no young hatched from any of the eggs. This was probably due in part to storms on Lake Ontario. There were heavy storms on June 17, and on August 4, 1943. After the storm on August 4, none of the nests could be found. Since the nests were situated

Figure 1

within a few yards of a beach where small boats could be rented, human interference was probably another factor. After the storm of August 4, new nests were built on the sites of Nests 4 and 5, but these also were unsuccessful.

Nesting success in 1944. In 1944, two pairs of Holboell's Grebes nested at Burlington. The first nest of Pair 1, found on June 11 when it contained one egg, was destroyed in a storm on June 18. A second nest was built by June 24 and contained three eggs on July 3, four eggs by July 7. On July 30 there were two eggs in the nest, and two young were seen with the adults. An adult was incubating the one egg that remained on August 5, but on August 6, following a storm during the night, the nest was gone. Two young were seen with the adults on August 6 and several times thereafter until September 18, when they were about seven weeks old.

The first nest of Pair 2 was destroyed in a storm August 2. Another nest had been built on a different site by August 10 and contained three eggs by August 27. An adult was observed on the nest on a number of occasions between August 13 and September 17, and on September 18 one young about one day old was seen.

The second nests of both pairs were built on wooden floats especially made for the grebes by William Hall, of Burlington.

No nests were discovered at Lorne Park, but 14 adult grebes were seen there on August 29, and a flock of adults with one young about seven weeks old on September 18.

Summary

Holboell's Grebes (*Colymbus grisegena holböllii*) have been seen in numbers up to 48 in the region between Hamilton and Toronto, on Lake Ontario, during 11 of the 14 summers from 1931 to 1944 inclusive.

During the summer of 1943, at least seven nests were built by Holboell's Grebes at Burlington. Four contained eggs, but none was successful—due, apparently, to storms and to human interference.

During the summer of 1944 two pairs of grebes nested at Burlington. One pair raised at least two young from four eggs; the other, at least one young from three eggs. One young (about seven weeks old on September 18) was observed at Lorne Park.

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HAWKS AND OWLS IN OKLAHOMA 1939–1942: FOOD HABITS AND POPULATION CHANGES

BY A. MARGUERITE BAUMGARTNER AND
FREDERICK M. BAUMGARTNER

BETWEEN May, 1939, and June, 1942, a population and food-habits study of hawks and owls was made on the Lake Carl Blackwell Cooperative Land Use Project approximately 10 miles west of Stillwater, Oklahoma. During the period 1935-1939 this area of 21,000 acres of submarginal land was entirely closed to agricultural practices, hunting, and trapping. The primary objective of the Project was to demonstrate proper land use, emphasizing controlled grazing and the recreational aspects of a large impounded lake. It was also designated as a wildlife refuge and as a study area, particularly for investigations on the Bob-white (*Colinus virginianus*), Oklahoma's most widely hunted game bird. The work reported in this paper was limited in the main to 3,000 acres in the northeast corner of the project.

The area consists of rolling prairie cut by numerous shallow ravines. Four major plant associations are present: little bluestem prairie (*Andropogon scoparius*); abandoned fields dominated by annual grasses, particularly the triple-awned grasses (*Aristida* spp.), annual brome grass (*Bromus tectorum*), wire-grass (*Poa compressa*), and annual and perennial weeds, particularly the small ragweed (*Ambrosia artemisiifolia*), the rough button-weed (*Diodia teres*), sunflowers (*Helianthus* spp.), gumweed (*Aplopappus ciliatus*), and fleabanes (*Erigeron* spp.); patches of black jack oak (*Quercus marilandica*) and post oak (*Q. stellata*) on the sandy slopes; and timbered stream beds dominated by American elm (*Ulmus americana*), slippery elm (*U. fulva*), and hackberry (*Celtis* spp.).

1939

In late April of 1939, a trap line for predatory birds was set up on a representative 100-acre area. The traps were set on top of posts in old fence lines totaling approximately two miles in length. These fence lines bounded or intersected the area trapped. In order to make the traps most effective, all posts and other perches were removed except those selected for trap sites. Trapping was intensive. Number 0 steel traps were modified by weakening the spring with heat and by padding the jaws with sponge rubber. Although a few birds suffered lacerated legs and feet, injuries did not appear to be serious. A few owls died in the traps during periods of extreme heat during the summer. (Such losses were kept at the minimum by running the traps early in the morning, since most of the owls had been caught during the night.) A few birds were killed by mammals, probably striped skunks (*Mephitis mephitis*) or opossums (*Didelphis virginiana*).

Between April 21 and the middle of December, 1939, a total of 154 predatory birds of 13 species were trapped. These comprised 78 Barn Owls, 26 Marsh Hawks, 19 Short-eared Owls, 8 Screech Owls, 8 Red-tailed Hawks, 5 Swainson's Hawks, and one to three each of six other species of predatory birds (Table 1).

In addition to trapping, a daily record was kept of the number of hawks and owls seen on a 3,000-acre tract set aside for special studies. Barn Owls were abundant. Thirteen, including both nestlings and adults, were caught in the steeple of a deserted church less than a mile away. Marsh Hawks were seen at all hours of the day, beating back and forth over the meadows of bluestem grass and old weedy fields.

TABLE 1

PREDATORY BIRDS TRAPPED ON THE LAKE CARL BLACKWELL PROJECT APRIL 1939 TO DECEMBER 1939

Barn Owl, *Tyto alba*	78
Marsh Hawk, *Circus cyaneus*	26
Short-eared Owl, *Asio flammeus*	19
Screech Owl, *Otus asio*	8
Red-tailed Hawk, *Buteo jamaicensis*	8
Swainson's Hawk, *Buteo swainsoni*	5
Sparrow Hawk, *Falco sparverius*	3
Barred Owl, *Strix varia*	2
Long-eared Owl, *Asio wilsonianus*	2
Red-shouldered Hawk, *Buteo lineatus*	1
Ferruginous Rough-leg, *Buteo regalis*	1
Great Horned Owl, *Bubo virginianus*	1
	154

During the fall migration it was often possible to count as many as 25 individuals in one square mile. During November and December Short-eared Owls appeared to be as numerous by night as the Marsh Hawks were by day, and several roosts were found on the grassy slopes. Red-tailed Hawks were also seen daily in considerable numbers, but since they did not regularly use the fence posts as perches only eight were trapped. Nine other species were seen, though in less notable abundance. In May, 1939, only 1.05 predatory birds were counted per mile; in August, 2.70; in September, 7.59; and by December the number had risen to 17.85 per mile (Table 2).

At the same time, population trends of rabbits and small rodents were ascertained by trapping at regular intervals as well as by continuous field observations. Even to a casual observer, the year 1939 was throughout the state a period of unusual abundance of rodents, particularly of the cotton rat (*Sigmodon hispidus*). Cotton rats were seen almost daily on the study area throughout November and December, 1939, and 500 trap nights in November yielded an average of eight cotton rats for 100 trap nights, an indication of a high population according to the findings of Blair (1938).

TABLE 2

HAWKS AND OWLS SEEN PER MILE, MAY 1939 TO JUNE 1942

May, 1939 **	1.05	Jan. 1941*	.50
June, 1939 *	.66	Feb. 1941*	.39
July, 1939 ***	1.39	Mar. 1941*	.37
Aug. 1939 *****	2.70	Apr. 1941**	1.16
Sept. 1939 **********	7.59	May 1941*	.37
Oct. 1939 **********	10.26	June 1941*	.07
Nov. 1939 **********	16.49	July 1941*	.52
Dec. 1939 **********	17.85	Aug. 1941	
Jan. 1940 ********	4.00	Sept. 1941*	.45
Feb. 1940 ***	1.37	Oct. 1941*	.67
Mar. 1940 *	.46	Nov. 1941**	.96
Apr. 1940 *	.66	Dec. 1941**	1.16
May 1940 *	.24	Jan. 1942**	.90
June 1940 *	.07	Feb. 1942*	.69
July 1940 *	.19	Mar. 1942*	.57
Aug. 1940		Apr. 1942**	.84
Sept. 1940 *	.83	May 1942*	.20
Oct. 1940 **	.60	June 1942*	.53
Nov. 1940 *	.71		
Dec. 1940 *	.55		

That these small mammals had made up practically the entire food of the majority of the predatory birds was shown by hundreds of pellets collected in 1939. Table 3 enumerates the food items and number of pellets for six of the predators. In every case the preponderant figures are in the cotton rat column, representing over 66 per cent of the total food items. The harvest mouse (*Reithrodontomys montanus*) was second (17 per cent), with the remaining 16 per cent distributed among 14 species of vertebrates and a few invertebrates.

The great bulk of the pellet material found was from Barn Owls, which were the most abundant species and offered opportunities for intensive collecting at nest sites. Material was also obtained from Marsh Hawks, Buteo hawks, Screech Owls, Great Horned Owls, Barred Owls, and Short-eared Owls. Pellets were analyzed according to the methods described by Errington (1930). For reference specimens we are indebted to the Zoology Department of Oklahoma Agricultural and Mechanical College.

Marsh Hawk. Thirty-one pellets collected from winter roosts of the Marsh Hawk consisted chiefly of fur. One pellet was composed largely of woodpecker feathers, and the remains of one carabid beetle were also found. The skeletal material was almost entirely cotton rat; in the field, Marsh Hawks were frequently flushed from cotton rat kills.

Unidentified Buteos. Large numbers of pellets of Buteo hawks were examined in the field and laboratory. These may be attributed chiefly to Red-tailed Hawks, which were abundant; in limited numbers to Swainson's, American Rough-legs (*Buteo lagopus*), and Ferruginous Rough-

TABLE 3

FOOD ITEMS OF PREDATORY BIRDS ON THE LAKE CARL BLACKWELL PROJECT

	Marsh Hawk	Screech Owl	Great Horned Owl	Barred Owl	Short-eared Owl	Barn Owl	Totals
Common mole (*Scalopus aquaticus*)			1			2	3
Little shrew (*Cryptotis parva*)			2		6	29	37
Short-tailed shrew (*Blarina brevicauda*)			1			7	8
Pocket mouse (*Perognathus hispidus*)			2		3	32	37
Harvest mouse (*Reithrodontomys montanus*)	2	1	1		12	171	187
Deer mouse (*Peromyscus* sp.)		1	1		7	39	48
Cotton rat (*Sigmodon hispidus*)	11	2	36	3	69	592	713
House mouse (*Mus musculus*)					4	2	6
Cottontail rabbit (*Sylvilagus floridanus*)			10			3	13
Black-tailed jack rabbit (*Lepus californicus*)			1				1
							1053 (97.86%)
Duck sp. (*Anatidae*)			1				1
Woodpecker sp. (*Picidae*)	1						1
Meadowlark sp. (*Sturnella*)			1				1
Blackbird sp. (*Icteridae*)			1				1
Fringillid sp. (*Fringillidae*)			2		1		3
Small bird sp.			2				2
							9 (0.84%)
Fish sp.				1			1
							1 (0.09%)
Crayfish sp. (*Cambarus*)						2	2
Beetle sp. (*Carabidae*)	1		5				6
Beetle sp. (*Calosoma* sp.)			1				1
Beetle sp. (*Trogidae*)			3				3
Beetle sp.						1	1
							13 (1.21%)
Total food items in pellets	15	4	71	4	102	880	1076 (100.00%)
Number of pellets	31	3	67	3	130	662	896

legs; and a few to Red-shouldered Hawks. Prey species were found in these pellets in proportions similar to those in the identified pellets, with a preponderance of cotton rats. Mice, shrews, and cottontail rabbits were noted in very limited numbers. No bird remains were found.

Screech and Barred Owls. Data on the Screech and Barred Owls, although meager, suggest that they also were depending upon cotton rats for their major food items.

Great Horned Owl. Some of the 32 Great Horned Owl pellets found in 1939 were taken from nests, but the majority were taken from under roosts. Cotton rats constituted 33 of the 44 food items found. Nine beetles were taken from the nest debris, and are listed with the food items, but it is possible that these insects were not eaten by the owls. (See Table 4.)

Short-eared Owl. During the spring and fall of 1939, 130 pellets were collected from Short-eared Owl roosts in the bluestem prairies. Almost 70 per cent of the 102 food items consisted of cotton rats, the rest being made up of five species of small mammals and one small bird.

Barn Owl. During 1939, Barn Owls were by far the most abundant owl on the area, furnishing almost 75 per cent of the total pellets collected. Because the volume of disintegrated pellets found at Barn Owl nest sites was too great to be disregarded, we attempted to deduce the number of pellets contained in the debris. The following simple equation, we believe, gives a reasonably accurate figure.

$$\frac{\text{409 complete pellets collected}}{\text{366 cotton rats found in pellets}} = \frac{\text{x pellets in debris collected}}{\text{226 cotton rats found in debris}}$$

Then x equals 253 pellets in the debris, which, added to the 409 complete pellets collected, make a total of 662 pellets.

Of the 880 food items included, 67 per cent were cotton rats. There were three young cottontail rabbits and three invertebrates. The remainder was made up of small mammals of seven species.

In comparing food items of the Barn Owl month by month, seasonal trends could be observed in the use of two species. Harvest mice rose from 10 per cent of the total food items in April to 33 per cent in July, and thereafter dropped steadily to 8 per cent in October. Cotton rats, fluctuating between 50 per cent and 66 per cent of the total food items during spring and early summer, began to rise steadily in August and by October made up 83 per cent. By the end of 1939, Barn Owls were apparently subsisting almost entirely on cotton rats.

January 1940

Thus we have an abundance of predatory birds accompanied by an abundance of rodents, shown by pellet analysis to constitute the major portion of the birds' food. But abruptly this situation changed. During late December, 1939, and early January, 1940, several inches of snow blanketed the ground, accompanied by unusually low temperatures.

January, 1940, was the second coldest month on record at Stillwater, with an average temperature of 13° F. below the 48-year average for the month. Sub-zero temperatures were recorded on two dates, and during a nine-day period the maximum temperature was below freezing.

The duration and severity of this period brought on a crisis in the small animal populations on which the hawks and owls had been feeding. Cotton rats almost completely died off, and the several species of mice suffered heavy losses. A total of 5,000 trap nights from the middle of January through July did not yield a single cotton rat (Schendel, 1940), and cotton rats were not seen at all in the field during the spring and summer of 1940.

Similarly, only 11 hawks and owls were trapped between mid-December, 1939, and June, 1940. In the field, an average of only four hawks and owls per mile was recorded in January, only 1.37 in February, and since that time, except for April and December, 1941, when the average was 1.16, the average figure has been consistently less than one predatory bird per mile (Table 2). Barn Owls, which had been the most plentiful species, were not recorded at all between February 1, 1940, and September, 1941, with the exception of one that was trapped on April 12, 1940.

One Short-eared Owl was seen in February; another was trapped in March, and the species was recorded again, and for the last time, on April 18, 1940. By the end of February, Marsh Hawks were seldom seen. Thereafter, 5 in a full day afield was considered a high figure, as contrasted with 25 in a square mile during the previous fall.

TABLE 4

Changes in Food Habits of the Great Horned Owl

	No. of pellets	Cotton rats	Rabbits	Other small mammals	Birds	Insects
1939	32	33	1	0	1	9
1940–41	35	3	10	8	6	0

Species such as Cooper's Hawk (*Accipiter cooperii*), which preys chiefly on birds, and the Great Horned Owl, which can overpower larger animals, did not suffer so marked a reduction as the other birds. Beak marks, tracks in the snow, and other evidence indicated that at least 6 of 21 bird kills that were found in the field had been made by Cooper's Hawks. Great Horned Owls were found in their usual numbers following the departure of the other predatory birds. But pellet analysis indicated a definite change in their food habits (Table 4). The 1939 pattern of food items was similar to that of the other predators, with cotton rats preponderating in the diet. But the pellets from 1940-41 contained a notably larger proportion of rabbits, birds, and rodents other than cotton rats.

Later Trends

The trend in 1941 and 1942 for both predatory populations and their food species, appeared to be slightly upward again. In April, and December, 1941, an average of 1.16 predatory birds was recorded per mile, a figure almost twice that for the previous April and December. Also, a few cotton rats were trapped at one station in late June, 1941, the earliest record following the storm.

Summary

A population and food-habits study of hawks and owls was made in northcentral Oklahoma between May, 1939, and June, 1942.

Both trapping and field observation in 1939 indicated an abundance of Barn Owls, Marsh Hawks, Short-eared Owls, and Screech Owls, as well as the presence in smaller numbers of nine other predatory species.

Populations of rodents, particularly cotton rats, were similarly high.

Pellet analysis indicated that over 66 per cent of the total food items of the predatory birds in 1939 consisted of cotton rats.

Following an unusually cold period in late December, 1939, and early January, 1940, both populations of rodents and species of predatory birds whose food had consisted primarily of cotton rats showed a notable decrease or disappeared altogether.

The Great Horned Owl, whose food habits are more generalized, and the Cooper's Hawk, which feeds primarily on small birds, were recorded in their usual numbers after the period of unusual cold.

In 1941 and the spring of 1942 populations of predatory birds showed a slight increase, and a few cotton rats were again trapped in late June, 1941, the earliest record following January, 1940.

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GENERAL NOTES

Avian adipocere.—During the removal of the bodies from the Cimetière des Innocens in Paris in 1786–87, there were found masses of a wax-like substance that A. F. Fourcroy named adipocere. Numerous examples of adipocere from various animal remains have been found since that time. The original fat undergoes certain chemical changes through hydrolysis and hydration whereby it is converted to free fatty acids—largely hydroxystearic acid, with some palmitic and stearic acids. The principal conditions necessary for the formation of adipocere appear to be the submersion of the animal in cool water and so limited an access of air that normal decomposition is prevented.

The conversion of bird remains to adipocere appears to be of very rare occurrence. I know of only three recorded examples. E. Wasmund, in his monographic paper ("Die Bildung von anabituminösen Leichenwachs unter Wasser." *Schriften aus dem Gebiet der Brennstoff-Geologie,* 10, 1935:1–70), mentions receiving a Mallard (*Anas boschas* [=*platyrhynchos*]) that was found in the Grosser Plöner See, in Holstein, in the summer of 1933. He states that this is the first case known of the formation of adipocere from a bird. The feathers usually prevent sinking. J. F. Durand and P. Vièles ("Etude d'une adipocire d'oiseau." *Bull. soc. chim. biol.,* 19, 1937:336–41) obtained the bodies of two chickens (*Gallus*) found in August, 1935, during the cleaning of a well at Sorgues, Vaucluse. The well had been dug 50 years previously but had not been in use for 30 years, so that 50 years was the upper limit of time during which the fowls could have been converted to adipocere. They rested in a calcareous clay with vegetable detritus. The water, infiltering from the Rhône, had a summer temperature of approximately 16° C. at the bottom of the well.

An earlier example than either of the above is that of a Canvas-back (*Nyroca valisineria*) mentioned by Ludwig Kumlien and N. Hollister ("Birds of Wisconsin," 1903:23) who state: "In December, 1877, some farmers who were digging the decayed vegetable matter, known locally as 'muck', for fertilizer, exhumed in a small bay on Lake Koshkonong, a beautiful specimen in the condition known as adipocere. With the exception of the feathers, every part, even to the intestines, was perfectly preserved, and had the appearance of meerschaum. Several shot holes are plainly noticeable on the breast and abdomen, and one shot is imbedded in the sternum." The specimen, formerly in the collection of Milton College, Milton, Wisconsin, cannot be located now.

Recently I received from Mrs. H. A. Main some old papers of Thure Kumlien, and among them was one on the subject of adipocere. This paper, undated, was prepared for reading before some scientific organization. The account of the discovery of the Canvas-back differs in date and certain other minor details from that given by Kumlien and Hollister. His description of the discovery of the duck and his speculations have considerable historical interest and are worth recording in view of the rarity of conversion of birds to adipocere.

"To ornithologists this specimen is probably of very little account, but as chemistry undoubtedly had a hand in making it what it is, chemists and others may perhaps be interested and I justified in introducing to your notice a canvas-back duck preserved by a to me unknown method and in a somewhat out of the way place.

"What we have here was once a fine fat canvas-back duck. What was bone is bone still, though somewhat discolored. The flesh is gone, every particle of it, the head, neck, wings, legs, feet and feathers are all gone and also many of the body-bones, but we have the sternum, some vertebrae, pelvis and ossa coccyges; some

of the intestines and the skin. The fat thick skin is here in general appearance, but not in substance. The skin is now hard, a little harder perhaps than hard white soap and feels a little soapy. It has not changed any since it was found sticking up out of the mud, near a muskrat house, in one of the so-called eddies, on the northwest side of Lake Koshkonong, Jefferson county, Wisconsin, in the spring of 1884.

"If this way of preservation is the result of some chemical combination between the fat of the duck and the lime and other matter in the water, it seems to me that we should find many specimens like this and just in the same lake, where annually hundreds, if not thousands, of ducks are shot, wounded and lost, diving under the small mud islands and perish. Why do not the spring floods, which sometimes entirely change the appearance of those eddies, by sweeping away the mud for acres, once in a while at least, bring to light something like this! Perhaps it is too early yet to expect many specimens, prepared by this under water-mud taxidermist and coming generations may be able to get good collections of them.[1] If chemistry is the conservator in this case, it would be interesting to know how long it has taken to do the job. I think that the duck was shot. I can see the marks.

"Allowing that guns were used on the lake one hundred years ago, which is somewhat doubtful, and that this duck was one of the first shot, lost and mud-bound, it would not be so very old after all for a semi-geological specimen.

"There are in the Museum of the City of Milwaukee two large lumps of a somewhat hard substance, white inside, like chalk, but dirty grayish on the outside. They are somewhat roundish in shape and about 7 to 8 inches in diameter. They are labelled adipocere found at the depth of many feet in a pond near Cedarburg, Wisconsin. The opinion I have heard about those specimens is that they were entrails of animals thrown into the pond by the Indians, some time ago, and by some chemical process got transformed into such solid masses.

"The animals, furnishing materials for this, must have been large, very large, possessing fat in such large lumps, as I cannot suppose that chemistry first picked together the fat and then lumped it into 'adipocere.' To judge from the duck, it is *only* the fat that is so treated.

"The animals must have been Buffaloes[2] or Elk or Moose, but in either case the fat would be *tallow* while in the case of the duck it was *duck-oil.*"—A. W. Schorger, *168 N. Prospect Avenue, Madison, Wisconsin.*

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[1] It is now known that under very favorable conditions a fatty body can be converted into adipocere within a year's time.—A.W.S.

[2] C. D. Wetherill (*Trans. Amer. Philos. Soc.* n. s., 11, 1860:18) found adipocere in a metacarpal bone of *Bison b. americanus* obtained at Big Bone Lick by Dr. Leidy.—A. W. S.

An albino hummingbird.—In view of the scarcity of records of albinistic plumages in the Ruby-throated Hummingbird (*Archilochus colubris*), the following observation may be of interest. Just before noon on August 22, 1944, a pale cream-colored, almost white, hummingbird suddenly appeared over a large clump of red bergamot (*Monarda didyma*) in a corner of my garden near Niagara Falls, Ontario. I obtained excellent views from all angles as the hummingbird hovered at some length, probing the red florets of the bergamot, before darting up and away across the garden. It was evidently an adult male, for although there was little variation apparent in the all-over cream of the plumage, there was a distinct bib, or dusky, darker area, over that part of the throat which is covered in the normal adult male by ruby-red feathers.—R. W. Sheppard, *1805 Mouland Avenue, Niagara Falls, Ontario.*

The type of *Grus proavus*.—Shufeldt in the introduction to his "Fossil Birds in the Marsh Collection of Yale University" (*Conn. Acad. Arts, Sci., Trans.*, 19, 1915:5) stated that the type of *Grus proavus* Marsh (*Amer. Jour. Sci.*, ser. 3, vol. 4, 1872:261) had long been missing. Recently while working in the study collection in the Department of Vertebrate Paleontology at Princeton University, I found a sternum labeled *Grus proavus*. Upon careful study I found that this checked in all details with the description given by Marsh. In the original description Marsh stated that he also had two leg bones, but these could not be located.—William F. Rapp, Jr., *University of Illinois, Urbana, Illinois.*

Hudsonian Chickadee in southern Minnesota.—On October 3, 1943, George Miksch Sutton and I discovered a Hudsonian Chickadee (*Parus hudsonicus hudsonicus*) in a small grove of coniferous trees bordering a cemetery on the outskirts of Northfield, Rice County, Minnesota. The bird, whose characteristic call-notes first attracted our attention, was alone and moving rapidly from tree to tree. We obtained one close view with the binoculars. On October 9, I again observed a single Hudsonian Chickadee at the same place and collected it. It was an immature female weighing 9.4 grams.

The Hudsonian Chickadee is rare in southern Minnesota, where coniferous trees, its preferred habitat, are not native. There is but one previous record south of the Minneapolis-St. Paul area, namely, a January observation at Fairmont, Martin County (T. S. Roberts, "The Birds of Minnesota," 1932, vol. 2, p. 78).—Olin Sewall Pettingill, Jr., *Carleton College, Northfield, Minnesota.*

White-crowned Sparrow in Michigan in winter.—On November 26, 1943, I observed an adult White-crowned Sparrow (*Zonotrichia leucophrys*) alone in a small group of elderberry a quarter of a mile from my banding station at Jackson, Michigan. It was easily approached, and I observed it for several minutes. I covered the surrounding area frequently during the next few months but saw no other individuals of the species.

On February 15, 1944, I trapped an adult White-crowned Sparrow at my banding station. It repeated on February 17 and 18, was quite unafraid, and was easily removed from the trap.

I collected the sparrow on February 19, 1944. It proved to be a female, apparently in good health. The ovary measured 6 x 3 mm. and contained numerous undeveloped follicles. The specimen is preserved in the University of Michigan Museum of Zoology.—Winthrop N. Davey, *2485 Hendee Road, Jackson, Michigan.*

EDITORIAL

The membership roll published in this issue of the *Bulletin* includes 1,085 names, the largest membership in the history of the Club. This is a very encouraging situation, especially when we recall that wartime conditions have caused the loss, at least temporarily, of many former members from the roll. The Treasurer will send out dues notices to all members soon after the publication of this issue of the *Bulletin*. Please send your dues in promptly or in any case send word to the Treasurer that you are continuing your membership and will pay your dues later. We shall then be able to save much time and expense in preparing the mailing list for the March *Bulletin*.

President Kendeigh has obtained new papers of incorporation in Illinois for the Wilson Ornithological Club, thus ensuring full legal protection for the Club and its invested funds. The Club was originally incorporated in Illinois in 1927.

We are very grateful to Ruth D. Turner who has again prepared the annual index for the *Bulletin*. Others to whom we are indebted for assistance during the past year are: Maurice Brooks, Edward M. Brigham, Jr., Helen T. Gaige, J. J. Hickey, Margaret B. Hickey, Ernst Mayr, and Milton B. Trautman.

Ornithological News

At the meeting of the American Ornithologists' Union held in New York on October 25, Frederick C. Lincoln was elected Treasurer and Business Manager; Ernst Mayr, A. L. Rand, and Josselyn Van Tyne were chosen for the Council; and the following were made Members: Robert P. Allen, Richard M. Bond, Maurice Brooks, Mrs. Amelia R. Laskey, Eugene P. Odum, William H. Phelps, and Charles F. Walker. The Brewster Memorial Award for the most meritorious work on American birds was given to Roger Tory Peterson. Maurice Brooks, the appointed representative of the Wilson Ornithological Club on the A.O.U. Council, was prevented from attending the meeting; Ernst Mayr served as representative in his stead.

Gustav A. Swanson, formerly Associate Professor of Entomology and Economic Zoology at the University of Minnesota, has been appointed biologist in the Division of Wildlife Research, U. S. Fish and Wildlife Service. He will head the cooperative research program and serve as liaison officer on Pittman-Robertson research projects.

Although continued military use of the Alaskan Highway closes it to the casual tourist, scientific students whose work promises to yield results of importance may still obtain permits. American applications should be addressed to: Officer Commanding U. S. Army Engineers, Edmonton, Alberta; Canadian applications to: Major-General W. W. Foster, D.S.O., V.D., Special Commissioner for Defence Projects in Northwest Canada, Edmonton, Alberta.

The Wildlife Society at its annual meeting last spring made two awards for outstanding papers published in 1943 in the field of wildlife ecology and management: to H. S. Mosby and C. O. Handley, for *The Wild Turkey in Virginia,* as reported in the September *Bulletin*; and to Richard Gerstell for *The Place of Winter Feeding in Practical Wildlife Management.*

WILDLIFE CONSERVATION

Canada Goose Hunting at Horseshoe Lake

At its October meeting the Illinois Conservation Council conducted a symposium on a subject of great concern to conservationists generally—the Canada Goose situation at Horseshoe Lake, Illinois. Speakers were Livingston Osborne, Director of the Illinois Conservation Department; Albert M. Day, Assistant Director of the Fish and Wildlife Service; Leo K. Couch, Assistant Chief of the Division of Wildlife Research of the same agency; and William H. Elder, of the Illinois Natural History Survey and the University of Chicago. The salient points discussed by the speakers are here summarized.

Since 1927, when Illinois established the Horseshoe Lake Refuge, thousands of Canada Geese that formerly wintered over a large area along the Mississippi River and the Gulf coast have gradually concentrated in this one small spot at the southern tip of Illinois. This concentration has made them increasingly vulnerable to hunting. The lake is so small that geese flying to or from it necessarily come within easy range of the pits on the surrounding, privately-owned farm lands, which for years have been leased on a $10 per day per hunter basis.

Under this system of commercialized hunting the kill became excessively high, and it was clear that the decimation at this one point was having a serious effect upon the Canada Goose population of the entire Mississippi Flyway. In 1941, therefore, the Fish and Wildlife Service established special restrictions in Alexander County, hoping to reduce the total kill at Horseshoe Lake. These measures appeared to be successful in 1941 and 1942—fewer than 8,000 geese were taken each year in contrast with approximately 17,000 and 13,000 respectively in 1939 and 1940. In 1943, however, the kill rose to 14,000, and the implications of the excessive kill at this one point were shown when it was discovered that along the Louisiana coast the numbers of Canada Geese had dropped from the more than 100,000 recorded a few years ago to only 16,000. It was obvious that more drastic restrictions were necessary. The Fish and Wildlife Service with full cooperation from the Illinois Conservation Department, is taking steps to ensure that the kill at Horseshoe Lake in 1944 shall not exceed 6,000 geese.

The problem is complicated by the commercialization of hunting, which has caused an inflation of the value of the surrounding land. One landowner is reported to have received $18,000 (far more than the income from agricultural products of his land) from hunting fees in 1943. These inflated values have blocked the efforts of the state to buy more land and increase the size of the refuge.

Intensive research on the problem at Horseshoe Lake has been conducted by members of the Illinois Natural History Survey, and studies of the breeding and wintering of Mississippi Valley geese have been made by Robert Smith of the Fish and Wildlife Service. Details of these investigations will undoubtedly be published later, but meanwhile conservationists will be watching with interest the efforts of the state of Illinois and the Fish and Wildlife Service to keep the kill of this group of Canada Geese within proper bounds.—Gustav Swanson.

Trumpeter Swan

Mrs. C. N. Edge, Chairman of the Emergency Conservation Committee, reported that the plan of that committee to raise Trumpeter Swans in captivity has been adopted by the U. S. Fish and Wildlife Service. The project is under the direction of Jean Delacour.

At the end of August, 20 cygnets had been captured and transported from Red Rock Lake, Montana, to Malheur Lake, Oregon, where they will be raised in pens. At Red Rock Lake it was observed that many cygnets were hatched so late in the season that they were not yet able to care for themselves when cold weather set in and the lake froze.—C.A.D.

Machias Seal Island Bird Sanctuary

The colony of Atlantic Puffins nesting on Machias Seal Island, a small remote island in extreme southwestern New Brunswick, on the north side of the mouth of the Bay of Fundy, has attained some prominence in ornithological literature, for it has long been the largest nesting colony of Puffins on the Atlantic coast of North America south of the Gulf of St. Lawrence. This colony of Puffins has increased in recent years and now contains a thousand or more breeding birds.

In order to ensure adequate protection for this particularly interesting colony and for other migratory birds nesting on Machias Seal Island, the Government of Canada, with the concurrence of the appropriate authorities of the Province of New Brunswick, adopted on April 17, 1944, an Order in Council making the island and the waters around it a bird sanctuary under authority of the Dominion statute known as The Migratory Birds Convention Act.

Ornithologists and bird lovers are free to visit Machias Seal Island to observe and photograph its seabirds, but they are expected to recognize its sanctuary status and to co-operate fully in protecting the birds of the island from harm.—Harrison F. Lewis.

Conservation Education

The state of Illinois has taken a very progressive step in its efforts to teach conservation to sportsmen. In October of this year 25 leading sportsmen of the state attended a 3-day school arranged for their benefit. The course of study was presented by the technical personnel of the Illinois Natural History Survey, Cook County Forest Preserve, U. S. Soil Conservation Service, Fish and Wildlife Service, and the Illinois Coal Strippers' Association. Continuation of this school should go far toward developing a better understanding between the sportsman and the naturalist on conservation problems. In addition, the state has conducted a course of study for conservation officers and for a boy and a girl from each county. Plans are being made for a 3-week training period for 100 school teachers.

North American Wildlife Conference

The tenth North American Wildlife Conference is scheduled for February 26, 27, and 28, 1945, at the Pennsylvania Hotel, New York City. There will be separate technical sections under the following titles:

Production and Marketing Fur
Forest and Wildlife
Crop-lands and Wildlife
Educational Forum
Range-lands and Wildlife
Recent Developments in Wildlife Research
Commercial Fisheries
Marshwater and Wildlife
Parks, Refuges, Urban Lands, and Wildlife
Waterfowl Forum

WILDLIFE CONSERVATION COMMITTEE
Charles A. Dambach, *Chairman*

ORNITHOLOGICAL LITERATURE

Measurement of Bird Populations. By S. Charles Kendeigh. *Ecological Monographs*, 14, January, 1944:67–106.

Using nearly a dozen studies (largely his own) as illustrations, Kendeigh here evaluates a number of techniques in bird-census work and presents a well-organized summary of others that have been developed. Many of the illustrative facts are new, others are brought up to date, still others are analyzed for the first time. They make the paper one that no serious worker in bird ecology will want to miss.

The richness of this report lies in the diversity of the author's experience and the long-term character (measured by present standards) of the census work in which he has participated. Summaries of the University of Illinois censuses of the Trelease Woods involve 11 nesting seasons between 1927 and 1943, and 14 winter seasons between 1924 and 1943; the excellent nest census on the 15-acre Baldwin estate in Ohio spans 15 years (1925 to 1939); the intensive investigation of a House Wren population on the same area covers 24 years (1916 to 1939).

Although Kendeigh feels that work on the House Wren should probably cover a century to furnish sufficient evidence for cyclic trends, his study of this species nevertheless represents one of the most impressive field investigations of birds ever completed in this country. Age, sex, and non-breeding classes are given for 24 years—the longest and most detailed bird census yet to be reported. Part of this material has previously been published (Kendeigh and Baldwin, 1937), but the analysis by age classes is new and of unusual interest. In the House Wren, 70 per cent of the breeding-season population is shown to consist of first-year birds; this class occupies a very important role in the annual fluctuations of the total population. Slightly unbalanced sex ratios (occasionally up to 62:38) do not seem to have affected the population in any consistent manner. An average of 9 per cent of the singing males did not nest in either half of the breeding season. The population curve shows marked low points about 1917, in 1926, and in 1940, with a possible three- to four-year cycle superimposed on these major fluctuations.

The paper contains three especially interesting analyses of bird-census work taken from the literature. In perhaps the most important of these, Kendeigh selects eight examples of breeding-bird communities in "mature relatively undisturbed climax deciduous forest." By eliminating the forest-edge birds (4 to 38 per cent of the populations reported) from these censuses, he obtains an average of about 220 pairs of forest-interior species per 100 acres. This is a new approach that further experience and knowledge may or may not justify. In one atypical example ("No. 3"), Kendeigh subtracts five acres from a 40-acre census tract to correct for edge birds present in the successional vegetation; but the forest birds breeding on these same five acres are averaged in with others breeding on the remaining 35 acres, and a small error in the calculated densities has resulted. Despite this lapse, Kendeigh's method of analysis represents the most practical method so far devised to summarize scattered information on the numerical composition of the bird community in a major biome.

In another analysis, three years of trip records of the Cleveland Bird Club are reviewed at length and evaluated as an index of relative abundance. Indices and numbers observed per hour are found to be more accurate in the winter than in the summer, and to be inconsistent for open-country species. "For ultimate reliable determination of the relative abundance of birds, analysis must be so complete as to put the results on essentially the basis of a true census. For the vast number of trip records compiled by bird students in the past, it is very doubtful if the necessary information is available in sufficient detail to make such analysis possible."

Under "Measurement of Absolute Abundance," Kendeigh includes a third analysis in which he gives additional data on the trend of yearly fluctuations in Bob-white numbers in Ohio from 1908 to 1942. "During these 35 years the total population has varied from less than 1,000,000 to over 4,000,000 birds." As a measure of absolute abundance, the Christmas Bird Counts, on which this statement is based, have most of the inherent weaknesses chargeable to ordinary trip records. Additional imperfections involved in the older lists are obscured by the lack in the present paper of any tabulation of the actual data and by an inadequate table in Kendeigh's earlier account (1933) of the same subject. In 1908, for instance, there were 15 parties reporting. According to *Bird-Lore,* three of these spent only one hour in the field, another only 90 minutes, three others less than three hours each. Only four parties in that year found any Bob-white at all, and the 200 they reported is converted into "a corrected total population" of over 1,000,000 birds. In trying to follow the process of this particular conversion, one further discovers that the distances traveled by 11 of these 15 parties have been estimated in some unstated manner by the analyst. This breakdown of the data is certainly not typical of the more recent Christmas Bird Counts, nor does it invalidate the major trends reported here. The real merit of this part of the study is its value as an index of *relative* abundance. Pronounced lows are indicated for 1915, 1928 or 1929, and 1940, with peaks in 1911 or 1912, 1923 or 1924, and 1935. At least during the period 1908 to 1942, a cycle of about 12 or 13 years is strongly suggested.

In a number of lesser studies, Kendeigh brings out many useful facts about bird-census work. Only a few of these can be noticed here. An interesting table summarizes a preliminary measurement of the conspicuousness of birds in the field; another tabulation shows that Palmgren's coefficient of efficiency in the field cannot be arbitrarily used by other investigators. Contrary to Lack, Kendeigh rightly stresses the inadequacy of nest counts as the sole basis of census work, especially in forest communities. In contrast to the 15-acre study plots required in *Audubon Magazine* breeding-bird censuses, he recommends that tracts of 50 acres be used in the study of woodlands and that 75 acres be used in grasslands. My own impression is that greater annual fluctuations in bird populations are being reported from small-sized areas than from tracts of 40 to 65 acres; and I heartily second Kendeigh's recommendation.

In this stimulating summary of the literature, some very remarkable gaps in bird-census work are particularly evident. The scarcity of reliable counts of migrants on a census plot is pointed out, although A. B. Williams' success in this connection seems to have been overlooked. Despite the uneven character of the field work, the University of Illinois winter census stands out as the best such investigation of this kind now in print.—J. J. Hickey.

Ecological Aspects of Species-formation in Passerine Birds. By David Lack. *Ibis,* 86, July, 1944:260–286.

It has become evident in recent years that new species of birds (and perhaps of most animals) evolve in geographical isolation from the mother species. Most workers have emphasized the point that an overlap of the ranges of two forms originating from the same species can come about only if isolating mechanisms have developed during the period of separation which guarantee reproductive isolation when geographical separation ends. Lack, in the present paper, makes the very important point that reproductive isolation alone is not enough, that at least in most cases the ranges of two closely related species overlap only if the species have developed certain ecological differences—dissimilar habitat or food preferences, for example—that prevent competition with each other.

At first glance many apparent exceptions to this thesis come to one's mind, for example, among eastern North American birds: Downy and Hairy Woodpeckers, Yellow-billed and Black-billed Cuckoos, Gray-cheeked and Olive-backed Thrushes, Prairie and Pine Warblers, Cooper's and Sharp-shinned Hawks, Sharp-tailed and Seaside Sparrows, Red-eyed and Yellow-throated Vireos, Baltimore and Orchard Orioles, and many others, but investigation shows that there are considerable ecological differences between the two members of each of the listed pairs. I do not know of any pairs of closely related eastern North American birds that are even similar in their habitat and food preferences. (The closest competition, in fact, seems to exist often between species which are not at all related, e.g. between Starling and Quail, for food on winter fields, or between Catbird and Robin, for berries.) Lack shows this difference in ecological requirements of closely related species of European and tropical birds. In many cases there is considerable overlap in the requirements, but it is never complete. Cases which I should like to see more closely analyzed are certain species of ducks and herons, hummingbirds and other flower-visiting birds (in particular the New Guinea honey-eaters of the *Meliphaga analoga* group), fruit doves (e.g. the genera *Ptilinopus* and *Ducula*), and white-eyes (e.g. *Zosterops minor* and *novaeguineae*). I should not be surprised if at least in some of these cases the ecological difference were very minute.

As logical as Lack's thesis is, his evidence is of necessity mostly circumstantial. It consists of such facts as different bill sizes, from which feeding differences can be inferred, or the significant observations of Colquhoun that the feeding zones (distance from ground) among closely related species of warblers and titmice are quite different. Equivalent observations in this country are still to be made. It would seem worthwhile to add direct evidence by appropriate analyses of stomach content.

An exception might be taken to some of Lack's illustrations of competition. For example, if the Curlew (*Numenius arquata*) and the more northerly Whimbrel (*N. phaeopus*) replace each other geographically in Great Britain, and if the Whimbrel is contracting its range while the Curlew is expanding northward, this does not necessarily prove that the Whimbrel is succumbing to the competition of the Curlew. Both range changes are perhaps correlated with a third factor, for example, a change in climate, and not directly with each other. It should not be overlooked that the borderline between two neighboring ecological districts is sometimes quite abrupt. I would not attribute it to competition if two closely related species meet along such a line.

The significance of Lack's study lies not only in its contribution to the field of evolution, but also in its bearing on the badly neglected subject of comparative ecology.—Ernst Mayr.

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Milton B. Trautman has been actively engaged in research in ornithology and ichthyology since 1920. From 1925 to 1934 he worked with the Ohio Division of Conservation. He went to Ann Arbor in 1934 to become Assistant Curator of Fishes and Assistant Director of the Institute for Fisheries Research. In 1939 he was called to the Franz Theodore Stone Laboratory of Ohio State University, where he is now Research Associate. In addition to a number of ichthyological papers he has published a book on his 12-year study of the birds of Buckeye Lake, Ohio, and many shorter papers on the birds of Ohio, Michigan, and Yucatan.

Ernst Mayr received the Ph.D. degree from the University of Berlin in 1926 and served as Assistant Curator in the Zoological Museum there for five years. In 1931 he came to the American Museum of Natural History, where he is now Associate Curator in charge of the Whitney-Rothschild Collection. He has done extensive field work in New Guinea and the Solomon Islands and is a specialist on the birds of the East Indies, Australia, and the southwest Pacific. His three books and many scientific papers deal especially with evolution, systematics, and faunal problems.

MEMBERSHIP ROLL[1]

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Adams, I. C. Jr., 14 N. Eighth St., Columbia, Missouri 1933
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*Adelson, Richard Henry, 34 Wensley Dr., Great Neck, Long Island, New York 1938
*Aldrich, Dr. John Warren, Fish and Wildlife Service, Washington, D.C. ..1930
Alexander, Donald Child, 127 Durant St., Lowell, Massachusetts 1937
Alexander, Dr. Gordon, Department of Biology, University of Colorado, Boulder, Colorado 1936
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Allen, Durward Leon, 1016 Elmwood Ave., Fort Wayne 3, Indiana 1933
Allen, Francis H[enry], 215 La Grange St., West Roxbury, Massachusetts 1941
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Allyn, Capt. Paul Richard, Waverly, Illinois 1944
Alpert, Bernard, 260 West End Ave., New York City, 23 1939
Amadon, Dean, 1595 Unionport Rd., New York City, 62 1935
Amidon, Mrs. Hilda F[arnum], 282 Sigourney, Hartford, Connecticut ..1942
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Anderson, Sgt. John M., East Orwell, Ohio 1938
Anderson, Dr. Rudolph Martin, National Museum of Canada, Ottawa, Ontario, Canada 1937
Andrele, Robert Francis, 59 Blantyre Rd., Buffalo 16, New York 1944
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Anthony, Jesse D., 722 1st Ave., E., Grand Rapids, Minnesota 1944
Appleton, John Sparhawk, Simi, California 1936
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*Bailey, Alfred Marshall, Colorado Museum of Natural History, City Park, Denver, Colorado 1928

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[1] This list is compiled as of November 1, 1944. The Secretary would appreciate immediate notification of any omission of names, changes in address, or errors in the spelling of names, the use of titles, the class of membership, and the exact year of first election to membership.

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*Baker, William Calvin, 559 Euclid St., Salem, Ohio 1931
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Beard, Mrs. Allen Shelby, Stony Hollow Farm, Algonac, Michigan 1942
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Beatty, Harry Andrew, Box 472, Christiansted, St. Croix, Virgin Islands, U.S.A. 1936
Beck, Rollo Howard, Planada, California 1943
Becker, George [Charles], Port Edwards, Wisconsin 1941
Becker, Mrs. Paul, 251 E. Phelps, Owatonna, Minneapolis 1944
Bedell, Miss Marie L., 1430 West 20th St., Lorain, Ohio 1940
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Belden, Robert F., 3 Kellogg St., Windsor, Connecticut 1944
*Bellrose, Frank Jr., Illinois Natural History Survey, Havana, Illinois ..1935
Bennett, George Noel, 9219 Newburg Rd., Plymouth, Michigan 1943
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Berger, Capt. Andrew J[ohn], Kingman Air Field, Kingman, Arizona ..1940

Bergstrom, E[dward] Alexander, 95 Evergreen Ave., Hartford 5, Connecticut 1943
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**Billington, Cecil, 21060 Thirteen Mile Rd., Birmingham, Michigan 1939
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Bliese, John C[arl] W[illiam], 118 Earlham Circle, Oak Ridge, Tennessee 1944
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*Boggs, Ira Brooks, West Virginia University, Morgantown, West Virginia 1938
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Bowdish, Beecher Scoville, Demarest, New Jersey 1921
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**Brandreth, Courtenay, Ossining, New York 1939
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Breiding, George H[erbert], 108 W. Woodruff, Columbus, Ohio 1942
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Broun, Maurice, The Northfield, East Northfield, Massachusetts 1935
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*Brown, Virginius Elholm, Biology Department, Taylor University
Upland, Indiana 1942
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Brush, Harold, 182 Mulberry St., Rochester 7, New York 1944
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*Buchheister, Carl W., 1006 Fifth Ave., New York City, 28 1943
Buckstaff, Ralph Noyes, Oshkosh Public Museum, Oshkosh, Wisconsin ..1941
Bujak, Boleslaus Joseph, 2547 N. St. Louis Ave., Logan Square Station,
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Bundy, M[alcolm] F[oland], R. 2, Atlanta, Georgia 1941
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Burget, Russel Lincoln, 526 Devon Place, Toledo, Ohio 1944
Burland, Lee J[ohnson], Ballston Lake, New York 1939
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Baton Rouge, Louisiana 1922
****Burns, Franklin Lorenzo, Berwyn, Pennsylvania .....Founder
Burroughs, Raymond Darwin, Game Division, Department of
Conservation, Lansing 13, Michigan 1937
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Campbell, John David, 319 Ford St., Geneva, Illinois 1944
*Campbell, Louis Walter, 4531 Walker Ave., Toledo 12, Ohio 1926
*Campbell, Miss Mildred Florence, 29 N. Hawthorne Lane,
Indianapolis, Indiana 1938
Capps, Sgt. Beryl F[ranklin], 37th General Hospital,
APO 425, % Postmaster, New York City 1939
Carnes, Mrs. Herbert E., 25 Kenwood Rd., Tenafly, New Jersey 1944
*Carpenter, F[loyd] S., 2402 Longest Ave., Louisville 4, Kentucky 1934
**Carrothers, Miss Vera, 14704 Alder Ave., East Cleveland 12, Ohio 1938
*Carter, John Darlington, Lansdowne, Pennsylvania 1930
*Cartwright, Bertram William, 59 Elm Park Rd., Winnipeg,
Manitoba, Canada 1930
Case, Leslie Delos Sr., 714 W. Madison St., Ann Arbor, Michigan 1938
Cassel, J[oseph] Frank[lin], 1529 Dauphin Ave., Wyomissing,
Pennsylvania 1940
Castle, Eugene Spencer, 80 S. State St., Elgin, Illinois 1936
*Cater, Milam Brison, P.O. Box 133, Millboro, Virginia 1944
*Chamberlin, C[harles] E[dward], Box 186, San Marcos, Texas 1944

**Chambers, Willie Lee, Robinson Rd., Topanga, California 1909
Chance, Edgar Percival, Gurdons, Witley, Godalming, Surrey, England 1941
*Chapman, Dr. Floyd Barton, 1944 Denune Ave., Columbus, Ohio 1932
**Chapman, Dr. Frank Michler, 3938 Leafy Way,
Coconut Grove 33, Florida 1910
Chapman, Lawrence B., 1 Woodridge Rd., Wellesley, Massachusetts 1940
*Chase, Henry B. Jr., 517 Decatur St., New Orleans 16, Louisiana 1932
Chesley, Miss Alma H., 1905 E. 3rd St., Duluth 5, Minnesota 1944
Chutter, Miss Mildred C., Box 229, Athens, Georgia 1936
Clapp, G[eorge] Howard, Pabst Farms, Oconomowoc, Wisconsin 1941
*Clarkson, Mrs. Edwin P., Wing Haven, 248 Ridgewood Ave.,
Charlotte, North Carolina 1940
Clement, Roland C[harles], 49 Tremont St., Fall River, Massachusetts ..1941
*Clow, Miss Marion, Box 163, Lake Forest, Illinois 1929
Coats, Miss Ruth E[mily], 702 East 1st St., Tillamook, Oregon 1942
*Coffey, Lt. Ben Barry Jr., 141-27 79th Ave., Flushing, New York 1927
Cogswell, Howard L[yman], 3807 Sierra Grande St.,
Pasadena 8, California 1944
*Cole, Dr. Leon Jacob, Department of Genetics, University of
Wisconsin College of Agriculture, Madison 6, Wisconsin 1921
*Coles, Victor, 2910 Grasselli Ave., Westwood, Cincinnati, Ohio 1929
*Compton, Lawrence Verlyn, 409 W. Webster St., Pittsburg, Kansas 1923
Comstock, W[illiam] Ogilvie, New Ipswich, New Hampshire 1942
*Congdon, Dr. Russel T[hompson], Medical Arts Bldg.,
Wenatchee, Washington 1944
**Conover, H. Boardman, 6 Scott St., Chicago 10, Illinois 1944
Conrad, Charles Louis, 1206 Warwood Ave., Wheeling, West Virginia 1937
Conway, Albert E., 123 Pennock Place, Media, Pennsylvania 1939
*Cook, Miss Fannye Addine, State Game and Fish Commission,
2550 N. State St., Jackson 44, Mississippi 1925
Cooley, Miss Eleanor Graham, Bot.-Chem.-Pharm. Library,
University of Iowa, Iowa City, Iowa 1936
*Cottam, Dr. Clarence, Fish and Wildlife Service, Merchandise Mart,
Chicago 54, Illinois 1929
Cottrell, George William Jr., 70 Lake View Ave., Cambridge 38,
Massachusetts 1941
*Court, Edward J., R. 3, 7 Lock's Rd., Bethesda, Maryland 1944
Craighead, Frank C., 5301 41st St., N.W., Washington, D.C. 1941
Crosby, John A[lexander], 56 Broadway Ave., Toronto, Ontario, Canada 1943
Cross, Edmund R[ust], 1751 University Ave., San Diego 3, California ..1941
*Cruickshank, Allan Dudley, National Audubon Society, 1006 Fifth Ave.,
New York City, 28 1939
Cunningham, James W., 3009 E. 19th Terrace, Kansas City, Missouri ..1935
*Currier, Edmonde Samuel, 8541 N. Chicago Ave., Portland, Oregon 1930
*Dahlberg, Wendell [Oscar], 11312 S. Michigan Ave., Chicago 28, Illinois 1939
Dambach, Charles A., Department of Zoology and Entomology, Ohio
State University, Columbus 10, Ohio 1934
Damon, David, 724 Sixth St., Ames, Iowa 1933
Danner, May S. (Mrs. John M.), 1646 Cleveland Ave., N.W.,
Canton, Ohio 1921
**Darden, Mrs. Colgate W., Executive Mansion, Richmond, Virginia 1943
Davey, Dr. Winthrop N[ewbury], 2485 Hendee Rd., Jackson, Michigan 1941
*Davidson, William Mark, National Research Center, Beltsville, Maryland 1933
Davis, Dr. David Edward, 721 Elmwood Ave., Wilmette, Illinois 1940
Davis, George, Middle Tennessee State College, Murfreesboro, Tennessee 1936
Davis, George W., 3 Fremont St., Montpelier, Vermont 1941

Davis, L[ouie[Irby, Box 988, Harlington, Texas 1933
Davis, Dr. William B., Department of Fish and Game, College Station, Texas....1938
Dear, Lieut. Col. L[ionel] S[extus], P.O. Box 127, Port Arthur, Ontario, Canada 1939
Dechen, Mrs. Lillian Orvetta, 14 Summer St., Port Dickinson, Binghampton 6, New York 1939
*Decker, Charles O., 6450 Kenwood Ave., Chicago 37, Illinois 1938
Dehner, Rev. Eugene William, 504 Dryden Rd., Ithaca, New York 1944
*Delacour, Jean T., 995 Fifth Ave., New York City 1944
Delavan, Wayne G., R. 2, Box 61, Bronson, Kansas 1943
*DeLury, Dr. Ralph Emerson, Dominion Observatory, Ottawa, Ontario, Canada 1920
DePuy, Margaret Kalke (Mrs. John S.), 4758 Lake Shore Rd., Port Huron, Michigan 1944
Derleth, August [William], Sauk City, Wisconsin 1940
**Desmond, Hon. Thomas C[harles], Box 670, Newburgh, New York 1942
*Deusing, Murl, Milwaukee Public Museum, Milwaukee, Wisconsin 1937
Devitt, Otto Edmund, 218 Eglinton Ave., E., Toronto, Ontario, Canada 1935
Dice, Dr. Lee Raymond, Laboratory of Vertebrate Biology, University of Michigan, Ann Arbor, Michigan 1943
Dickinson, Mrs. William Winston, 2006 Reid Ave., Bluefield, West Virginia 1942
Dierker, William W[ilfred], 4186a Sacremento, St. Louis 15, Missouri ...1944
*Dietz, Robert Austin, 220 Beechwood Rd., Ridgewood, New Jersey 1944
Dille, Frederick Monroe, 822 Grand Ave., Nogales, Arizona 1912
Dingle, Edward von Seibold, Huger, South Carolina 1921
*Dixon, James Benjamin, R.D. 1, Box 688, Escondido, California 1936
Dobbins, H[ugh] C[linton], 1456 W. Clifton Blvd., Lakewood 7, Ohio 1941
*Dodge, Victor Kenney, 137 Bell Court, W., Lexington, Kentucky 1935
Domm, Dr. Lincoln Valentine, Whitman Laboratory for Experimental Zoology, University of Chicago, Chicago, Illinois 1936
Donaldson, Harry Byron, Rose Lake Wildlife Experiment Station, R. 1, East Lansing, Michigan 1943
Doughty, Jacob P[hinizy], R. 2, Prospect, Kentucky 1940
*Douglass, Dr. Donald W., Department of Conservation, Lansing, 13, Michigan 1929
Downing, Paul E[arl], 835 Waukegan Ave., Highland Park, Illinois 1943
*Drake, Donald M., 102 Buena Vista, Modesto, California 1944
Dreyfoos, Wallace David, 1212 Virginia Ave., N.E., Atlanta, Georgia 1941
*Dudley, John Munchie, 20 Germain St., Calais, Maine 1944
Duer, Harry E., 9304 Edmunds Ave., Cleveland, Ohio 1941
*Duffield, Marjorie Olney (Mrs. J. W.), Box 645, Peekskill, New York ...1940
*DuMont, Philip Atkinson, Fish & Wildlife Service, Merchandise Mart, Chicago 54, Illinois 1928
*Duncan, Donald Pendleton, 5841 Nickerson Ave., Chicago, Illinois 1936
Dundas, Lester Harvey, 2107 W. 6th St., Duluth, Minnesota 1943
Dusi, Julian Luigi, 963 Bellows Ave., Columbus 8, Ohio 1941
*Eagleson, Joseph P., 85 E. Gay St., Columbus 15, Ohio 1943
*Eastman, Whitney H[askins],% General Mills, Inc., Chamber of Commerce Bldg., Minneapolis, Minnesota 1941
*Eastwood, Sidney Kingman, 5110 Friendship Ave., Pittsburgh 24, Pennsylvania 1928
Eaton, Stephen W[oodman], 808 S. Main St., Geneva, New York 1942
*Edge, Mrs. Charles Noel, 1215 Fifth Ave., New York City, 29 1931

*Eifert, Virginia Snider (Mrs. H. D.), Illinois State Museum, Springfield, Illinois 1941
*Eifrig, Charles William Gustave, Windermere, Orange Co., Florida 1907
Eisenmann, Eugene, 110 W. 86th St., New York City 1942
*Ekblaw, Dr. George Elbert, 511 W. Main St., Urbana, Illinois 1914
*Ekblaw, Dr. Walter Elmer, Clark University, Worcester, Massachusetts ..1910
*Eklund, Capt. Carl R[obert], AAF Tactical Center, ADTIC, Orlando, Florida 1944
Elder, William Hanna, 5136 Kimbark, Chicago, Illinois 1938
*Elliott, Dr. Richard M., 1564 Vincent St., St. Paul, Minnesota 1940
Ellis, Miss Hazel R[osetta], Kenka College, Kenka Park, New York ..1942
***Ellis, Ralph Jr., 2420 Ridge Rd., Berkeley, California 1926
Emerson, David L[oweH], 25 Everett Ave., Providence, Rhode Island ..1939
*Emerson, Guy, 16 Wall St., New York City 1938
*Emilio, Shepard Gilbert, R. 4, Laconia, New Hampshire 1929
Emlen, Dr. John Thompson, Jr., Psychobiological Laboratory, Johns Hopkins Hospital, Baltimore, Maryland 1936
Empey, Miller, Freeland, Michigan 1939
*English, Dr. Pennoyer Francis, Department of Zoology, Pennsylvania State College, State College, Pennsylvania 1934
Ennis, Dr. James Harold, Cornell College, Mount Vernon, Iowa 1942
Erickson, Dr. Arnold Burton, Division of Economic Zoology, University Farm, St. Paul, Minnesota 1938
*Erickson, Miss Mary Marilla, Santa Barbara State College, Santa Barbara, California 1930
Erickson, Ray C[harles], 1104 Washington Ave., St. Peter, Minnesota ..1939
*Errington, Dr. Paul L[ester], Iowa State College, Ames, Iowa 1932
*Eslinger, Kenneth N[elson], Box 521, Lincoln 1, Nebraska 1944
**Eustice, Mrs. Edith C., 1138 Sheridan Rd., Evanston, Illinois 1944
*Evans, Dr. Evan Morton, 550 Park Ave., New York City 1929
Evans, John Harwood, 517 Jackson Dr., Oshkosh, Wisconsin 1943
**Everett, Miss Louise A., 3824 Pillsbury Ave., S., Minneapolis, Minnesota 1944
*Fables, David George, 421 Walnut St., Roselle Park, New Jersey 1944
Faegre, David [Colin], North Country School, Lake Placid, New York ..1940
Fahrenholz, Fred E[mery], 2912 Elmo Place, Middleton, Ohio 1942
**Fargo, William Gilbert, 506 Union St., Jackson, Michigan 1923
*Farner, Donald S[ankey], 4926 Cass, Omaha, Nebraska 1941
Farquharson, Miss Jessie, 2338 Marshall Ave., St. Paul 4, Minnesota 1944
Farquharson, Miss Mildred Grace, 2338 Marshall Ave., St. Paul 4, Minnesota 1944
Feighner, Miss Lena Veta, 298-1 S. Tremont St., Kansas City, Kansas ..1935
Feigley, Miss Margaret Denny, 544 Chestnut St., Winnetka, Illinois 1944
Findlay, Miss Violet Liberty, Board of Education, 11th and Washington Sts., Wilmington, Delaware 1943
Fischer, Richard B[ernard], 140-19 Beech Ave., Flushing, New York 1942
Fleetwood, Raymond Judy, Piedmont Wildlife Refuge, Round Oak, Georgia 1931
Fleugel, James Bush, 1104 American National Bank Bldg., Kalamazoo, Michigan 1942
Flick, Miss Katherine Jane, 5150 W. Pierson Rd., Flint, Michigan 1944
Floyd, E[arl] Pershing, 107 S.E. 2nd St., Pryor, Oklahoma 1939
*Floyd, Judge Joseph Larke, 1009-11 George Harter Bank Bldg., Canton, Ohio 1903
*Foote, Maurice Edwin, R. 1, Mantua, Ohio 1932
Ford, Edward Russell, Newaygo, Michigan 1914
Forsyth, Mrs. Louise [Ann], Lebanon Rd., Hanover, New Hampshire ...1940

Fox, Adrian Caspar, % Mrs. Nels Fasen, Leeds, North Dakota 1937
France, H[orace] Owen, Biology Department, University of Colorado, Boulder, Colorado 1941
Franke, Norman H[enry], 5210 N. Marshall St., Philadelphia 20, Pennsylvania 1944
*Fredine, C[larence] Gordon, Long Prairie, Minnesota 1938
**French, Mrs. Elizabeth Thomas, 1801 Las Lomas, Albuquerque, New Mexico 1943
Frey, Edward Snively, 517 Hummel Ave., Lemoyne, Pennsylvania 1944
Frost, Herbert Hamilton, "Pen Craig," Newport, Rhode Island 1941
Fryman, Miss Kathryn E[lizabeth], 409 Elm St., Wyandotte, Michigan 1943
Fuller, Raymond Tifft, Winterton, New York 1943
Funsten, R[andolph] Fairfax, 1515 Delmar Blvd., St. Louis, Missouri ..1944
*Furniss, Owen Cecil, 2203 First Ave., W, Prince Albert, Saskatchewan, Canada 1934
*Gabrielson, Dr. Ira Noel, Fish and Wildlife Service, Washington, D.C. ..1913
*Gaillard, Stephen Lee, 9 Lee Place, Bronxville, New York 1942
*Gammell, Dr. R[obert] T[heodore], Kenmare, North Dakota 1943
**Ganier, Albert F[ranklin], 2112 Woodlawn Drive, Nashville, Tennessee ..1915
Garrett, Miss [Mary] Lois, 1709 Chestnut St., Kenova, West Virginia ..1942
Garrison, Sgt. David L[loyd], 5th General Hospital, APO 519, % Postmaster, New York City 1940
Garst, Miss Virginia Louise, De Soto, Indiana 1944
Gashwiler, Jay S., 12 Parker St., Newburyport, Massachusetts 1944
Gatterdam, Paul C[hristoffers], 2539 Edgewood Place, La Crosse, Wisconsin 1940
Gaulding, Luther Willard Jr., 1002 College Ave., Tifton, Georgia 1944
Gavin, Angus, Eskimo Point, via Churchill, Manitoba, Canada 1942
Geiser, Ernest, R. 4, Troy, New York 1943
George, John L[othar], U.S.S. Mervine, % Fleet Postmaster, New York City 1939
Gensch, Robert H[enry], Address unknown 1939
Gershten, Miss Blossom, 2816 Cortland St., Brooklyn 24, New York ..1944
Gerstell, Richard, Pennsylvania Game Commission, Harrisburg, Pennsylvania 1939
Gibbs, Walter C., Whitehall, Michigan 1941
Gier, Dr. Herschel Thomas, Ohio University, Athens, Ohio 1937
Gifford, Dr. Harold, 3636 Burt, Omaha, Nebraska 1936
Gilbert, Gareth, 2422 Indianola Ave., Columbus, Ohio 1943
Gilbert, Dr. Perry Webster, Department of Zoology, Cornell University, Ithaca, New York 1942
**Gillen, Harold W., Denslow Rd., New Canaan, Conecticut 1944
Gillette, D[elbert] A[sa], R. 5, Yakima, Washington 1942
Gillette, Miss Fredericka B., 1319 Forest Ave., Ann Arbor, Michigan ..1938
Giltz, Maurice L[eroy], 841 Lincoln Way, N.W., Massillon, Ohio 1939
Givens, Lawrence S[pessard], Box 67, St. Marks, Florida 1943
Glenn, Robert W., 509 Orchard Ave., Avalon, Pittsburgh 2, Pennsylvania 1934
**Glover, Ray J[ames], R. 1, Addison, Pennsylvania 1943
Gloyd, Dr. Howard Kay, Chicago Academy of Sciences, 2001 N. Clark St., Chicago 14, Illinois 1925
**Goetz, Christian John, 3503 Middleton Ave., Cincinnati, Ohio 1930
Good, Ernest E[ugene], R. 1, Van Wert, Ohio 1937
Goodman, John David, 204 W. Grimes St., Fairfield, Iowa 1944
*Goodridge, Edwin Tyson, Province Line Rd., Princeton, New Jersey 1944
*Gordon, J[esse] Halford, 139 E. Second Ave., Roselle, New Jersey 1942
*Goslin, Charles R[ussell], 726 E. King St., Lancaster, Ohio 1940

Goslin, Robert Martin, 316 Wilson Ave., Columbus 5, Ohio 1936
**Gough, William McDonald, 28 Baby Point Rd., Toronto, Ontario, Canada 1944
*Gram, Mrs. Margaret Edwards, 409 Notre Dame Rd.,
Grosse Pointe 30, Michigan 1941
Grannis, Harriet Dudley, (Mrs. J. Kidwell), Flemingsburg, Kentucky 1944
Granrud, Capt. Walter Hjalmer, Materiel Dept., FAS,
Fort Sill, Oklahoma 1941
*Grant, Cleveland Putnam, 620 Greenup St., Covington, Kentucky 1928
Graves, Miss [Cynthia] Katherine, 1209 N. Illinois St., Apt. 28,
Indianapolis, Indiana 1942
*Gray, William Arthur, Room 646, 224 S. Michigan Ave.,
Chicago 4, Illinois 1938
Greeley, Frederick, 200 Chestnut St., Winnetka, Illinois 1942
Green, N. Bayard, Training School, Marshall College, Huntington,
West Virginia 1943
Green, Miss Rhoda J[anet], 3343 Aldrich Ave., S., Sylacauga 8, Alabama 1940
**Greene, Albert E., 517 Oswego St., Ann Arbor, Michigan 1939
Greene, Earle Rosenbury, 22 Virginia Court, New Orleans, Louisiana ...1930
*Greenhalgh, Clifton M., Kanab, Kane County, Utah 1939
*Gregory, Stephen Strong Jr., Box N, Winnetka, Illinois 1922
Griffin, Donald R[edfield], Biological Laboratories, Harvard
University, Cambridge, Massachusetts 1941
Grimes, S[amuel] A[ndrew], 825 S. Shore Dr., Jacksonville 7, Florida ..1924
*Grimm, William C[arey], Box 424, Lineville, Pennsylvania 1939
*Grinnell, Lawrence I[rving], 710 Triphammer Rd., Ithaca, New York ..1939
*Griscom, Ludlow, Museum of Comparative Zoology,
Cambridge, Massachusetts 1937
Griswold, John A[ugustus] Jr., 1511 30th St., N.W., Washington 7, D.C. 1941
Groskin, Horace, 210 Glenn Rd., Ardmore, Pennsylvania 1937
*Gross, Dr. Alfred Otto, 11 Boody St., Brunswick, Maine 1927
*Guelf, George F., Brockport, New York 1944
*Gunderson, Harvey Lorrain, % Mr. H. H. Gunderson, Gary, Minnesota 1941
*Hadley, Thomas E., 48 Wellesley Dr., Pleasant Ridge, Michigan 1944
Haecker, Frederick Woods, 506 S. 52nd St., Omaha, Nebraska 1938
*Hagar, Mrs. Jack, Box 339, Rockport, Texas 1930
*Hague, Dr. Florence S., Sweet Briar College, Sweet Briar, Virginia 1931
Haines, T. P., Biology Department, Mercer University, Macon, Georgia 1941
*Hainsworth, William Pickard, 216 Railroad Ave., North Andover,
Massachusetts 1930
Hall, Lt. Fred T., % Mrs. Fred T. Hall, Fabius, New York 1937
Haller, Frank D[enver], 125 S. Second St., Coshocton, Ohio 1940
*Hallman, Roy Cline, Box 826, Panama City, Florida 1928
*Hamerstrom, Lt. Frederick N. Jr., 6th Alt. Trg. Unit
Harding AAF, Baton Rouge, Louisiana 1934
*Hamilton, Dr. William J[ohn], Department of Zoology, Cornell
University, Ithaca, New York 1933
Hammond, Merrill C[lyde], Upham, North Dakota 1939
*Handlan, John Welty, 409 41st St., Charleston 4, West Virginia 1932
*Handley, Charles Overton, Virginia Polytechnic Institute,
Blacksburg, Virginia 1925
*Handley, Charles Overton, Jr., Blacksburg, Virginia 1941
*Hann, Dr. Harry Wilbur, Department of Zoology, University of
Michigan, Ann Arbor, Michigan 1930
Hanna, Wilson Creal, 141 East F St., Colton, California 1936
Hanson, E[lmer] Charles, 1305 Wisconsin Ave., Racine, Wisconsin 1940
Hanson, Lt. R. C., U.S.N.A.S., Clinton, Oklahoma 1942

Happ, Prof. George Bippus, The Principia College, Elsah, Illinois 1935
Hardy, Dr. [Cecil] Ross, Dixie Junior College, Saint George, Utah 1940
*Harkness, Reed B., 4908 Laclede Ave., St. Louis, Missouri 1942
*Harper, Dr. Francis, 224 S. Chester Rd., Swarthmore, Pennsylvania 1930
Harrell, Byron Eugene, 1594 Stanford Ave., St. Paul, Minnesota 1943
Harrell, Frank Ridlen, Museum Libraries, University of Michigan, Ann Arbor, Michigan 1936
**Harriot, Samuel Carman, 200 W. 58th St., New York City, 19 1934
Harrison, Hal H., The Valley Daily News, Tarentum, Pennsylvania 1941
*Hart, Frank Elmer, 2499 Medary Ave., Columbus 2, Ohio 1943
*Hartman, Frank A[lexander], Hamilton Hall, Ohio State University, Columbus, Ohio 1941
*Hartwell, Arthur Mowry, 1506 Mt. Curve, Minneapolis, Minnesota 1940
*Haskin, J[oseph] R[obert], Box 65, Babson Park, Florida 1944
Haskins, Mrs. Edith D., Hanover Rd., Lebanon, New Hampshire 1941
Hausler, Mrs. M., 7348 Paxton Ave., Chicago, Illinois 1936
**Havemeyer, Henry Osborne, Mahwah, New Jersey 1930
*Hawkins, S/Sgt. Arthur S., Reg. Sta. Hosp., AAF, Amarillo, Texas 1936
Hawkins, B. L., Hamline University, St. Paul 4, Minnesota 1936
Hawksley, Mrs. Janet P., 123 Lafayette Circle, Cincinnati, Ohio 1942
**Hebard, Frederick V., 1500 Walnut St. Bldg., Philadelphia, Pennsylvania 1940
Heckler, S[ydney] B[aer], Folly Farm, Cherry Plain, New York 1942
Hedges, Harold [Charles], R. 2, Lake Quivira, Kansas City, Kansas 1940
*Hefley, Dr. Harold M[artin], Department of Biology, Texas Technological College, Lubbock, Texas 1942
*Heidenkamp, Joseph Jr., 538 Glen Arden Dr., Pittsburgh 8, Pennsylvania 1942
Heiser, Sgt, J[oseph] M[atthew] Jr., Det. Med. Dept., Brooke General Hospital, Ft. Sam Houston, Texas 1939
Henderson, Alexander, 89 Woodland Rd., Chestnut Hill 67, Massachusetts 1941
Hendricks, G. Bartlett, Berkshire Museum, Pittsfield, Massachusetts 1943
*Hendrickson, Dr. George Oscar, Department of Zoology and Entomology, Iowa State College, Ames, Iowa 1933
*Henry, Cordia John, Lower Souris Refuge, Upham, North Dakota 1933
Henwood, Mrs. Ethel May, 609 W. Ohio St., Urbana, Illinois 1941
**Hewitt, Oliver H[arold], Lands, Parks and Forests Branch, Department of Mines and Resources, Ottawa, Ontario, Canada 1943
*Hickey, Joseph James, Museum of Zoology, Ann Arbor, Michigan 1940
***Hicks, Dr. Lawrence Emerson, Ohio State University, Columbus, Ohio ..1925
Hiett, Lawrence Davison, 1945 Ottawa Dr., Toledo, Ohio 1929
Higgins, Harold Guymon, 352 N. 1st, East, Price, Utah 1941
Hill, Herbert Oliver, 2140 Oxford St., Berkeley 4, California 1938
Hill, Julian Werner, 1106 Greenhill Ave., Wilmington 56, Delaware 1935
Hill, Norman Pierce, 15 Oxford St., Arlington, Massachusetts 1941
Hill, Raymond W., 3316 Kenmore Rd., Shaker Heights, Cleveland, Ohio 1941
*Hillmer, Davis B., 8228 Woodward Ave., Detroit 2, Michigan 1926
*Hilton, Dr. David Clark, 305 Continental Bldg., Lincoln, Nebraska 1918
*Hinds, Frank J., Department of Biology, Western Michigan College of Education, Kalamazoo, Michigan 1935
*Hochbaum, Hans Albert, Delta, Manitoba, Canada 1942
*Hoff, Clayton M., 810 Blackshire Rd., Wilmington, Delaware 1943
Hoffman, Paul William, 8415 Kenyon Ave., Wauwatosa 13, Wisconsin ..1940
Hoffmeister, Linus C[hristian], 504 W. Ripa Ave., Lemay 23, Missouri 1939
Hofslund, Pershing B[enard], Milaca, Minnesota 1944
*Holabird, Christopher, 2236 Lincoln Park West, Chicago, Illinois 1940
*Holland, Harold May, Box 615, Galesburg, Illinois 1915
Holsen, James N., 444 Clark Ave., Kirkwood 22, Missouri 1944

*Hoodema, Richard, 116 W. 14th St., Holland, Michigan 1941
Horner, Sgt. William A[rchibald], Hdq. Co. 103 Inf. Div. (Band), APO 470, % Postmaster, New York City 1943
Horton, Mrs. M. B., 360 Prospect St., Fall River, Massachusetts 1941
Hostetter, D[avid] Ralph, Eastern Mennonite School, Harrisonburg, Virginia 1937
Hotchkiss, Neil, Patuxent Research Refuge, Bowie, Maryland 1940
Hough, Mrs. Eleanor Sloan, 4820 Olentangy Blvd., Columbus, Ohio 1941
Howard, Hubert C., Minden, Nebraska 1944
Howard, William J[ohnston], 5518 Fairglen Rd., Chevy Chase 15, Maryland 1940
Howe, [Henry] Branch Jr., 414 W. Ponce de Leon Ave., Decatur, Georgia 1943
Howell, Joseph Corwin, Department of Zoology, A. & M. College, Stillwater, Oklahoma 1938
Howes, W[illiam] H[erbert], Box 310, Kindersley, Saskatchewan, Canada 1943
Hoyt, George B[rown], 2603 Habersham Rd., Atlanta, Georgia 1941
*Hoyt, J[ohn] Southgate Y[eston], 5 Lewis St., Lexington, Virginia 1936
*Hughes, George Thomas, R. 3, Plainfield, New Jersey 1929
Hughes, Dr. W. W., Embro, Ontario, Canada 1944
Hulbert, Lloyd Clair, 529 W. Grand River Ave., East Lansing, Michigan 1938
*Hunt, Ormond Edson, 14-133 General Motors Bldg., Detroit 2, Michigan 1937
Hurley, John Beatty, 401 S. 17th Ave., Yakima, Washington 1937
Hutchinson, Arthur E., 715 Mission Canyon Rd., Santa Barbara, California 1940
Hyde, Lt. A[rthur] Sidney, Student Officers' Mail Room, AAFSAT, Orlando, Florida 1939
Ingersoll, Albert Mills, 908 F. St., San Diego 3, California 1921
**Ingersoll, Mrs. Marion Crory, 4 East 66 St., New York City, 21 1942
*Jackson, Cicero Floyd, University of New Hampshire, Durham, New Hampshire 1936
*Jackson, Francis Lee, 541 Hammond St., Chestnut Hill, Massachusetts 1941
Jameson, Everett Williams Jr., 179 Highland Ave., Buffalo, New York .. 1941
*Janvrin, Dr. Edmund R[andolph] P[easlee], 38 East 85th St., New York City 1942
Jaques, F[rancis] L[ee], 610 West 116th St., New York City, 27 1939
Jaquith, Mrs. L. E., 72 Hudson Dr., Toronto 5, Ontario, Canada 1943
Jenkins, James H[obart], 1204 W. Chestnut, Mt. Vernon, Ohio 1939
*Jenner, William Alexander, 806 W. Davis St., Fayette, Missouri 1933
*Johnson, Clifford O., 987 14th St., Marion, Iowa 1944
*Johnson, Irene W. (Mrs. Oscar), 38 Portland Place, St. Louis, Missouri 1931
*Johnson, Mrs. Martin A., Kelley, Iowa 1944
Johnson, Perry Frank, 2918 S. Anthony Blvd., Fort Wayne, Indiana .. 1935
*Johnson, Robert Anthony, 150 East St., Oneonta, New York 1930
Johnson, William M[cNutt], R. 4, Knoxville, Tennessee 1939
Johnston, David Ware, 1037 St. Charles Ave., N.E., Atlanta, Georgia .. 1943
Johnston, Miss Verna R[uth], Live Oak, Sutter Co., California 1941
*Jonah, Miss Christie May, 311 Park St., Hackensack, New Jersey 1942
*Jones, Dr. Harold Charles, Thomas Berry College, Mount Berry, Georgia 1929
Jones, Isaac Marshall, Marionville, Missouri 1944
Jones, John Courts, 718 Garfield St., Eveleth, Minnesota 1931
****Jones, Dr. Lynds, 352 W. College St., Oberlin, Ohio ..... Founder
Jones, Myrle L., Ledges State Park, Boone, Iowa 1944
*Jones, S[olomon] Paul, 509 West Ave., N., Waukesha, Wisconsin 1921
Jones, Victor Emmons, University of Idaho, Southern Branch, Pocatello, Idaho 1938

Jorae, Miss Irene Frances, Central Michigan College of Education, Mt. Pleasant, Michigan 1942
Jorns, Byron Charles, 3725 Gregory St., Madison, Wisconsin 1943
*Jung, Clarence Schram, 6383 N. Port Washington Rd., Milwaukee 9, Wisconsin 1921
Jurica, E., Lisle, Illinois 1940
*Kabat, Cyril M., 1416 Chandler St., Madison 5, Wisconsin 1944
Kahmann, Karl W., R. 2, Hayward, Wisconsin 1941
Kahn, Mrs. Reuben L., 1122 Michigan Ave., Ann Arbor, Michigan 1938
*Kalmbach, Edwin Richard, Fish and Wildlife Service, 546 Custom House, Denver, Colorado 1926
*Kase, John Charles, Versailles, Indiana 1937
Kautz, Lorin G., White River Refuge, St. Charles, Arkansas 1944
*Keating, F[rancis] Raymond Jr., 519 5th Ave., S.W., Rochester, Minnesota 1944
*Keck, Warren N., Coe College, Cedar Rapids, Iowa 1944
*Kelker, George Hills, School of Forestry, U.S.A.C., Logan, Utah 1938
*Keller, Richard [Thomas], 717 S. 18th St., St. Joseph, Missouri 1943
Kelly, Evelyn (Mrs. George A.), 2300 N. La Salle Gardens, Detroit 6, Michigan 1935
*Kelso, Leon Hugh, 1370 Taylor St., N.W., Washington 11, D.C. 1930
*Kendeigh, Dr. S[amuel] Charles, Vivarium Bldg., University of Illinois, Champaign, Illinois 1923
Kerr, Mrs. Mary Helen, 1290 Delaware, Springfield, Missouri 1943
Kiefer, Mrs. Elizabeth D[eyo], 243 Gratiot Blvd., Port Huron, Michigan 1941
*Kieran, John, 4506 Riverdale Ave., New York City, 63 1942
Kindler, Mrs. Grace Emma, Sheridan Dr., R. 1, Lancaster, Ohio 1937
Kirk, Allan D[ixon], 14 Forest Hill Rd., Wilkinsburg, Pennsylvania 1939
Kirkpatrick, Charles Milton, Department of Forestry, Purdue University, Lafayette, Indiana 1941
*Klinkerfuss, Dr. G. H., 340 Bermuda Ave., Normandy, Missouri 1941
*Klinkerfuss, Mrs. G. H., 340 Bermuda Ave., Normandy, Missouri 1941
Kluge, Miss Helen H[enrika], Woodtick Rd., Waterbury 63, Connecticut 1942
*Knapp, Elmer Leslie, R. 2, Troy, Pennsylvania 1930
Knox, Miss Margaret Richardson, 4030 Park Ave., Indianapolis 5, Indiana 1937
Koch, Peter, Address unknown 1939
Koehler, Mrs. Arthur, 109 Chestnut St., Madison, Wisconsin 1941
Koestner, E. J., Box 263, Piper City, Illinois 1938
Kolb, Charles Haven Jr., 5021 Midwood Ave., Baltimore 12, Maryland 1937
Korgen, Miss Mollie, 1919 East 3rd St., Duluth 5, Minnesota 1944
**Kortright, Francis Herbert, 5 St. Edmunds Dr., Toronto, Ontario, Canada 1943
Kramer, Theodore Christian, Department of Anatomy, East Medical Bldg., Ann Arbor, Michigan 1939
Kraus, Dr. Douglas L[awrence], Department of Chemistry, California Institute of Technology, Pasadena 4, California 1942
Kreag, Keith K., R. 2, Box 196, Lansing, Michigan 1942
Krug, Howard H[enry], Chesley, Ontario, Canada 1944
Kuitert, Capt. Louis Cornelius, 18th Malaria Survey Unit, A.P.O. 21840 P.M., New York City 1938
*Kutz, George Karl, 705 S. Holcombe St., Stillwater, Minnesota 1944
*Kutz, Dr. Harry Leon, Game Research Center, Delmar, New York 1939
*Kyllingstad, Henry C[arrell], Mountain Village, Alaska 1940
Lacey, Miss Mifton H., Box 614, Canton, Ohio 1939
Laffoon, Jean [Luther], 1401 W. 3rd St., Sioux City, Iowa 1940

Lagler, Dr. Karl F., Department of Zoology, University of Michigan, Ann Arbor, Michigan 1941
***Lambert, Bert H., 16854 Wildemere Ave., Detroit, Michigan 1936
Lanyon, Wesley Edwin, 23 E. Wheelock St., Hanover, New Hampshire ..1943
*Larrabee, Prof. Austin Park, Yankton College, Yankton, South Dakota ..1921
*Laskey, Amelia Rudolph (Mrs. F. C.), Graybar Lane, Nashville 4, Tennessee 1928
Lawrence, William Hobart, 1410 Decatur St., N.W., Washington 11, D.C. 1943
Lay, Daniel Wayne, Game, Fish and Oyster Commission, Austin, Texas 1939
Lea, Robert Bashford, 24 N. Worth Ave., Elgin, Illinois 1940
*Lee, Maj. Howard James, MC, Winbee General Hospital, Topeka, Kansas 1941
Leedy, Dr. Daniel Lovey, Ohio Wildlife Research Station, Ohio State University, Columbus, Ohio 1936
Leenhouts, Miss Pearle Esther, Pease Rd., Williamson, New York 1941
Legg, William C[larence], Mt. Lookout, West Virginia 1939
*Leopold, Prof. Aldo, 424 University Farm Place, University of Wisconsin, Madison 6, Wisconsin 1928
Leopold, A[ldo] Starker, 424 University Farm Place, Madison 6, Wisconsin 1940
Levy, Alice Klund (Mrs. H. P.), 235 E. 22nd St., Apt. 11T, New York City, 10 1941
*Lewis, Dr. Harrison Flint, Lands, Parks and Forest Branch, Department of Mines and Resources, Ottawa, Ontario, Canada 1939
Lewis, Brother Hubert, Cretin High School, St. Paul, Minnesota 1940
*Lewy, Dr. Alfred, 2051 E. 72nd Place, Windsor Park Sta., Chicago, Illinois 1915
Lincoln, Frederick Charles, Fish and Wildlife Service, Washington, D.C. 1914
Lindzey, James S[hotwell], 901 W. 22nd St., Wilmington, Delaware 1942
*Linsdale, Dr. Jean Myron, Jamesburg Route, Monterey, California 1928
Linton, M[orris] Albert, 315 E. Oak Ave., Moorestown, New Jersey 1941
Lloyd, Clark K., 2712 Hoover Ave., Dayton, Ohio 1925
*Lloyd, Hoyes, 582 Mariposa Ave., Rockcliffe Park, Ottawa, Ontario, Canada 1922
Lockley, R. M., Skokholm Bird Observatory, Dale, Haverfordwest, Pembrokeshire, Wales, Great Britain 1940
Lodge, William Ralph, Silver Lake Estates, R. 2, Cuyahoga Falls, Ohio ..1935
Long, Chester, 39½ N. Kealing Ave., Indianapolis 1, Indiana 1943
Longley, William H[oward], 334 S. Albert St., St. Paul 5, Minnesota ..1943
Loop, George Andrew, 205 S. Keystone Ave., Sayre, Pennsylvania 1944
Lord, Dr. Frederic P[omeroy], 39 College St., Hanover, New Hampshire 1939
Lovell, Dr. Harvey B., 3011 Meade Ave., Louisville 4, Kentucky 1936
*Low, Seth Haskell, Box 253, Cherokee, Oklahoma 1931
***Lowery, George Hines Jr., Museum of Zoology, Louisiana State University, University, Louisiana 1937
Lowther, Malcolm Alfred, Museum of Zoology, Ann Arbor, Michigan ..1944
*Ludwig, Claud Charles, 506 Wilson Bldg., Lansing, Michigan 1938
Ludwig, Dr. Frederick Edwin, 2864 Military St., Port Huron, Michigan 1941
Lum, Miss Elizabeth C[aroline], Box 355, College Park, Maryland 1940
*Lunk, Lt. William Jr., 29 Bell Run Rd., Fairmont, West Virginia 1937
Lupient, Miss Mary [Louise], 212 S.E. Bedford St., Minneapolis, Minnesota 1944
*Luthy, Ferd Jr., 306 N. Institute, Peoria, Illinois 1937
*Lyman, Clara Cross (Mrs. Frederick C.), 1716 Colfax Ave., S., Minneapolis, Minnesota 1944
MacArthur, John W[ood] Jr., 200 Glencairn Ave., Toronto, Ontario, Canada 1941

MacDonald, Donald L[aurie], 72 Alexandra Blvd., Toronto, Ontario, Canada 1941
MacLean, Miss Dorothy W[illiams], 21 Ashley St., Hartford, Connecticut 1939
MacLulich, Dr. Duncan Alexander, 144 Mavety St., Toronto, Ontario, Canada 1933
*MacMullan, Capt. R[alph] Austin, Address unknown 1940
*McAtee, Waldo Lee, Fish and Wildlife Service, Merchandise Mart, Chicago 54, Illinois 1911
McBeath, Donald Young, L'Anse, Michigan 1936
McCabe, Robert Albert, 424 University Farm Place, Madison, Wisconsin 1942
McClure, Dr. H[owe] Elliott, 1609 P. St., Ord, Nebraska 1942
*McCue, Dr. Earl N[ewlon], Box 104, Morgantown, West Virginia 1941
*McCullagh, Dr. E[rnest] Perry, 2020 E. 93rd St., Cleveland, Ohio 1937
McDonald, Malcolm, Parsons College, Fairfield, Iowa 1936
McGeen, Daniel S., 144 Garfield Ave., Waukesha, Wisconsin 1944
McGraw, Harry Arthur, 1600 5th Ave., Altoona, Pennsylvania 1936
***McIlhenny, Edward Avery, Avery Island, Louisiana 1910
McIntosh, William Baxter, 414 Oakridge Blvd., Lynchburg, Virginia 1942
McKeever, Otto Donald, Box 143, Rensselaer, Indiana 1943
*McKnight, Edwin Thor, 5038 Park Place, Friendship Station, Washington, D.C. 1936
*McMath, Robert R., R. 4, Pontiac, Michigan 1934
McMurray, Arthur A., 2110 Fairfax Ave., Nashville 5, Tennessee 1939
*McNeil, Dr. Charles Andrew, 111 W. Fourth St., Sedalia, Missouri 1914
McNish, Edgar Mann, Madison, Tennessee 1940
Mace, Miss Verna Marie, Department of Physiology, Colorado State College, Fort Collins, Colorado 1943
Mack, Horace Gordon, % Gilson Mfg. Co. Ltd., Guelph, Ontario, Canada 1937
Magath, Dr. Thomas Byrd, Mayo Clinic, Rochester, Minnesota 1935
*Magee, Michael Jarden, 603 South St., Sault Ste Marie, Michigan 1919
Magney, Mrs. G. R., Scandia, Minnesota 1940
Manners, Edward Robert, 233 Maple Ave., Westville, New Jersey 1942
Manville, Richard H[yde], Museum of Zoology, University of Michigan, Ann Arbor, Michigan 1941
*Margolin, A[braham] S[tanley], Oglebay Hall, Morgantown, West Virginia 1944
Markle, Jess Matthew, 917 Sierra St., Madera, California 1943
*Marshall, Mrs. Florence F[oreman], Seashore State Park, Box 31, Virginia Beach, Virginia 1944
Marshall, [Harry] Morton, R. 1, Pamplin, Virginia 1944
*Marshall, Terrill, 1619 W. 20th St., Little Rock, Arkansas 1944
Marshall, William Hampton, 1006 N. 27th St., Boise, Idaho 1942
**Martin, John E. H., Ancaster, Ontario, Canada 1944
*Maslowski, Karl Herbert, 1034 Maycliff Rd., Cincinnati 30, Ohio 1934
Mason, Miss Esther, 2523 Montgomery St., Louisville 12, Kentucky 1941
Mathiak, Harold A[lbert], Horicon, Wisconsin 1941
*Mayfield, Dr. George Radford, Vanderbilt University, Tennessee 1917
Mayfield, Harold F[ord], 3311 Parkwood Ave., Toledo, Ohio 1940
***Mayr, Dr. Ernst, American Museum of Natural History, 79th St. and Central Park West, New York City, 24 1933
Mead, Frank W[aldreth], 227 Brighton Rd., Columbus, Ohio 1941
Meade, Dr. Gordon Montgomery, Strong Memorial Hospital, Rochester, New York 1937
Mellinger, E[nos] O[ren], North Lima, Ohio 1939
Meltvedt, Burton W., Paullina, Iowa 1930
Mendall, Howard L[ewis], 28 Pendleton St., South Brewer, Maine 1936

Meng, Heinz Karl, 116 Miller St., Ithaca, New York 1943
Meritt, James Kirkland, 99 Battle Rd., Princeton, New Jersey 1944
***Merry, Dr. Katherine, 520 E. Jefferson, Apt. 11, Ann Arbor, Michigan 1944
Messner, Clarence John, 308 McKinley, Grosse Pointe 30, Michigan 1944
**Metcalf, H[omer] N[oble], Fruit Tree Branch Experiment Station, Wenatchee, Washington 1944
*Metcalf, Dr. Zeno Payne, State College, West Raleigh, North Carolina ..1900
*Meyer, Henry, Zoology Department, Unnversity of Tennessee, Knoxville, Tennessee 1939
Michaud, Howard H[enry], 1205 Kensington Blvd., Fort Wayne, Indiana 1938
*Michener, Harold, 418 N. Hudson Ave., Pasadena 4, California 1926
Mierow, Miss Dorothy, 205 E. Second St., Northfield, Minnesota 1940
*Miles, Merriam Lee, Box 928, Vicksburg, Mississippi 1941
Miles, Mrs. Philip E., 1900 Arlington Place, Madison 5, Wisconsin 1943
Miller, Alden Holmes, Museum of Vertebrate Zoology, Berkeley 4, California 1930
Miller, Mrs. Alice, 2200 Belmont, Dearborn, Michigan 1944
*Miller, Douglas Scott, 122 Lawrence Ave., E. Toronto, Ontario, Canada 1939
Miller, Loye [Holmes], University of California at Los Angeles, Los Angeles 24, California 1939
Miller, Richard F[ields], 2627 N. Second St., Philadelphia 33, Pennsylvania 1942
Mills, Robert H[enry], 2466 Medary Ave., Columbus 2, Ohio 1941
Milnes, Miss Hattie Kernahan, 331 Gowen Ave., Mt. Airy, Philadelphia 19, Pennsylvania 1935
*Minich, Edward C., 1047 Fairview Ave., Youngstown 2, Ohio 1923
Mitchell, Earl T[homas] Address unknown 1940
Mitchell, Harold Dies, 378 Crescent Ave., Buffalo, New York 1936
Mitchell, Mrs. R. V., R. 1, Canton, Ohio 1943
*Mitchell, Mrs. Osborne, R. 1, Streetsville, Ontario, Canada 1933
**Mitchell, Dr. Walton Iungerich, 398 Vassar Ave., Berkeley 8, California 1893
Moeran, Edward Henry, 541 Bronx River Rd., Yonkers, New York 1940
Mohler, Levi L[app], 1635 Smith St., Lincoln, Nebraska 1942
*Monk, Harry Crawford, 406 Avoca St., Nashville 5, Tennessee 1920
*Monroe, Burt Leavelle, Ridge Rd., Anchorage, Kentucky 1935
*Monson, Gale, 2728 E. Helen St., Tucson, Arizona 1933
Moore, Miss Clara Alma, 3510 W. Michigan St., Indianapolis, Indiana 1939
*Moore, Miss Dora, 60 E. Mulberry St., Athens, Ohio 1934
Moore, George A[zro], 289 Admiral Rd., Stillwater, Oklahoma 1938
Moore, George M[itchell], Nesmith Hall, University of New Hampshire, Durham, New Hampshire 1942
Moore, Miss Jeanne [Ellen], 718 Onondaga, Ann Arbor, Michigan 1943
Moore, Miss Laura Brooks, French Creek, West Virginia 1941
Moore, Robert Thomas, R. 1, Box 28A, Pasadena, California 1939
Moran, James Vincent, 1 Alfred St., Jamaica Plain, Boston 30, Massachusetts 1943
Morgan, Allen H[ungerford], Cochituate Rd., Wayland, Massachusetts 1943
Morrell, Charles K., 119 E. Maxwell St., Lexington, Kentucky 1943
Morrell, Miss Elsie, 148 W. Peachtree St., Knoxville 15, Tennessee 1942
*Morse, Miss Margarette Elthea, 11432 Mayfield Rd., Cleveland 6, Ohio 1921
*Moseley, Edwin Lincoln, University Museum, Bowling Green, Ohio 1925
*Moser, Edward Randolph, Aberdeen, Iowa 1944
**Moser, Dr. R[euben] Allyn, R. 1, Benson Station, Omaha 4, Nebraska 1940
Moul, Edwin T[heodore], 4 Hill St., York, Pennsylvania 1942
*Mousley, William Henry, 4073 Tupper St., Westmount, Montreal, Quebec, Canada 1922

Mowrer, Miss Julia Elizabeth, 1251 Lilitz Ave., Lancaster, Pennsylvania 1944
**Mudge, Edmund W. Jr., 4105 Averill Way, Dallas, Texas 1939
Mueller, Walter Josef, 3043 N. Prospect Ave., Milwaukee, Wisconsin ..1936
Muirhead, Miss Peggy, Vassar College, Poughkeepsie, New York 1940
Mundy, Miss Barbara B., 1009 Park Ave., New York City 1942
Munro, James Alexander, Okanagan Landing, British Columbia, Canada 1935
*Munter, Capt. William Henry, 4518 52nd Ave., N.E.,
Seattle 5, Washington 1933
Murdock, James Ingram, 311 Irving Ave., Glendale 1, California 1940
*Murie, Adolph, Jackson, Wyoming 1932
*Murie, Olaus Johan, Jackson, Wyoming 1934
Murphey, Dr. Eugene Edmund, 432 Telfair St., Augusta, Georgia 1935
*Murphy, Paul C[harles], 731 Fairmount Ave., St. Paul 5, Minnesota ...1944
Murray, Rev. Joseph James, Lexington Presbyterian Church,
Lexington, Virginia 1931
Musselman, T[homas] E[dgar], 124 S. 24th St., Quincy, Illinois 1940
**Myers, Frank M[arcel], Address unknown 1944
Nash, Lt. Nathaniel C[ushing] IV, 1 Reservoir St.,
Cambridge, Massachusetts 1941
*Neff, Johnson Andrew, 546 Custom House, Denver, Colorado 1920
*Nelson, Arnold Lars, 3256 Van Hazen St., N.W., Washington, D.C.....1932
Nelson, Charles Ellsworth Jr., 124 Oxford Rd., Waukesha, Wisconsin ..1937
Nelson, Edwin L[ewis], 77 Adelaide Ave., New Brunswick, New Jersey ..1939
**Nelson, Dr. Theodora, 315 E. 68th St., New York City, 21 1928
Nelson, Urban C., Soil Conservation Service, Stillwater, Minnesota 1939
Netting, M[orris] Graham, Carnegie Museum, Pittsburgh 13,
Pennsylvania 1941
Nevius, Mrs. Richard, R. 1, Greenville, Tennessee 1940
Newman, Barnett, 343 E. 19th St., New York City 1942
*Newth, Donald J[ennings], 480 W. Kirby St., Detroit 2, Michigan 1939
Newton, Earl T[homas], 5500 College St., Kansas City, Missouri 1939
*Nice, Dr. Leonard B., 5725 Harper Ave., Chicago 37, Illinois 1932
*Nice, Mrs. Margaret Morse, 5725 Harper Ave., Chicago 37, Illinois 1921
*Nichols, Charles Ketcham, 212 Hamilton Rd., Ridgewood, New Jersey 1933
Nichols, John Treadwell, American Museum of Natural History,
Central Park West at 79th St., New York 24, New York 1941
*Nichols, L[eon] Nelson, 331 E. 71st St., New York City 1937
*Nickell, Walter Prine, Cranbrook Institute of Science,
Bloomfield Hills, Michigan 1943
*Nissley, Amos S., R. 1, Manheim, Pennsylvania 1944
Nordquist, Lt. Theodore, 1423 James Ave., N., Minneapolis 11,
Minnesota 1941
Norris, Robert Allen, 1408 N. College Ave., Tifton, Georgia 1941
Norris, Russell T[aplin], R. 7, Miller St., Butler, Pennsylvania 1939
*Norse, William J[ohn], 531 W. 211th St., New York City 34 1939
North, George W[ebster], 249 Charlton Ave., W., Hamilton,
Ontario, Canada 1941
Norton, Mrs. Margaret E[astman], 2206 Sheffield Dr.,
Kalamazoo, Michigan 1944
Nyc, Frederick Francis Jr., Box 869, Brownsville, Texas 1943
*Oberholser, Dr. Harry Church, Cleveland Museum of Natural
History, 2717 Euclid Ave., Cleveland, 15, Ohio 1894
*O'Conner, Miss Esther Laura, 4344 Locust Ave., Kansas City, Missouri 1940
*Odum, Dr. Eugene Pleasants, Department of Zoology, University of
Georgia, Athens, Georgia 1930
Oliver, Miss Mary Clara, Ganado Mission, Ganado, Arizona 1934

*Olsen, Humphrey A., Pikeville College Library, Pikeville, Kentucky 1941
Olson, Mrs. Gladys E[lizabeth], 17906 Lake Rd., Lakewood 7, Ohio ..1942
Ommanney, G. G., Room 703, Windsor St. Station, Canadian Pacific Railway, Montreal, Quebec, Canada 1944
*O'Reilly, R. A. Jr., 11892 Ohio Ave., Detroit 4, Michigan 1936
**Osborn, Chase S[almon], Sault Ste Marie, Michigan 1943
*Osgood, Dr. Wilfred Hudson, Chicago Natural History Museum, Chicago 5, Illinois 1910
*Otis, Dr. Charles Herbert, Department of Biology, Bowling Green State University, Bowling Green, Ohio 1937
Ott, Frederick Louis, 2527 N. Wahl Ave., Milwaukee 11, Wisconsin ..1941
Outler, John Morgan III, 2865 N. Hills Drive, N.E., Atlanta, Georgia ..1944
*Overing, Robert, R. 4, Raleigh, North Carolina 1930
*Owre, Oscar T., 2625 Newton Ave., S., Minneapolis, Minnesota 1935
Packard, Dr. W. H., 223 S. Glenwood Ave., Peoria, Illinois 1944
Painton, Dr. Harry R., 220 Mount Rose, Reno, Nevada 1939
*Palmer, Ralph Simon, Department of Zoology, Vassar College, Poughkeepsie, New York 1934
*Palmer, Dr. Theodore Sherman, 1939 Biltmore St., N.W., Washington, D.C. 1914
*Parker, Dr. Dean Roberts, Texas Technological College, Lubbock, Texas 1944
Parker, Henry M[elville], 122 School St., Concord, New Hampshire 1941
Patch, Dr. Edith M[arion], Box 150, Orono, Maine 1944
Pate, Miss Lennie Elizabeth, 1315 E. Cervantes St., Pensacola, Florida 1944
*Patterson, Lt. Robert, U.S.S. Clarence K. Bronson, Fleet Post Office, San Francisco, California 1943
Pause, Donald [Arthur], 675 E. Utica St., Buffalo, New York 1944
Pearce, John, 643 Park Square Bldg., Boston, Massachusetts 1939
Pearson, Miss Dorothy, 19 Lincoln St., N. Weymouth, Massachusetts ..1944
*Peartree, Edward William, 425 S. State St., Oconomowoc, Wisconsin ..1941
*Peasley, Mrs. Harold Raymond, 2001 Nash Drive, Des Moines, Iowa 1934
Peelle, Prof. Miles L., 329 Rice St., Adrian, Michigan 1940
*Peet, Dr. Max Minor, 2030 Hill St., Ann Arbor, Michigan 1935
Penner, Lawrence R., Department of Zoology, University of Connecticut, Storrs, Connecticut 1940
*Perner, Miss Margaret E., 2463 Woodridge Rd., Cleveland Heights 21, Ohio 1943
*Peters, Harold Seymore, 107 River Rd., Ashley Forest, Charleston, South Carolina 1924
*Peterson, Alfred, Box 201, Brandt, South Dakota 1931
Peterson, Mrs. Charles Emil, Madison, Minnesota 1936
Peterson, Lt. Liven A[dam] Jr., 904 S. 4th Ave., Virginia, Minnesota ..1940
*Peterson, Roger Tory, National Audubon Society, 1006 Fifth Ave., New York City, 28 1942
Peterson, Mrs. Theodore, 80 Oaklawn Ave., Battle Creek, Michigan 1941
Petrides, George Athan, U. S. Navy Preflight School, Athens, Georgia ..1942
***Pettingill, Dr. Olin Sewall Jr., Department of Zoology, Carleton College, Northfield, Minnesota 1930
**Phelps, William H[enry], Apartado 2009, Caracas, Venezuela 1940
**Philipp, Frederick B[ernard], 99 John St., New York City 1940
*Phillips, Allan Robert, 113 Olive Rd., Tucson, Arizona 1934
*Phillips, Cyrus Eastman, 255 Polk St., Warsaw, Illinois 1944
Phister, Miss Gloria J[ean], Verona St., Vernon, New York 1944
*Pickwell, Dr. Gayle Benjamin, Department of Natural Sciences, San Jose State Teachers College, San Jose, California 1923

*Pieper, William R[obert], 237 E. Main St., Anoka, Minnesota 1944
*Pierce, Robert Allen, Nashua, Iowa 1941
*Pirnie, Dr. Miles David, W. K. Kellogg Bird Sanctuary, Augusta, Michigan 1928
Pitelka, Frank Alois, Museum of Vertebrate Zoology, University of California, Berkeley 4, California 1938
Plath, Karl, 2847 Giddings St., Chicago, Illinois 1942
**Poole, Cecil A[very], 830 Chapman St., San Jose, 11, California 1942
*Poor, Hustace Hubbard, 112 Park Ave., Yonkers 3, New York 1935
*Porter, Thomas Wayne, % Mrs. M. A. Porter, R. 1, Bowling Green, Ohio 1938
*Potter, Julian Kent, 437 Park Ave., Collingswood, New Jersey 1915
Potter, Louis Henry, R. 2, West Rutland, Vermont 1941
*Pough, Richard Hooper, 33 Highbrook Ave., Pelham 65, New York 1938
*Powell, Roger Warren, Lincoln Auto Court, Cheyenne, Wyoming 1944
Powers, Myrtle Marie, Scotts, Michigan 1944
Prather, Millard F[illmore], 1129 Brown-Marz Bldg., Birmingham 3, Alabama 1940
*Preble, Edward Alexander, 3027 Newark St., Washington, D.C. 1929
*Preble, Norman A[lexander], Biology Department, Ashland College, Ashland, Ohio 1941
*Presnall, Mrs. Clifford Charles, Lake Zurich, Illinois 1930
Price, Homer F., Payne, Ohio 1944
*Prill, Dr. Albert G., Main St., Scio, Oregon 1921
**Proctor, William, Bar Harbor, Maine 1937
Prucha, Miss Alma, 3052 N. Maryland Ave., Milwaukee, Wisconsin 1943
*Pueschel, Paul, 520 Drexel Ave., Glencoe, Illinois 1939
Putnam, Loren Smith, Box 202, College Station, Murray, Kentucky 1942
*Pyle, George W[inner], South Valley Rd., Box 604, Paoli, Pennsylvania 1939
Quam, Mrs. Mary Battell, 141 Joralemon St., Brooklyn 2, New York ..1944
Quay, Thomas L[arelle], 2805 Bedford Ave., Raleigh, North Carolina ..1939
Quimby, Don C., 4742 Garfield Ave., S., Minneapolis, Minnesota 1942
Ragusin, Capt. Anthony Vincent, Box 225, Pascagoula, Mississippi 1937
Rahe, Carl W., 4666 Turney Rd., Cleveland 5, Ohio 1931
Ramsden, Dr. Charles Theodore, 8 & 19, Vista Alegre, Santiago de Cuba, Cuba 1914
Rapp, William F[rederick] Jr., 203 E. Green St., Champaign, Illinois ..1941
*Rebmann, G. Ruhland Jr., 729 Milbrook Lane, Haverford, Pennsylvania 1941
*Reeder, Miss Clara Maude, 1608 College Ave., Houghton, Michigan 1938
*Reese, Mrs. Hans H., 3421 Circle Close, Shorewood Hills, Madison, Wisconsin 1941
Remington, Charles Lee, 5570 Etzel Ave., St. Louis, Missouri 1944
Rett, Egmont Z[achary], Museum of Natural History, Santa Barbara, California 1940
Reuss, Alfred Henry Jr., 12929 S. Mozart St., Blue Island, Illinois 1936
Rice, Mrs. Harry Wilson, 3940 Richfield Rd., Minneapolis, Minnesota ..1940
*Ricker, Dr. William E[dwin], Department of Zoology, Indiana University, Bloomington, Indiana 1943
Riggs, Carl Daniel, 5312 N. New Jersey St., Indianapolis, Indiana 1943
*Rinehart, Edwin P[aul], 1013 Wyandotte Bldg., Columbus, Ohio 1944
Riner, Miss Alice, 503 S. Millwood, Wichita, Kansas 1939
Ritchie, R. C., 250 Riverside Drive, Toronto, Ontario, Canada 1942
Ritter, Rhys T[heophilus], R. 4, Bethlehem, Wheeling, West Virginia ..1944
*Roads, Miss Myra Katie, 463 Vine St., Hillsboro, Ohio 1914
Robbins, Chandler S[eymour], Patuxent Research Refuge, Bowie, Maryland 1941

Roberts, Homer D[onald], 1011 Hazel St., Birmingham, Michigan 1943
**Roberts, Dr. Thomas Sadler, Museum of Natural History, University of Minnesota, Minneapolis, Minnesota 1914
Robertson, William B[eckwith] Jr., Box 85, Berlin, Illinois 1942
***Rogers, Charles Henry, East Guyot Hall, Princeton, New Jersey 1903
*Rogers, Irl, 402 Alturas Ave., Modesto, California 1937
*Rogers, Mrs. Walter E., 911 E. North St., Appleton, Wisconsin 1931
*Rollo, Mrs. W. E., Otis Rd., Barrington, Illinois 1942
***Root, Oscar M[itchell], Brook's School, North Andover, Massachusetts 1940
Rorimer, Irene Turk (Mrs. J. M.), 4 Garden Court Apts., Charlottesville, Virginia 1938
Rosene, Walter Melvin Jr., 1212 Jupiter, Gadsden, Alabama 1923
*Rosewall, Dr. Oscar Waldemar, Department of Zoology, Louisiana State University, University, Louisiana 1931
Ross, C[harles] Chandler, 7924 Lincoln Dr., Chestnut Hill, Philadelphia, Pennsylvania 1937
*Rossbach, George Bowyer, Poynette, Wisconsin 1943
*Roth, Conrad, Box 1108, Portsmouth, Ohio 1943
*Rudd, Dr. Clayton G[lass], 315 Medical Arts Bldg., Minneapolis, Minnesota 1944
Ruderman, Miss Claire, 8660 105th St., Richmond Hill 18, Long Island, New York 1944
Ruecker, Miss Emilie, Seapowet Ave., Tiverton, Rhode Island 1943
Russell, Dr. Whitfield Leggett, Box 22, Rhome, Texas 1935
Sage, Evan V., R., 3, Waterloo, Iowa 1944
Sampson, Miss Mabel, Ivanhoe, Minnesota 1943
Sandve, J[oseph] Reuben, 883 23rd Ave., S.E., Minneapolis, Minnesota 1943
*Satterthwait, Mrs. Elizabeth Allen, 806 W. Ohio St., Urbana, Illinois ..1925
Saugstad, N[els] Stanley, R. 4, Minot, North Dakota 1939
*Saunders, Aretas Andrews, 361 Crestwood Rd., Fairfield, Connecticut ..1934
Saunders, Dr. George Bradford, Fish and Wildlife Service, 1623 N.W. Washington St., Brownsville, Texas 1926
*Savage, James, Buffalo Athletic Club, Buffalo, New York 1939
Sawyer, Miss Dorothy, R. 1, Unadilla, New York 1937
Scarlett, Mrs. William, 522 E. Big Bend, Webster Groves, Missouri ..1944
Schantz-Hansen, Donald [Ernst], Forestry Station, Cloquet, Minnesota 1944
Schaub, Mrs. Mary Hall, 1040 Isabella St., Wilmette, Illinois 1939
*Schneider, Miss Evelyn J., University of Louisville, Belknap Campus, Louisville, Kentucky 1935
*Schorger, Dr. Arlie William, 168 N. Prospect Ave., Madison, Wisconsin 1927
**Schramm, Wilson Cresap, 321 Kensington Rd., Syracuse, New York 1944
*Schuette, Chal, 1446 Beaver Rd., Sewickley, Pennsylvania 1942
Schumm, William George, 302 C. Street, LaPorte, Indiana 1944
Schutz, Miss Clara I[rene], 277 Park Place, Meadville, Pennsylvania 1941
Schwall, Eugene E[dward], New Concord, Ohio 1943
*Schwartz, Charles Walsh, R. 6, Columbia, Missouri 1943
Scotland, Dr. Minnie Brink, 42 Continental Ave., Cohoes, New York ..1938
*Scott, Dr. John W[illiam], Department of Zoology, University of Wyoming, Laramie, Wyoming 1937
Scott, Dr. Thomas George, Department of Zoology, Science Bldg., Ames, Iowa 1936
Scott, Walter Edwin, Mendota Beach Heights, Madison 5, Wisconsin 1938
Seaberg, Dr. John A[rthur], Veterans Administration, Minneapolis 6, Minnesota 1944
Seebey, Edward L[incoln], 1854 A Kenmore Ave., Buffalo, New York ..1944
Seibert, Henri C., 2102 E. 98th St., Chicago 17, Illinois 1941

*Sener, Miss Ruth, 233 Charlotte St., Lancaster, Pennsylvania 1943
Serbousek, Miss Lillian, 1226 2nd St., S.W., Cedar Rapids, Iowa 1935
*Shaffer, Chester Monroe, 809 S. 4th St., Chickasha, Oklahoma 1934
Shaftesbury, Dr. Archie D., University of North Carolina, Greensboro, North Carolina 1930
Sharp, Dr. Ward M., Red Rock Lakes Refuge, Monida, Montana 1936
Shattuck, Miss Lois Jean, 1317 Blanchard Ave., Flint 3, Michigan 1944
Shaughnessy, Mrs. Martin, One Washington Terrace, St. Louis, Missouri 1944
Shaver, Dr. Jesse Milton, George Peabody College for Teachers, Nashville, Tennessee 1922
Shaw, Dr. Charles H[icks], Bremen, Ohio 1941
Shaw, Mrs. Elizabeth Martin, 2312 Stuart Ave., Richmond 20, Virginia 1943
**Shearer, Dr. Amon Robert, Mont Belvieu, Chambers Co., Texas 1893
*Shelar, Keller, State Teachers College, Slippery Rock, Pennsylvania 1940
*Shelford, Dr. Victor Ernest, Vivarium Bldg., University of Illinois, Champaign, Illinois 1931
Sheppard, Roy Watson, 1805 Mouland Ave., Niagara Falls, Ontario, Canada 1933
Sherwood, John Willits, 26 Smith St., Salinas, California 1936
Short, Wayne, 1207 N. 7th St., St. Louis 6, Missouri 1941
Shortt, Terence Michael, Royal Ontario Museum of Zoology, Toronto, Ontario, Canada 1941
Sibley, Charles G., 1438 Hawthorne Terrace, Berkeley, California 1942
Simmons, Mrs. Amelia C., 2007 N. Holton St., Milwaukee 12, Wisconsin 1943
***Simmons, Edward McIlhenny, Avery Island, Louisiana 1942
Sims, Harold Lee, 714 St. Philip St., Thibodaux, Louisiana 1942
Skaggs, Merit Bryan, Julian Rd., South Euclid, Ohio 1934
Skutch, Alexander F., Finca 'Los Cusingos', San Isidro del General, Costa Rica 1944
Slack, Miss Mabel, 1004 Everett Ave., Louisville, Kentucky 1934
*Smith, Dr. Arthur Francis, Manning, Iowa 1934
*Smith, Bertram H., 512 Harries Bldg., Dayton, Ohio 1944
*Smith, Frank Rush, R. 2, Box 100, Laurel, Maryland 1910
*Smith, Harry Madison, Whitman Laboratory of Experimental Zoology, University of Chicago, Chicago, Illinois 1936
*Smith, J. Donald, 1359 Sargent Ave., St. Paul 5, Minnesota 1939
*Smith, Lewis MacCuen, 8040 St. Martins Lane, Chestnut Hill Sta., Philadelphia, Pennsylvania 1931
Smith, Luther Ely, 1554 Telephone Bldg., 1110 Pine St., St. Louis, Missouri 1941
*Smith, Oliver L[edlie], 15 York Ave., Towanda, Pennsylvania 1944
Smith, Orion O., 1539 Crosby St., Rockford, Illinois 1936
*Smith, Roy Harmon, 183 N. Prospect St., Kent, Ohio 1936
Smith, Thomas [Price], Osage Ave., Anchorage, Kentucky 1941
Smith, Wendell Phillips, Wells River, Vermont 1921
Snapp, Edith (Mrs. R. R.), 310 W. Michigan Ave., Urbana, Illinois 1940
Snyder, Lester Lynne, Royal Ontario Museum of Zoology, Queens Park at Bloor, Toronto 5, Ontario, Canada 1929
Snyder, Richard Craine, 431 Clark St., South Orange, New Jersey 1940
Sooter, Clarence Andrew, 402 Hester St., Stillwater, Oklahoma 1940
Soper, J[oseph] Dewey, 827 Riverwood Ave., Fort Garry, Winnipeg, Manitoba, Canada 1937
Spangler, Miss Iva M., 128 E. Foster Parkway, Fort Wayne, Indiana ..1939
Spawn, Dr. Gerald B., South Dakota State College, Brookings, South Dakota 1941
Spear, Ivan [MacDonald], 39 W. Elm St., Yarmouth, Maine 1942

*Speirs, Mrs. Doris Huestis, 92 McIntyre St., North Bay, Ontario, Canada 1936
Speirs, John Murray, 92 McIntyre St., North Bay, Ontario, Canada 1931
*Spencer, Miss O[live] Ruth, 1030 25 Avenue Court, Moline, Illinois 1938
Sperry, Charles Carlisle, 1455 S. Franklin St., Denver 10, Colorado 1931
Spofford, Walter R[ichard] II, Vanderbilt University Medical School, Nashville, Tennessee 1942
Stabler, Robert M[iller], Glen Mills, Pennsylvania 1939
Stackpole, Richard, Address unknown 1940
Staebler, Lt. Arthur Eugene, U. S. Public Health Service, Miami Beach 39, Florida 1937
**Stahl, Miss Marjoretta Jean, Kimberly, West Virginia 1942
Stanford, Jack A[rchibald], 553 S. First St., Ann Arbor, Michigan 1941
Stark, Miss Wilma R[uth], 1701 16th St., N.W., Washington, D.C. 1939
Starrett, William Charles, % W. E. Starrett, 105 Glen Oak Court, Peoria, Illinois 1933
*Stebbins, Miss Fannie Adell, 31 Ely Ave., West Springfield, Massachusetts 1935
*Steffen, Earnest William, 1000 Maplewood Drive, Cedar Rapids, Iowa 1944
Steggerda, Dr. Morris, Kennedy School of Missions, Hartford, Connecticut 1941
Stegle, Joseph J[ames], 220 Pondfield Rd., W., Bronxville, New York 1944
Stephens, Dr. Thomas Calderwood, Morningside College, Sioux City, Iowa 1911
*Stevens, O. A. State College Station, Fargo, North Dakota 1926
Stevenson, H[orace] Godwin Jr., 641 Woodward Way, Atlanta, Georgia 1939
Stevenson, Dr. Henry M[illis] Jr. Emory and Henry College, Emory, Virginia 1943
Stevenson, James Osborne, 1138 S. Wheeling, Tulsa 4, Oklahoma 1931
**Stewart, Paul Alva, Leetonia, Ohio 1925
Stewart, Robert Earl, Patuxent Research Refuge, Bowie, Maryland 1939
*Stickney, Mrs. Albert Jr., % H. E. Herrick, Woodmere, Long Island, New York 1935
*Stillwell, Jerry E., 7460 San Benito Way, R. 4, Dallas 18, Texas 1935
**Stine, Miss Perna M., State Teachers College, Minot, North Dakota 1931
**Stoddard, Dr. Herbert Lee, R. 5, Sherwood Plantation, Thomasville, Georgia 1916
Stone, Harry H[erbert] Jr., Box 101, Sturbridge, Massachusetts 1941
Stophlet, John Jermain, 2612 Maplewood Ave., Toledo, Ohio 1934
Storer, John Humphreys, 579 Beaver St., Waltham, Massachusetts 1939
Storer, Robert Winthrop, Museum of Vertebrate Zoology, Berkeley 4, California 1938
*Storer, Dr. Tracy Irwin, Division of Zoology, University of California, Davis, California 1928
Street, Thomas M., Bottineau, North Dakota 1940
***Strehlow, Elmer William, 721 W. Mason St., Green Bay, Wisconsin 1941
Stringham, Dr. Emerson, Box 2172, Capitol Station, Austin 11, Texas ..1940
Stromgren, Carl, Box 742, Newton, Iowa 1944
****Strong, Dr. Reuben Myron, 5840 Stony Island Ave., Chicago, Illinois. Founder
Struck, Dr. Kuno H[erbert], 1003 First National Bank Bldg., Davenport, Iowa 1942
Strunk, William Franklin, 700 Madison Ave., Morgantown, West Virginia 1944
Stupka, Arthur, Great Smoky Mountains National Park, Gatlinburg, Tennessee 1935
***Sturgeon, Myron T., Michigan State Normal College, Ypsilanti, Michigan 1934
Sturgis, S[ullivan] Warren, 66 Marlboro St., Boston, Massachusetts 1941
*Sturm, Louis, Sheffield Rd., Glendale, Ohio 1943

Suits, Miss Constance Jean, R. 1, Watervliet, Michigan 1944
*Suthard, James Gregory, 1881 Raymond Ave., Long Beach, California ..1936
***Sutton, George Miksch, Major, A.C., ADT Branch, Bldg. T-2093, AAF Tactical Center, Orlando, Florida 1920
*Swanson, Dr. Gustav [Adolph], Research Division, Fish and Wildlife Service, Merchandise Mart, Chicago 54, Illinois 1927
*Swedenborg, Ernie David, 4905 Vincent Ave., S., Minneapolis 10, Minnesota 1929
Swoger, Arthur [Glenn], 921 Wood St., Wilkinsburg, Pittsburgh 21, Pennsylvania 1943
*Taber, Wendell, 3 Mercer Circle, Cambridge, Massachusetts 1936
Tabor, Miss Ava Rogers, 305 Canal Blvd., Thibodaux, Louisiana 1940
Tallman, William S[weet], Jr., 4 Linden Place, Sewickley, Pennsylvania 1940
*Tanger, Mrs. C. Y., 318 N. President Ave., Lancaster, Pennsylvania 1943
Tanghe, Leo J[oseph], 120 Barnard St., Rochester, New York 1943
Tanner, James Taylor, 16½ N. Church St., Cortland, New York 1937
Tatum, Miss Bernice, 1105 Lowell, Kansas City 2, Kansas 1943
*Taverner, Percy Algernon, 45 Leonard Ave., Ottawa, Ontario, Canada 1905
*Taylor, Dr. Aravilla Meek, Lake Erie College, Painesville, Ohio 1936
***Taylor, Dr. Arthur Chandler, Irving Zuelke Bldg., Appleton, Wisconsin 1929
***Taylor, Rose Schuster (Mrs. H. J.), 900 Santa Barbara Rd., Berkeley, California 1916
Taylor, Miss Joanne, 1176 Shattuck, Berkeley, California 1941
*Taylor, Walter Penn, 254 Faculty Exchange, College Station, Texas 1937
Taylor, William Ralph, Museum of Vertebrate Paleontology, University of Kansas, Lawrence, Kansas 1940
*Teachenor, Dix, 1020 W. 61st St., Kansas City, Missouri 1923
Templeman, Wilfred, Memorial University College, St. John's Newfoundland 1943
Terres, J[ohn] Kenneth, R. 3, Trumansburg, New York 1939
Thacher, S. Charles, 2918 Brownsboro Rd., Louisville 6, Kentucky 1942
*Thomas, Edward Sinclair, 319 Acton Rd., Columbus, Ohio 1921
*Thomas, Mrs. Rowland, R. 3, North Little Rock, Arkansas 1937
*Thornton, William James, Box 1011, Birmingham, Alabama 1940
***Thorp, George B[oulton], 1400 Lake Shore Dr., Chicago 10, Illinois 1935
*Tift, Richard, Madison Terrace Apts., Albany, Georgia 1937
*Tilley, Francis Thomas, 26 Mohican Ave., Buffalo 8, New York 1944
*Tinker, Almerin David, R. 1, Chelsea, Michigan 1909
*Tipton, Dr. Samuel R[idley], 158 The Highlands, Tuscaloosa, Alabama 1941
Todd, Mrs. Elizabeth D., 918 W. Main St., Kalamazoo, Michigan 1939
Todd, Ens. George K[endall], USS LST 663, % Fleet Post Office, San Francisco, California 1942
Todd, Henry Oliver Jr., Woodbury Rd., Murfreesboro, Tennessee 1938
Todd, Mabel Sellars (Mrs. A. P.), 1622 Kensington St., Houston 6, Texas 1940
**Todd, W[alter] E[dmond] Clyde, Carnegie Museum, Pittsburgh 13, Pennsylvania 1911
Toner, George Clive, Address unknown 1939
*Tomkins, Ivan Rexford, 1231 E. 50th St., Savannah, Georgia 1931
*Towle, Miss Helen Jessie, 5148 29th Ave., S., Minneapolis 6, Minnesota 1944
**Townsend, Miss Elsie White, Wayne University, Detroit 1, Michigan ..1938
***Trautman, Milton B[ernhard], Stone Laboratory, Put-in-Bay, Ohio ..1932
Trimm, Wayne, 165 Strong Ave., Syracuse, New York 1943
Tryon, C[larence] A[rcher] Jr., Zoology Department, Montana State College, Bozeman, Montana 1942

*Tubbs, Farley F., Game Division, Department of Conservation, Lansing 13, Michigan 1935
***Tucker, Mrs. Carll, Penwood, Mount Kisco, New York 1928
Tucker, Edward Robert, 245 N. Auburndale, Memphis, Tennessee 1942
*Turner, Miss Ruth D[ixon], Clapp Laboratories, Duxbury, Massachusetts 1939
Tuttle, George Mott Jr., 4016 Cliff St., Niagara Falls, New York 1940
Tvedt, Capt. Harold B[loom], 1911 Grand St., St. Paul, Minnesota 1941
*Twomey, Dr. Arthur Cornelius, Carnegie Museum, Pittsburgh 13, Pennsylvania 1936
*Tyler, Dr. Winsor Marrett, 1482 Commonwealth Ave., Brighton 35, Massachusetts 1914
*Uhler, Francis Morey, Patuxent Research Refuge, Bowie, Maryland 1931
**Uhrig, Mrs. A. B., Box 28, Oconomowoc, Wisconsin 1926
Umbach, Miss Margaret, 2526 East Drive, Fort Wayne 3, Indiana 1941
*Vaiden, Meredith Gordon, Rosedale, Mississippi 1937
Van Camp, Laurel F[redrick], Genoa, Ohio 1943
Van Coevering, Jack, 9816 Ingram-Rosedale Gardens, Plymouth, Michigan 1939
Vandervort, Charles Champion, Laceyville, Pennsylvania 1937
Van Epps, Claude A., 824 Eighth St., Brookings, South Dakota 1943
Van Laar, Henry, 1924 Indiana Ave., Kalamazoo 39, Michigan 1944
*van Rossem, Adriaan Joseph, 2205 W. Adams St., Los Angeles, California 1939
Van Strum, Miss Caroline, 3122 15th Ave., S., Minneapolis 7, Minnesota..1944
**Van Tyne, Mrs. C. H., 315 S. Division, Ann Arbor, Michigan 1939
***Van Tyne, Josselyn, Museum of Zoology, Ann Arbor, Michigan 1922
*Vaughan, William Coleman, 591 Ashland Ave., Buffalo, New York 1938
Velich, Ralph W., 5212 S. 23rd St., Omaha, Nebraska 1941
Vesey, W[illis] Glenn, 102 E. High St., Painesville, Ohio 1943
Vesey-Fitzgerald, Brian, Red Ridge, Burley, Nr. Ringwood, Hampshire, England 1944
*Visscher, Dr. Paul, Biology Laboratory, Western Reserve University, Cleveland, Ohio 1924
*Vogt, William, % Mrs. F. V. Brown, 32 Cunningham Ave., Floral Park, New York 1935
*Vollmar, Mrs. Joseph E. 6138 Simpson Ave., St. Louis, Missouri....1941
*Wade, Douglas E., Dartmouth College, Hanover, New Hampshire 1936
Wagner, Miss Esther Elizabeth, 13 Locust Ave., Danbury, Connecticut...1937
*Wagner, Nancy Elizabeth (Mrs. C. R.), South Lane Farm, Utica, Ohio..1944
*Walker, Dr. Charles Frederic, Stone Laboratory, Put-in-Bay, Ohio 1939
Walker, M[yrl] V[incent], Yosemite National Park, California 1943
***Walkinshaw, Dr. Lawrence Harvey, 1703 Central National Tower, Battle Creek, Michigan 1928
Wallace, George John, Zoology Department, Michigan State College, East Lansing, Michigan 1937
Wallner, Alfred, % University of Wisconsin Medical School, Madison, Wisconsin 1941
Walters, Miss Kathleen, 312 Crane, Royal Oak, Michigan 1944
Wampole, John Henry, Callaway, Nebraska 1944
Wandell, Willet N[orbert], 425 S. Pleasant St., Amherst, Massachusetts ..1944
Wangnild, Miss Lillian M[arie], 2818 Gaylord St., Denver 5, Colorado ..1943
Wanless, Dr. Harold R[ollin], 704 S. McCullough St., Urbana, Illinois ..1940
*Watson, Dr. Clarence W., Box 833, Atlanta, Georgia 1943
Watson, Frank Graham, % Shell Oil Co., Cactus Ordnance Works, Dumas, Texas 1937

Watson, Robert James, Box 75, Blacksburg, Virginia 1943
*Weaver, Dr. Richard Lee, Audubon Nature Center, R. 4, Greenwich, Connecticut 1936
Weber, Edmund P[eter], 95 Ingram Ave., Pgh. No. 5, Ingram, Pennsylvania 1942
*Weber, Orlando Franklin Jr., 5370 Los Feliz Bldg., Hollywood 27, California 1936
Webster, Lt. J[ackson] Dan, 2381 Thornton, Newark, California 1939
Webster, [Noah] Randall, 341 Western Ave., Brookville, Pennsylvania ..1940
Webster, Victor S[tuart], College Station, Brookings, South Dakota ...1944
Weingart, Vernon Rolland, R. 1, Kent, Ohio 1940
Welles, Mary Pyke (Mrs. George M.), Magnolia, Delaware 1938
**Wernicke, Mrs. Julius F., Gull Point, Escambia Co., Florida 1944
Wester, Russell William, 112 Prospect St., Nutley, New Jersey 1942
Weston, Robert, Salmon Pool Farm, Brewer, Maine 1944
*Wetmore, Dr. Alexander, U. S. National Museum, Washington, D. C. ...1903
*Weydemeyer, Winton, Fortine, Montana 1930
*Weyl, Edward Stern, 6506 Lincoln Drive, Mt. Airy, Philadelphia, Pennsylvania 1927
**Wheatland, Miss Sarah B[igelow], 211 Main Hall, Vassar College, Poughkeepsie, New York 1942
White, Claude, 940 W. 6th St., Box 1001, Plainfield, New Jersey 1944
White, Courtland Y., Box 31, Bennett Hall, University of Pennsylvania, Philadelphia, Pennsylvania 1942
*White, Francis Beach, Silk Farm Rd., R. 2, Concord, New Hampshire ..1926
*White, Miss Katherine A[ugusta], R. 2, Collinsville, Illinois 1940
White, Miss Marcia R., 5626 Dorchester Ave., Chicago 37, Illinois 1944
*Whitney, Nathaniel Ruggles, Jr., 975 Willow Ave., Glendale, Ohio 1942
*Whittier, Mrs. Lida, 2830 E. 130th St., Cleveland 20, Ohio 1943
Widdicombe, Harry T., 439 Fulton St. S.E., Grand Rapids 3, Michigan ..1943
Widmann, Berthold, 4621 Wesley Ave., Los Angeles 37, California 1936
*Wiggin, Henry Taylor, 151 Tappan St., Brookline, Massachusetts 1941
Wilcox, Harry Hammond Jr., 1025 Vaughan St., Ann Arbor, Michigan ..1938
Wilcox, LeRoy, Speonk, Long Island, New York 1944
Wiles, Harold O[liver], 26 Boxwood Ave., Wilmington 177, Delaware ..1936
Wilkowski, William Walter, 119 Bronson Court, Kalamazoo 12, Michigan 1943
*Willett, George, Los Angeles County Museum, Exposition Park, Los Angeles 7, California 1944
*Williams, Laidlaw Onderdonk, R. 1, Box 138, Carmel, California 1930
*Willingham, Robert Shealy Jr., Lafayette, Alabama 1944
Willis, Miss Myra G., 953 28th St., S.E., Cedar Rapids, Iowa 1944
*Wilson, Archie F[rancis], 1322 Braeburn Rd., Flossmoor, Illinois 1937
Wilson, Bruce Vernon, Okemos, Michigan 1943
Wilson, Mrs. Carl, 11285 Lakepointe, Detroit 24, Michigan 1941
*Wilson, Dr. Gordon, 1434 Chestnut St., Bowling Green, Kentucky 1920
Wilson, Harold Charles, Ephraim, Wisconsin 1938
Wilson, Myrtha M. (Mrs. Henry E.), R. 3, Raleigh, North Carolina 1942
Wilson, Lt. Rowland Steele, % Otto Heaton, Apt. 1854, Deshler-Wallick Hotel, Columbus, Ohio 1941
Wiltshire, Mrs. Grace T., Randolph-Macon Womans College, Lynchburg, Virginia 1941
**Wineman, Andrew, 150 Michigan Ave., Detroit, Michigan 1934
Wing, Harold F[rancis] R. 3, Jackson, Michigan 1941
*Wing, Dr. Leonard [William], State College, Pullman, Washington 1924

Winterbottom, J[ohn] M[iall], African Education Office, Box 150, Livingstone, Northern Rhodesia 1939
Wistey, Mrs. A. L., South English, Iowa 1944
Wolfling, Cyril T[homas], 29 Gerhardt St., Buffalo 8, New York 1944
Wolfson, Dr. Albert, Department of Zoology, Northwestern University, Evanston, Illinois 1944
*Wood, Dr. Harold Bacon, 3016 N. Second St., Harrisburg, Pennsylvania .1932
Woodward, Arthur Jason, 504 Kahkwa Blvd., Erie, Pennsylvania 1937
**Woodward, Miss Barbara, 150 Central Park South, New York City 19 ..1943
*Worley, John G[raves], 237 Charleston St., Cadiz, Ohio 1936
Wright, Miss Audrey Adele, 1312 Hepburn St., Louisville, Kentucky 1941
Wright, Lt. Col. Dana [Monroe], State Game Farm, St. John, North Dakota 1943
Wright, Ernest Bicknell, 140 W. Chestnut Ave., Chestnut Hill, Philadelphia, Pennsylvania 1941
*Wright, J[ohn] T[homas], R 5, Box 665, Tucson, Arizona 1941
Wright, Philip L[incoln], Montana State University, Missoula, Montana 1940
Wright, Thomas Jr., Box 56, Wakefield, Rhode Island 1939
Yeager, Lee E[mmett], Illinois Natural History Survey, Urbana, Illinois .1939
*Yeatter, Dr. Ralph Emerson, Illinois Natural History Survey, Urbana, Illinois 1932
Young, J. Addison II, 93 Argyle Ave., New Rochelle, New York 1942
**Young, James Boswell, 2516 Talbott Ave., Louisville, Kentucky 1937
Zempel, Arnold, 6623 Kingsbury Ave., University City 5, Missouri 1941
*Zimmerman, Dale, 480 N. Almont St., Imlay City, Michigan 1943
*Zirrer, Francis, R. 3, Hayward, Wisconsin 1943

REPORT OF THE AUDITING COMMITTEE

The Auditing Committee has checked and approved the accounts and financial reports, as published in *The Wilson Bulletin* for March, 1944, of Gustav Swanson, former Treasurer of the Wilson Ornithological Club, and of Milton B. Trautman, Treasurer for 1943.

Respectfully submitted,
THOMAS H. LANGLOIS
CHARLES F. WALKER

November 7, 1944

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The following gifts have been recently received. From:

Frederick M. Baumgartner—5 reprints.
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Hustace H. Poor—1 reprint.
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Gustav Swanson—1 book, 197 journals and reprints.
Laidlaw Williams—7 reprints.

INDEX TO VOLUME 56, 1944

In addition to names of species and of authors, this index includes references to the following topics: albinism, bathing, bibliography, conservation, courtship, distribution, food, localities by states and countries, longevity, melanism, migration, molt, nesting, new forms noticed, parasites, parasitism, physiology, plumage, polygamy, population, predation, roosting, sex ratio, taxonomy, territory, voice, weight.

NEW NAME PROPOSED IN VOLUME 56: Phoenicopterus ***stocki***, 77

TO OUR CONTRIBUTORS

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