Dues for 1937

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Members who may wish to assist the Club may bring the WILSON BULLETIN to the attention of the local Library or High School. All additions to our subscription list will aid in making a larger magazine.

In behalf of the officers of the Club the WILSON BULLETIN extends the greetings of the Season to all of its readers.

THE
WILSON BULLETIN

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of Birds in the Field
and the Official Organ of the

WILSON ORNITHOLOGICAL CLUB

Edited by

T. C. Stephens O. A. Stevens

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1937

Published Quarterly
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Sioux City, Iowa

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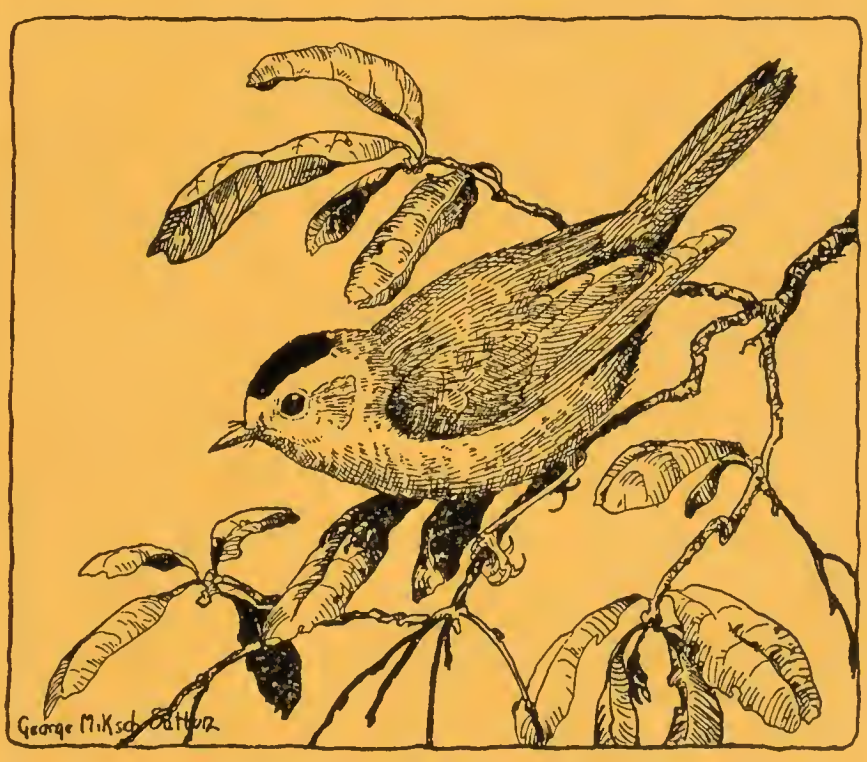

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CONTENTS

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THE WILSON BULLETIN

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BARROW'S GOLDEN-EYE IN THE YELLOWSTONE NATIONAL PARK

BY M. P. SKINNER

Records of the Barrow's Golden-eye (*Glaucionetta islandica*) in the Yellowstone, are very similar to what they have been elsewhere—largely neglected. Since this bird was both resident at all times, and abundant at least in summer, I can explain the neglect only by saying a Golden-eye, as usually seen in summer when the majority of scientists visited the Park, had few distinctive marks. It then passed as a small, unimportant black, or very dark brown, duck.

Knight (1902) mentions it as occurring in Wyoming but does not record it in the Yellowstone National Park. A year later, President Theodore Roosevelt just missed being the first to record Barrow's Golden-eye there. In his "Wilderness Reserves" he says that he noted ducks on the Gardiner River on April 8, 1903. On that date, only these Golden-eyes and Mallards were likely to have been there in numbers. As he does not particularly say "Mallards", it can be assumed that he saw other kinds, probably these Golden-eyes, or perhaps both Golden-eyes and Mallards.

My own reaction to the presence of Barrow's Golden-eyes has been similar—one of neglect and silence. I first actually saw them during an extensive trip on Yellowstone Lake in 1898; yet it was not until seventeen years later that I even mentioned their name in an article. And still five more years passed before I wrote out a description, and a few additional words, in 1920.

At the end of this article there is a bibliography of twenty-one titles, of every article that I can find mentioning the bird in Yellowstone Park at all. Most of them give but a few words each; and, aside from historical and bibliographical completeness, many can be neglected. Bent (1925), Sawyer (1928), and the present paper contain all the essential material published to date about Barrow's Golden-eyes in the Yellowstone.*

*An important article by Allan Brooks, in the Auk, 1920, pages 356-365, should also be consulted.

In the spring and early summer, it was easy to identify the drakes by the purple color of their heads and their white cheek crescents. But during most of the summer and the fall, and including all of what was known as the "Park season", the drakes then in eclipse plumage had few distinguishing marks, to say nothing of the decidedly unmarked females and young (even the young drakes did not assume breeding plumage until approximately sixteen months old). It was not until October (October 14 in 1922) that the adult males resumed distinctive plumage, although it developed rather rapidly after that.

Because descriptions of the topographical and climatic features that affect Yellowstone bird life have already been given in the Wilson Bulletin for December, 1927, and September, 1928, they are not repeated here. But it will prove advantageous to bear in mind that the Transition, Canadian, and Hudsonian Zones cover large areas in Yellowstone Park, and that the first two are generously supplied with water—ponds, lakes, and rivers. Mr. Sawyer's paper (1928) deals with the Barrow's Golden-eyes at Ice Lake. While the present author has made many studies at Ice Lake, both earlier and later than he did, Mr. Sawyer has covered so well that locality, and the whole subject of courtship there, that repetition here is carefully avoided. Mr. Sawyer's valuable article should be read with this one in order to have a complete picture of the whole.

While I really thought that these Golden-eyes preferred the larger lakes and streams, I often found them on smaller bodies of water in all parts of the Park. But I saw so many far out from shore on Yellowstone Lake, and on the Yellowstone River just below the Lake, that I learned to look upon those two locations as more representative. Still, in spring, they frequented small ponds and the open water that first gathered at the edge of the ice of larger lakes; and in summer, I found them on virtually all the well known Park waters, even on beaver ponds. They usually preferred to remain on the water; but sometimes they climbed out on a boulder to preen or sun themselves, or lined up on a sand beach or gravel bar, almost in the breaking waves, for the same purpose. In winter, they stayed on the partially frozen reservoir near Mammoth Hot Springs, on the rapid water of the Yellowstone River, along the open Gardiner River, and on other waters kept open by hot spring and geyser water.

Usually these ducks were seen one or two at a time; or, in the proper season, a family party. But on one occasion, I noted a compact flock of a hundred individuals well out on Yellowstone Lake. When in pairs, it was the female that took alarm and flushed first. A

seeming exception to this rule was a pair on the Gardiner River on April 8, 1923, when the male flew away first. But this was no doubt due to the female being still under water, and not seeing me, when I suddenly revealed myself to the male.

Although Barrow's Golden-eyes were normally ducks of the lakes and other still waters, they were well able to negotiate the swift waters of rivers. In fact, they seemed to take delight in coasting down the rapids. While doing so, they frequently allowed themselves to be washed over "falls", dropping as much as three feet, and at the bottom even going temporarily out of sight in the foam and spray without showing the slightest concern. Sometimes, I thought they intentionally flew up the Gardiner for the purpose of coasting down. Still, as they came down, they fed; and food might have been the real reason of the floating trip. At times, during the descent, these birds took advantage of an eddy, or of quiet water behind a rock, to rest and preen. Even on the much larger Yellowstone River, I noted that these Golden-eyes actually seemed to favor the roughest water. Neither were they afraid of ice. On November 14, 1922, when the anchor ice was freely running in the Yellowstone River below Alum Creek, these ducks were the only ones among a dozen species to be dodging in and out, and diving under, the floating cakes.

As a rule the Barrow's Golden-eyes in Yellowstone Park became extraordinarily tame on waters close to main highways; they even appeared entirely unconcerned when the biggest autos along the Gardiner River went thundering past within a hundred feet. But even there they regarded with suspicion an auto *that stopped*. When I approached them too closely, either on foot or on horseback, they swam away, or disappeared down the rapids, instead of flushing as soon as the nearby Mallards did. But if they were forced to flush, they only flew a short distance, and soon came back again without apparent hesitation or fear.

I do not know that these Golden-eyes had any more curiosity than other ducks, but I have seen them come swimming across Swan Lake when they caught sight of me in the bushes on shore. And I once had a similar experience at Twin Ponds, near Junction Butte, and again on the Yellowstone River at the mouth of Alum Creek. In the first instance, there were a dozen Barrow's Golden-eyes scattered over the Lake; but there was only one pair at Twin Ponds. On the other hand, the mouth of Alum Creek was alive with many individuals of several species of water-birds.

I doubt if the Barrow's Golden-eyes ever sought the soeiety of other waterfowl, but eommon interests and tastes brought other speeies near them. For instanee, I have seen individual Coots, Mallards, Green-winged Teals, Mergansers, Buffleheads, Ruddy Dueks, Redheads, Canvasbaeks, Bluebills, and White Pelieans in the neighborhood of Barrow's. Oeeasionally in winter, Ameriean Golden-eyes and Barrow's were aeeidentally near eaeh other, but more often the two speeies kept entirely apart. I have seen both beavers and muskrats on the same pond with Barrow's Golden-eyes, but so far as I eould see, eaeh of the different speeies swam along about its own business, merely eareful to avoid eollision with any other individual.

Nesting in hollow trees as they did, the Barrow's Golden-eyes' eggs were eomparatively safe from enemies. I did not observe that any of the hawks, owls, or eagles preyed on these Golden-eyes. But all the fur-bearing mammals, smaller than the wolf, hunted them more or less, with rather indifferent sueeess, beeause these dueks usually kept well out of reaeh. However, on one oeeasion (Deeember 3, 1922), I found the remains of a drake on the shore of Gardiner River. Some animal, probably a mink, had fed on the body, but I eould not determine whether it had killed the bird, itself, or had found it already dead. Or, this might have been a wounded bird, as the plaee was only a mile or so from permissible shooting territory outside the Park.

As a rule, the flight of these dueks was low, not more than three to four feet high. When rising from the water, their progress seemed labored at first. If the air was ealm, or the wind was light, they were often eompelled to kiek the water for the first twenty or thirty wing strokes. Sometimes, along the Gardiner River, where the average deseent of the water surfaee, due to the rapids, was five degrees, or less, from the horizontal, I have seen them start up the river, finding the rising too difficult, and later strike the water a resounding splash when they fell baek. But if they had a strong wind blowing down the river, they rose easily against it, and might then fly at a greater height, even as mueh as thirty or forty feet above the water. Once, when I was going up a narrow stream, with the wind blowing *up stream*, I suddenly found a half dozen Barrow's Golden-eyes before me. They dared not fly up into my faee, they eould not rise at all with the wind, and the canyon we were in was too narrow and high to fly out of sideways. So they were obliged to swim down past me, no doubt eloser than they liked, and then flush behind me. On broad, open waters these ducks always flew up against the wind, if at all possible, and later swung around in the direetion they wished to go. In sueh plaees,

they had much less difficulty in rising, probably because there was generally some wind. Apparently, even against a breeze, these Golden-eyes could not jump up as the Mallards so frequently did. But once under way, the flight of Barrow's Golden-eyes was swift, steady, and powerful, giving rise to a peculiar whistling sound that earned them the name of "Rocky Mountain Whistlers".

While the majority of these ducks that were in the Park during the summer migrated south when their home waters began to freeze, a few remained along the Yellowstone River, the Gardiner, and some other waters. The Yellowstone was large enough, and rapid enough, so that it always remained open in places. On the other hand, the Firehole, Gibbon, Madison, Snake, and Gardiner Rivers, being much smaller, would undoubtedly have frozen if it had not been for the large quantities of thermal water discharged into them.* It seemed very wonderful that there should be enough natural hot water to keep these streams open, for the rivers named remained clear of ice, even when the temperature was far below zero. When the temperature of the air fell to near the freezing point, vapor appeared above these waters. As the degree of cold increased, this vapor became denser and denser until it was really a heavy fog for a few feet above the water, at extremely low temperatures. So far as I know, this visible vapor did not affect the Barrow's Golden-eyes in any way, but the warmer water did undoubtedly increase the food—both vegetable and animal—over what would have been available otherwise. Minute vegetation flourished as luxuriantly all winter in the warmed water as it did in summer; and in places, insects actually persisted at all times close to the warm water!

Ordinarily, these Golden-eyes did not summer along the Gardiner; but they appeared there each autumn at the time the larger ponds and lakes closed over. In 1922, the first of the season came to the water supply reservoir at Mammoth Hot Springs on October 15, and on the Gardiner River a month later on November 11. Those that wintered along the Gardiner, 1920-1921, began leaving about February 25, or about the time that the first open water appeared along the edges of ponds and lakes—the waters supplied with spring water that was somewhat warmer than the snow then beginning to melt a little during the warmest part of the day, being the earliest to open. First to leave the Gardiner that year were the males, followed one by one by the

*The Gardiner River, for instance, was usually frozen in winter above the mouth of Boiling River, where the accumulated hot waters from Mammoth Hot Springs discharged themselves into it; but it was always open below.

females and immature, until the last one left on March 2. But a cold, freezing spell brought a female back on March 7; and others returned later until there were six drakes and five females on the approximately three miles of open river water, on March 12. Then they decreased in number again, gradually. By March 24, they were abundant at the outlet of Yellowstone Lake, forty miles away and a thousand feet higher in altitude, about 7700 feet above sea level. No doubt, some of the Golden-eyes gathering at the Lake outlet came from other wintering grounds, although they had all probably spent the winter within the Park, for all were very tame. A month later, during the last week in April, some much wilder birds arrived, indicating that the flight from more southern, unprotected waters, had begun.

Usually, Barrow's Golden-eyes fed by diving, even going far under the ice of partly closed ponds and streams, and later returning unerringly to the open portions when they wished to regain the air. While feeding on the bottom, these ducks kept their bodies comparatively motionless while their heads and necks swung from side to side below them in their search. At least once, I found a swimming female feeding along the Gardiner in shallow water by thrusting her head under; but on getting into deeper water, she stopped feeding, and did not attempt to "tip" as Mallards do.

These Golden-eyes bathed by rising in the water until almost standing on the surface, scooping the water up with bowed wings and throwing it forward and over them. After from five to fifteen of these "showers", they plunged head and neck under, shooting forward and shaking themselves at the same time so that a thin film of water ran over the shoulders and down the back. Generally, they preened while on the water, if not too rough, turning far over on one side or the other to get at those parts of their plumage that were ordinarily under water. In windy weather, or when the surface was rough, they gathered in protected bays and coves, or on smaller ponds and streams, to do their bathing and preening.

During the first part of the winter, the females along the Gardiner River outnumbered the drakes—three to one. While I did not learn where they came from, more and more drakes arrived as spring approached, and the two sexes gradually became more nearly equal. By the first of February there was a marked tendency to pair off, courtship beginning at this time and lasting until June in some cases. Almost all flocks were broken up by April, even on the ponds and small lakes where the birds now were. On waters other than Ice Lake, I found the courting differing in small particulars from the procedure

as given by Mr. Sawyer (1928). While the drakes always did most of the "chasing" and the "dancing", the females usually responded, often bobbing rapidly up and down so as to send a widening series of circular waves chasing each other across the water. Sometimes, I saw a male swim jerkily along, not necessarily toward the female, with an occasional extra effort raising his breast high above the water, and at the same time the bill pointing upward, and opening and shutting twice. Then the head was drawn far back until it rested on the lower back. After remaining there a moment, the head was returned to normal; and the drake that had been swimming forward all the time kicked backward and upward, a little spurt of water. Often a male pursued a female with *his* head and neck extended out in front just above the surface and parallel with it. Of course some of these variations may have been due to individualism as Mr. Sawyer also pointed out.

The breeding range of this species is usually given as the far north, without recognition of the extensive breeding range extending south along the Rocky Mountain backbone as far as Colorado. Although the fourth edition of the A. O. U. Check-List does not mention Wyoming at all, the Barrow's Golden-eye was actually the most abundant breeding duck, with the possible exception of the Mallard, in the Park.

Here the Barrow's Golden-eyes made their nests and laid from eight to twelve eggs in May, at the lowest elevations in the Transition Zone, as at Ice Lake at about 5700 feet altitude. But most of the resident Golden-eyes nested in the Canadian Zone, where the first eggs were laid in early June; and there were even a few sites in the Hudsonian Zone above 8500 feet elevation where eggs were still a little later. All nests that I found were in hollow trees, either standing on the shore, or within a hundred feet, of lakes, small natural ponds, beaver ponds, or streams. So far as I know, the females did all the brooding. After hatching, the mothers took entire care of the young while the males spent their time elsewhere, recovering from the molt. Some of the broods were large enough to fly by the end of July, as was the case at Twin Lakes, near Norris Geyser Basin. On the other hand, I once found a backward brood of partly grown ducklings following their mother across a backwater near Yellowstone Lake on August 8.

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While I have not named any article from it in the above list, there is an important mimeographed serial, issued by the National Park Service in Yellowstone Park, from six to twelve times a year, called the "Yellowstone Nature Notes". These Nature Notes contain many valuable references to all birds of the Park, but it is rather hard to refer to them, because it is quite difficult to locate a complete file.

Long Beach, California.

WHY BIRD SONG CAN NOT BE DESCRIBED ADEQUATELY

BY ALBERT R. BRAND

Almost as soon as a bird student delves into the subjeet of song, he discovers that it is extremely diffieult—in many cases impossible—adequately to describe song. Of course the limitations of language are such that many songs are impossible of description; whistling can be attempted in a few cases, but we have no method of transcribing whistling to paper; musical notations are almost useless. There are only a few songs that lend themselves to this type of transcription. Onomatopoetic words or phrases definitely help in a limited number of cases; the Whip-poor-will does seem to say those words. But in the vast majority of eases it is absolutely impossible to deseribe or write down what the bird sound is so that it can be intelligible to any person except, perhaps, the writer himself.

Why this is, seems difficult to determine. Bird songs, in many cases, are quite constant. We can recognize them every time we hear them, yet we cannot describe them. Examples of constant songs, cases where eaeh male of the species sings a song very like other males of the same species, are numerous. The songs of many of the flyeatchers and some of the warblers are examples. The songs of such species as the Phoebe, Alder, Yellow-bellied, and Olive-sided Flycatchers, are very similar in most birds of the species; and the songs of the Black-throated Green and the Mourning Warblers, and the eommoner song of the Chestnut-sided Warbler are essentially alike—each species' member's songs, much like his brother's—yet they can not be intelligibly described.

Of course, there is the method of using catch phrases, "Poor Sam Peabody Peabody Peabody", for the White-throat's song, "Cheerily cheer up eheer up", for the Robin, "Sweet-sweet-sweet-I'll-switch you" or "Very very pleased to meet you", for the Chestnut-sided; but no one claims that these are adequate descriptions. They are aids in praetieal identification, and as such are useful; that is all.

If, however, we attack the problem from a slightly different angle, we may understand why adequate description is really impossible. It is not a question of what sound is made, but what is heard. Hearing differs, in all probability quite markedly, from person to person. In the range of ordinary sound, these individual differenees are rarely noticed; but in bird sound the range of frequency is quite different from other common sounds. The average fundamental frequeney of most bird song is about 4000 double vibrations, approximately the

highest note of the piano keyboard; and many bird sounds are pitched in the octave between 4000 and 8000 double vibrations. Practically no other sounds of everyday life are pitched as high as bird song; certainly nothing musical or melodious approaches this range.

Individual hearing differs from person to person, and especially is this true as the pitch of the sound rises. In a recent experiment at Cornell University the hearing of some sixty persons, ranging in age from fourteen to sixty-six, was tested, in an attempt to discover how high they could hear. Most of the subjects were between the ages of eighteen and twenty-five. The results were similar to those usual in such tests. The younger people heard better; they perceived higher vibrations than did persons in middle life or later. The curve was quite normal; but what impressed the writer, who personally made a number of the tests, was that there were spots of apparent fading in a great number of the subjects: and these fading areas were not necessarily at a very high pitch; sometimes they occurred as low as 4000 double vibrations; at other times, at 6000, 12,000, or 15,000; sometimes a person who could hear quite clearly the highest pitch to which the oscillator was tuned, 17,000 double vibrations, had two or three fading areas, some of them, an octave or two below the high. Occasionally a person could not hear, at all 12,000 or 15,000, yet heard 17,000 perfectly well.

The variations in the fading point of the subjects were many and seemed to follow no obvious rules. They were noted in the higher ranges, at or above 4000 double vibrations. They might occur anywhere from 4000 to 17,000. Now within this range are many of the bird songs that are difficult to describe.

It is apparent that individual variation in hearing is very great: in addition, hearing and psychology are very closely allied; practically always there enters into hearing the psychological factor. We hear what we are listening for, and what we expect to hear. We can not, try as we will, hear objectively; it is impossible to separate the hearing apparatus from the thinking mechanism—the ear, from the brain. Hearing is a decidedly subjective function. Then if we remember that probably in no two people is hearing exactly the same, we will readily conclude that this, the subjectivity of hearing, is the reason why no two persons describe bird songs in exactly the same way. They do not hear them in exactly the same way; it would be absurd to expect them to describe them similarly.

A few examples of these subjective interpretations of bird song will serve to make the point clear. To the writer, the songs of the

Alder Flycatcher and the Phoebe are quite similar. The former has a three-note song; the latter a two; but the quality, to my ear, of both songs is very similar; in fact, one of our earliest film recordings of bird songs was made of an Alder Flycatcher which was mistaken for a Phoebe with a slightly peculiar three-note song. Not until the film had been processed and played back was it realized that the Alder Flycatcher and not the Phoebe had been recorded. Today, I never hear an Alder without being reminded of a Phoebe; probably my earlier confusion of the two songs has an unconscious effect upon my perception; be that as it may, I see a striking resemblance between these two songs. On the other hand, the three-note song of the Olive-sided Flycatcher, syllabized by Hoyes Lloyd as "Tuck three beers", has nothing in common with the Alder Flycatcher's song, so far as I can see. Its quality is different and distinct. The Olive-sided's song is shrill and clear; the Alder's is buzzy; its feature is a furry quality, a hoarseness suggestive of the Phoebe; at least that is my interpretation; yet Dr. Arthur A. Allen tells me that the Olive-sided's song and that of the Alder, to him, are quite similar. I cannot see the similarity in the least; yet I am forced to conclude that we are both right! The Olive-sided and Alder do sound alike—to one with Dr. Allen's hearing and thinking apparatus; the Alder's and Phoebe's notes are similar to a person with my make-up; to one with Dr. Allen's, they are quite dissimilar.

Numerous examples could be cited; to some careful observers' ears the notes of the Wood Pewee and Yellow-bellied Flycatcher are quite confusing; to others, they are not at all similar. There is no question here of inaccurate or careless observation; it is patently a case of difference in interpretation.

While playing a phonograph record of the song of the Western Meadowlark for Dr. James P. Chapin—a song that Dr. Chapin had never heard in life—his reaction was that here was a song that showed the relationship of the Meadowlarks to the Icterids. In the Eastern bird, he had never noted the peculiar strain. When he called this to my attention, I imagined or believed I saw this family resemblance in the Western Meadowlark's song, but it certainly was not the most important or characteristic feature of the song.

One of the values of bird sound photography—the recording of bird song on film—on the phonograph records made from such pho-

tography, is that it reproduces the song essentially as it is heard. The reproduction is not, in all cases, perfect; certain mechanical difficulties in reproduction, especially in the high frequencies, are often present. Even if a perfect piece of film is produced, getting the sound off requires a machine of excellent quality, able to reproduce frequencies of extreme height. Few machines in motion picture houses do not lose accuracy at 7000 double vibrations and even lower. In phonograph reproduction the same difficulty is met but it is more pronounced. Even the best commercial phonographs are not strictly accurate above about 5000 double vibrations. But even accounting for these discrepancies, the mechanical reproduction of photographed bird song has the advantage that it reproduces with more or less fidelity, what is heard by the human ear. We hear about what we would in the field; and it is interesting to note that the subjective reaction of the listener is much the same as in the open. Thus when they are mechanically reproduced, Dr. Allen hears in the songs of the Olive-sided and Alder Flycatchers the same similarities that he notes as peculiar in the field: while to me, the Phoebe's and Alder Flycatcher's songs, when reproduced in the laboratory, do not differ materially, and I note the same resemblances that always appear when I hear the birds in life.

In conclusion, I wish to advance the thought that probably the reason for the innumerable different and conflicting descriptions of the same song with which the literature of ornithology is replete, is, that rarely do two observers hear the same song in exactly the same way. The song is not noticeably different when produced by varying members of the species, but by the time the sound waves have affected the listener's hearing apparatus, and have been transferred by the nerves to the brain, and interpreted by that organ, it has created an entirely different sensation and impression on each individual listener. The cause of these differences is the differing receiving apparatus and psychological make-up of each individual listener. Bird song interpretation is a subjective phenomenon; interpreting what is heard can only be done subjectively.

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FURTHER NOTES ON A VERY OLD CARDINAL

BY ALBERT F. GANIER

In previous issues of this journal (December, 1933, December, 1934, and December, 1935) I have given the history of a male Cardinal, banded by me at my home on February 12, 1924. I am glad to be able to say that at this writing (November 10, 1936) the bird is still living and is therefore more than thirteen years old. So far as I am able to learn, it is the oldest known small wild bird.

It will be recalled that the winter of 1935-36 produced some of the coldest weather on record including subzero temperatures here, and that the drouth of the past summer was particularly severe, yet this bird came through in good condition. There are unmistakable evidences of age however. When feeding at his shelf he does not stand erect with head held high 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 neck is exposed. Molting has become slow and tedious; at this writing there is still a ragged appearance on the upper breast. During the drouth he was much troubled with mites until I trapped him and dusted his feathers with insect powder. After the nesting season this year his pugnacity has been entirely lacking. The song of spring and summer was regular though somewhat subdued.

In the last instalment, I recorded that this male mated with a young female early in April, 1935, on the day after his former mate was killed. The two remained mated through that year and through the present season. The pair remained together all during the winter of 1935-36, roosting on branches under the eaves of the garage and visiting the feeding shelf together for their breakfast each morning. With the first signs of spring in February, the male demonstrated the awakening of a devotion for his mate by feeding her at the shelf. This has occurred each year at this season. Their first nest was begun on March 28 in a bush-honeysuckle shrub, thirty feet from the house, and on April 18, the female began sitting on three eggs. These were immediately taken, presumably by a grackle. (The shrub at the south window, which has held the male's first nest for many years, was not chosen this year, possibly because another pair of Cardinals were prospecting the site at the time). The second nest was built six feet up in a lilac shrub close to the dining room window. It was begun on April 20 and finished in a week. Incubation, always by the

female, began on May 1 and on the 15th the nest was seen to hold three small young. A high wire guard was placed around the shrub but on the night of May 19, a cat climbed this, pulled the nest over and ate the young. At 8 A. M. the female was seen to fly to the wrecked nest with a large green worm, not yet able to realize the young were gone.

Ten days later the male was observed to be particularly attentive to his mate, feeding her constantly from the grain on the shelf. The long drouth, which dated from April 9, was already making itself felt however and, apparently sensing its continuance, no new nest was begun. The drouth broke on July 2 with copious rains but a nest had been finished a few days before and the female had begun incubation on July 1, on three eggs. This nest was built eight feet up near the top of a privet, against the house next door. Here success finally crowned their efforts and three healthy youngsters left the nest late in the afternoon of July 20. Two of the young were taken in charge by the female and one by the old male. The former were constantly about the premises until the young had fully reached maturity when they supposedly joined a wandering flock of a dozen birds. The old male and his charge soon left the premises and were absent through most of August and September though showing up occasionally. On August 3, a male Towhee whipped him off the shelf, whereon he had regularly breakfasted for years, and from that day to this he has not been seen to return to it. He has taken up quarters in shrubbery at the opposite end of the house, adopted a new feeding shelf there, lost the youngster he raised and became a hermit. He pays no attention to his mate of the past two years. She feeds regularly at the old stand but also keeps to herself and it remains to be seen whether the companionship of last winter will be resumed when the leaves are gone. The constant care and feeding of the late hatched and perhaps wayward fledgling seems to have thrown the old male entirely off his former manner of living.

Addendum. (February 15, 1937). I regret to add that the old Cardinal has not been seen since November 20. And while it is possible that he may have established quarters elsewhere, it is more probable that, having become senile and inactive, death has befallen him. Should he return I will report in this journal. The female continues her daily breakfast at the old shelf, usually accompanied by her new mate.—A. F. G.

Nashville, Tenn.

A WILSON MEMORIAL

BY BAYARD H. CHRISTY

A reeeipt-book kept by Alexander Wilson preserves the rceord of work done on plates for the "American Ornithology"—engraved plates, eolored by hand. The book was an item of a colleetion of Wilson memorials displayed at Pittsburgh, in conneetion with the meeting there of the Wilson Ornithologieal Club in Deeember, 1935. It eame from the Thayer Collection and was eourteously loaned by the Museum of Comparative Zoölogy, in Cambridge, Massachusetts.

It is a humble reeord—a slender book in faded, marbled-board eovers. five inches by seven and a quarter in size, containing six leaves, twelve pages. The earliest entry is one of January 9, 1810; the latest, February 16, 1811. The thirteen months that intervened between those dates were the most notable in the story of Wilson's *magnum opus*. When, early in 1810, the second volume had appeared, the enterprise was still in equivoeal ease: the element of doubt was large, whether the purpose and hope of this amateur earried with them substance such as to beeome value reeeived in the hands of an adequate number of subscribers. But in the round of the following year Wilson extended somewhat the list of his subseribers, enlarged in mueh greater measure the store of his data, brought to completion his third volume. and gained for the undertaking in its commercial aspect a very mueh wider and surer recognition. Thereafter the story is one of the plodding heavy work of actual performanee.

The receipts that this book contains are written in Wilson's hand and are severally signed by the payees. There are thirty-seven receipts. given by ten persons, for the aggregate amount of $1.657.35½. Here (September 3, 1810) appears Alexander Lawson's vigorous signature, set down in acknowledgment of $229, payment "in full for engraving the four first plates of Vol. Third of American Ornithology": here (February 6, 1811) appears George Murray's acknowledgment of the receipt of $25, for "etching and work done on the Carolina Parrot". (The Carolina Parrot plate is the eighth of the nine plates of the third volume). In a letter written six days later (Grossart, LXXXVI) Wilson said, "I have now no farther dependence on Murray; and I mean to make it consistent both with the fame, and the interest, of Lawson to do his best for me."

Here are receipts given by Joseph Brown, for printing in all 5.838 prints, chiefly from the nine plates of volume three; and here are the receipts given by the artists for coloring 4.868 of these prints. The engraving of a plate eost Wilson from $50 to $60; the printing,

1.6 cents a print; and the coloring, 25 cents a print. The seven colorists whose names appear are Alexander Rider, John H. Beck, E. Leslie, Anna C. Peale, John H. Hopkins, Louise Adelersterren, and Prosper Martin.

Alexander Rider was, according to Miss Lavinia Lawson (a daughter of the engraver), "the artist who undertook the coloring of Wilson's first edition"; he was, she says, "a Swiss painter in oils."[1] Dunlap thought he was a German, from Würtemberg[2]; but Mr. Frank L. Burns, who is well qualified to speak, seems to think that Miss Lawson

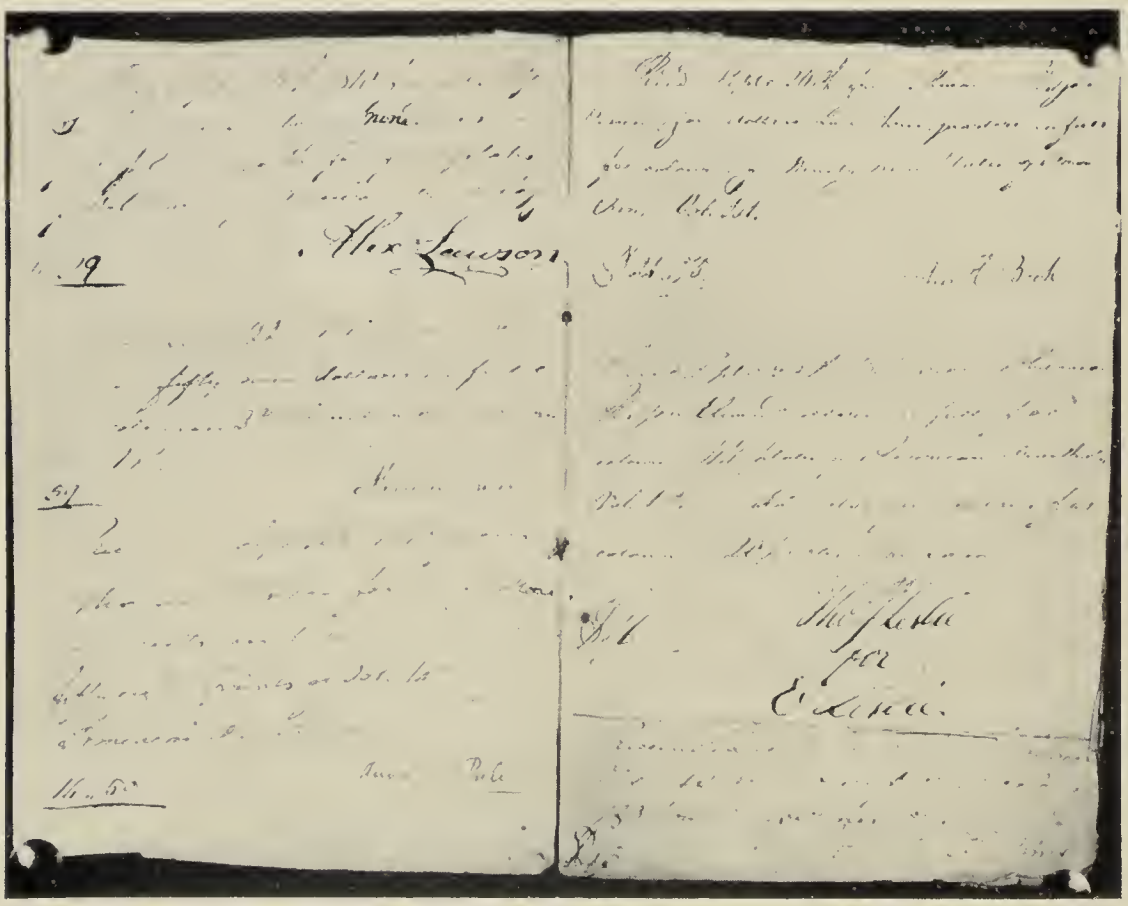

Fig. 1. A page from Wilson's Receipt Book.

was right.[3] Mr. Burns says of Rider that "he appears to have been the only professional 'fancy painter' of that time in Philadelphia"; he alludes to Miss Lawson's characterization of Rider's work—"he understood water colors however, but to facilitate his work, spoiled a great many copies by using opaque colors both in Wilson's and afterwards in Bonaparte's works"[4]; and he quotes Bonaparte who "in an outburst of impatience wrote Lawson: 'That confounded Rider has enraged us

[1]Burns, "Miss Lawson's Recollections", Auk, July, 1917; XXXIV, p. 279.
[2]Dunlap, "History of the Arts of Design in the United States", Bayley & Goodspeed ed. 1918, II, p. 392.

to a pretty eonsiderable extent. Look at volume first [of Bonaparte], all the red and orange tints have been obliterated! Shame on him for employing such colors!' " Mr. Burns says, "The work of Alexander Rider probably oceurs more or less in every volume" of Wilson. Dunlap's further notation, that Rider "made miniatures and historieal compositions in Philadelphia between 1818 and 1825",[5] is, of eourse, to be aeeepted.

Eliza Leslie (1787-1858), author, daughter of Robert and Lydia (Baker) Leslie, was an elder sister of Charles Robert Leslie, the artist, and of Thomas Jefferson Leslie, the soldier.[6] She was a eontributor to "Godey's Ladies Book", and editor of "The Gift". Her writings have to do chiefly with housekeeping subjeets. Her brother Charles Robert (1794-1859) also was one of Wilson's assistants. Born in England, he returned to that eountry and beeame a painter of note and a Royal Academician. In his Recolleetions,[7] written about 1850 and published after his death, Leslie said, "Mr. Bradford, the same liberal patron who enabled me to study painting, enabled Wilson to publish the most interesting aeeount of birds, and to illustrate it with the best representations of their forms and eolours, that has ever appeared. . . . I assisted him to colour some of its first plates. We worked from birds whieh he had shot and stuffed, and I well remember the extreme aeeuracy of his drawings, and how earefully he had eounted the number of scales on the tiny legs and feet of his subject." Wilson's bodily appearanee then is swiftly characterized—"He looked like a bird; his eyes were piercing, dark, and luminous, and his nose shaped like a beak. He was of a spare bony form, very ereet in his earriage, inclining to be tall; and with a light elastie step, he seemed perfeetly qualified by nature for his extraordinary pedestrian achievements."

Anna Claypoole Peale (1791-1878), daughter of James, and nieee of Charles Willson Peale, the artist and proprietor of Peale's Museum, beeame herself an artist of some distinetion and a miniature-painter. She was the wife, first, of the Rev. Dr. William Staughton, and, seeond, of Gen. William Dunean.[8]

John H. Hopkins (1792-1868), then an unknown young man, was destined to beeome a elergyman, reetor of Trinity Chureh in Pitts-

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[3]Burns, "Mechanical Execution of Wilson's American Ornithology", Wils. Bull., March, 1929, XLI, p. 21.

[4]Auk, 1917, XXXIV, p. 279.

[5]Dunlap, *op. cit.* III, p. 330.

[6]Her portrait may be found in Appleton's Cyclopaedia of American Biography.

[7]Leslie, "Autobiographical Recollections" (with portrait), Boston, 1860, p. 163.

[8]Dunlap, *op. cit.* III, p. 322; Appleton's Cyclop. Amer. Biog.

burgh, and eventually the first Protestant Episcopal bishop of Vermont. Of this episode in his career Bishop Hopkins's son has written (somewhat condescendingly):[9] "A more congenial sort of drudgery was soon thrown in his way. Wilson the ornithologist had begun the publication of his *Birds of America;* but, in the infancy of the arts among us at that time, he was unable to find any one competent to color the splendid plates of that great work from Nature. My Father was at length induced to attempt it. The price paid was lucrative, to him: and his proficiency in the art of painting, his delicacy and accuracy of both eye and hand in observing and imitating the hues and the forms of Nature, ensured him a degree of success which delighted his employer, besides being for a time, very agreeable to himself. [In a footnote the eulogist adds, In water-colors, he had, at that day, no superior in this country; and his love for his art, as for music, continued unabated during his whole life.] Mr. Wilson always shot a fresh bird for his colorist, so that there should be no chance of the fading or changing of the brilliant tints of life. But constant repetition at length brought weariness, where the work had been begun with so much of zest and conscious self-improvement: and when other assistants had been sufficiently well trained, the task-work was willingly transferred to humbler hands."

Of neither John H. Beck, Louise Adelersterren, nor Prosper Martin has any certain knowledge been gained. Dunlap mentions an artist named Beek[10]; but he became a teacher in Lexington, Kentucky, and died in 1814; so he can hardly have been in 1810 Wilson's colorist. Louise Adelersterren, with her German name, may, as a guess, have been a protégée of Rider's.

The further story of the task of getting out an edition of several hundred copies with their laboriously colored plates is told by Ord in his "Life of Wilson":[11] "Independently on that part of his work which was Mr. Wilson's particular province, viz., the drawing of his subjects and their histories, he was necessitated to occupy much of his time in coloring the plates: his sole resource for support being in that employment, as his duties as assistant editor of the Cyclopædia had ceased. This is a circumstance much to be regretted, as the work would have progressed more rapidly if he could have avoided that confining drudgery. The principal difficulty, in effect, attending this work, and that which caused its author most uneasiness, was the coloring of the

[9]Hopkins, "The Life of the Late Right Reverend John Henry Hopkins" (with portrait), 1873.

[10]Dunlap, *op. cit.* II, 382.

[11]American Ornithology, 9, XLIV.

plates. If this could have been done solely by himself; or, as he was obliged to seek assistanee in this delieate process, if it could have been performed immediately under his eye, he would have been relieved of much anxiety; and would have better maintained a due equanimity; his mind being daily ruffled by the negligence of his assistants; who too often, through a deplorable want of skill and taste, made disgusting caricatures of what were intended to be modest imitations of simple nature. Hence much of his precious time was spent in the irksome employment of inspecting and correcting the imperfections of others."

In a letter to the Editor of the Wilson Bulletin for September, 1928 (XL, 208), the present writer intimated that William Bradford, Wilson's publisher, maintained "a shop of colorists". From what has now been set down it is manifest that he spoke with too great assurance and to erroneous effect. In this he afterward was very properly corrected by Mr. Burns (Wilson Bulletin, March, 1929; XLI, 20).

Surely this receipt-book and the associations that cluster about it go far to restore, to create before the mind's eye, a picture of the episode—a major episode in the story of Wilson's life. And as we contemplate that picture, our sympathy must be quickened, and our appreciation deepened of the accomplishment of this inspired schoolmaster.

Sewickley, Pennsylvania.

SNOW-KILLING OF THE BOB-WHITE

BY THOS. G. SCOTT*

Reports of ground-roosting birds imprisoned by snow or sleet may be found in various ornithological publications, and occasionally popular articles with illustrations appear relating to birds killed by exposure to the weather. However, convincing evidence that snow imprisonment occurs and actually results in death to the prisoners is scarce.

The data included in this paper may provide conclusive evidence that, at least in one instance, reasonably strong Bob-whites (*Colinus virginianus virginianus*) were imprisoned and killed by drifting snow. In addition, it will be pointed out that other birds of the same covey met death by exposure to severe weather in spite of apparent physical fitness and the protection of normally acceptable cover.

The notes supporting this paper were incidental to observations upon emergency feeding practices. However, the notes are detailed

*Iowa State College Extension Service, Iowa Agricultural Experiment Station, Iowa Conservation Commission, and U. S. Bureau of Biological Survey Coöperating.

enough to be significant and are adequately warranted by photographs. The writer is indebted to Dr. H. H. Knight of Iowa State College for the accompanying photographs.

The covey of Bob-whites under observation was located on the Little Wall Area by Mr. Robert I. Simpson and the writer during a preliminary survey to prospective emergency feeding operations. This inspection was carried out on the twenty-eighth day of January. The birds were using a plum (*Prunus*) and willow (*Salix*) thicket as a day roost. The thicket was growing upon a slight embankment immediately to the northwest of a marsh which in that region is largely grown up to river bulrushes (*Scirpus fluviatilis*). The embankment and thicket provided excellent mechanical protection from the prevailing northwest winds, and the skyward branching of the thicket insured the birds against the attacks of winged predators. At that time there were approximately twenty-one birds in the covey. It may be of interest to note that both Bob-whites and Pheasants (*Phasianus colchicus torquatus*), in apparent tolerance of each other, were using this thicket almost to the exclusion of one or two available willow thickets which were, if possible, more exposed to the wind. The birds were not fed during this visit, but later, on February 2, shelled corn was placed in the thicket by emergency feeders.

On February 8 the most severe blizzard of the season occurred. The writer, interested in its effect upon wildlife, drove to the Little Wall Area to observe the birds already mentioned. Under protected

Fig. 2. The thicket. The snow-prison was at the writer's feet, and the highest level of the drift is being indicated upon the willow clump.

FIG. 3. This shows the night-roost group and the approximate positions of the single birds collected on the same day.

FIG. 4. A close up of the night-roost group. The singles, probable victims of exposure, have been placed near the night-roost group for comparative reasons.

conditions the temperature was 15° below zero, but it was probably ten to fifteen degrees lower in the face of the thirty to forty mile an hour gale which was blowing. Although but three inches of snow fell during the day, there was enough of it in the wind to make visibility very low and to cause extensive drifting. The visit was made at 10 A. M., and at that time the snow was drifting rapidly. The Bob-whites and Pheasants were both at the thicket, but the cover was proving inadequate to the test. A part of the Bob-whites were in a night-roost formation, and the others were scattered throughout the cover. Iced snow was seen upon the head and upper neck of a few Pheasants and Bob-whites. Two of the Bob-whites, weakened by the weather and encumbered by an increasement of snow and ice upon their heads, were noticeably helpless. Without difficulty these birds were collected by hand, and the others flew into the bulrushes. The eyes and nostrils of the captured birds were sealed with iced snow, but the mouth was clogged with neither ice nor snow. Although helpless and decidedly subject to predation in the face of the blizzard, these birds revived hurriedly once within the car. The car was unheated, hence served only to break the wind. The wind undoubtedly carries snow to the head of a bird, but, what is more important, keeps it there. As the roads were rapidly becoming impassable, the writer was forced to leave the field.

It was impossible to return to the area for three days. On February 11 the roads were again passable, and a trip was made to the thicket to view the results. Upon approaching the thicket, one live bird was seen to make a reasonably strong flight away from the opposite side. The cover was drifted with from four to eight feet of snow, and there was but little sign indicating that live birds were using it. After a short search, one dead bird was found with its head projecting above the snow. It was facing into the blizzard, as were all Bob-whites found dead through exposure in this covert. The drift was too extensive to attempt shoveling to the birds which were possibly somewhere within, so an intensive watch was kept upon the drift as soon as melting began on February 23.

The notes concerning each member of the covey accounted for may possibly be handled to the best advantage as follows:

Bob-white I—Male; taken alive February 8; weight 176.2 grams.
Bob-white II—Male; taken alive February 8; weight 194.2 grams.

Note: Bob-whites I and II were the specimens taken during the blizzard. Although the weights indicate reasonably healthy birds

(Errington 1931a), they were extremely susceptible to predation and would undoubtedly have died from exposure. These birds were kept in captivity at the college, and their weights were taken again on March 6. Bob-white I—181.5 grams. Bob-white II—197 grams.

Bob-white III—Male: found dead February 11; weight 185 grams. The crop of this bird was empty, but the stomach contained corn. The weight again indicates a reasonably strong bird.

Bob-white IV—The lone living bird seen three days after the blizzard. Its flight was strong and vigorous.

Bob-white V—Female; found dead March 8; weight 135 grams. This was one of the first birds to appear after the melting began on February 23. It was found approximately four feet below the highest level of the drift. The snow was pushed or melted back from the body of the bird on all sides for about four inches, thus forming a small compartment and indicating that the bird may have lived beneath the snow for a short time.

Bob-white VI—Male; found dead March 8; weight ? It was not considered of any particular value to weigh the bird in that its head was gone. The breast contour and stomach analysis would indicate a bird of about 180 grams. Later the head was found a few inches lower in the snow leaving evidence that the attack had occurred during the blizzard. Circumstantial findings indicated that the predator was a mink (*Mustela vision vision*).

Bob-white VII—Male; found dead March 15; weight 175 grams.

Bob-white VIII—Male; found dead March 15; weight 182 grams.

Bob-white IX—Male; found dead March 15; weight 118 grams.

Note: Bob-whites VII, VIII, and IX are the birds pictured in Fig. 4, just back of the covey group. The weights of VII and VIII would signify strong birds. From the fresh appearance, lack of snow compartment and findings by stomach analysis it is quite likely that they perished from exposure. The weight of IX indicates a very weak bird. A snow compartment was not seen about the bird, but that may have been due to untimely observation. The low weight and stomach analysis would indicate death through trapping beneath the snow.

Bob-white X—Male; found dead March 15; weight 104 grams.

Bob-white XI—Male; found dead March 15; weight 96 grams.

Bob-white XII—Female; found dead March 15; weight 120 grams.

Bob-white XIII—Male; found dead March 15; weight 116 grams.

Note: Bob-whites X, XI, XII, and XIII are the birds composing the night-roost group in Fig. 3 and Fig. 4. These birds quite obviously met death through imprisonment. The difference in outward

appearance may readily be seen by comparison with the three birds in the background. Notice the droppings and the steamed or drenched appearance of the birds in the night-roost group. The body weights are all below that which commonly deeds a Bob-white the right to live in the wild. The stomach analysis tends to clinch the argument that the birds perished through imprisonment. It is interesting to note that Bob-white XIII was heavily infested with lice (*Goniodes ortygis* Den.). Imagination might conceive of these lice moving from the dead or dying birds to XIII as the last living bird.

STOMACH ANALYSIS

Bob-white	Color of Stomach Lining	Weight of Stomach (full)	Weight of Stomach (empty)	Weight of Grit	Weight of Food and Other Remaining Material	Body Weights
V	Dark green	7	4.83	1.25	.92	135
VI	Green	8.35	5.2	1.27	1.88	†
VII	Green	9	5.8	1.15	2.05	175
VIII	Green	7.1	4.87	1.01	1.22	182
IX	Black	6.55	4.72	1.00	.83	118
X*	Black	5.2	3.85	.75	.60	104
XI*	Black	5.15	3.78	.64	.73	96
XII*	Black	6.03	4.21	.97	.85	120
XIII*	Black	5.5	4.30	.79	.41	116

†See Bob-white V note.
*Night-roost group.

The quantitative stomach analysis denotes that the imprisoned Bob-whites of the night-roost group died in much poorer condition than did those birds which died from exposure. Birds V and IX, for which former circumstantial evidence implied death by imprisonment, also show a tendency to be poorer than the exposed birds, but still not so poor as the night-roost group. Color of the stomach lining may or may not be of importance, however, the darker colors seem to be associated with the imprisoned birds. The comparatively small amount of grit found in the stomachs of the night-roost group and the lack of food provides evidence to the fact that they must have remained alive in their snow-prison for some time. The birds in the night-roost group probably died from a combination of starvation and suffocation. The exposed birds presumably died from a combination of suffocation and cold.

Nine of the original covey are unaccounted for, but this is not an entirely unusual happening. Frequently entire coveys of birds disappear from their chosen coverts only to be found by diligent searching in open corn fields many yards away. (Errington, 1936). Perhaps this entire covey would have done the same thing had not

part of them been unable to leave due to death or imprisonment. The accounted-for birds may have moved into the bulrushes where the drifting was less severe and without the characteristic crust found where the wind was able to play upon the surface of the snow. The Pheasants did this very thing and came through well except for those birds which remained too near the embankment. The embankment provided a break for drifting, and the wind froze a crust over it for some yards out into the marsh. One male Pheasant was seen to break its way up through this crust and escape after three days of imprisonment. The crust at this point was strong enough to support a man's weight.

Although drifting and undue cold is an infrequent occurrence, it appears worthy of the game manager's attention, especially in the provision and strengthening of cover. Cover which encourages drifting may be perfectly acceptable during the greater part of the year, but it certainly fails in the face of the final test. The primary purpose of good cover is that of offering protection from predators. Cover, drifted full of snow, fails in this respect and often becomes a trap to birds trusting in its protection. Future research into management practices should include the effect of drifting upon normally acceptable cover and the possibility of controlling it.

A great many ideas for controlling the drift may enter one's mind. But are they practicable, and if so, are they inexpensive and simple enough to be practiced by the ordinary landowner?

Summary

1. Reasonably healthy Bob-whites may perish through imprisonment by drifting snow.

2. Exposure to cold, high winds and snow may kill reasonably healthy Bob-whites.

3. Cover, subject to heavy drifting, is not ideal.

4. Research into management practices should include work upon the effect and control of drifting snow.

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HABITS OF WISCONSIN PHEASANTS

BY GILBERT GIGSTEAD

The annual taking of 5,000,000 pheasants in the United States, indicates truly that the bird has triumphantly affixed itself to our hunting program. Sportsmen have eagerly accepted the exotic creature, not, to be sure, because of any superior sporting quality in comparison to our native species, but because it meets the modern demand for quick, satisfactory service.

Apparently free from many diseases, immune from severe cyclic disturbances and prolific in captivity, the pheasant can be stocked in almost unlimited numbers. Once established in a locality, it is, unlike our native grouse and quail, difficult to clean out. Should they be destroyed in a given cover, simple methods of restocking will bring them back again in equal numbers within a short time. Conspicuous too, is their hardiness in withstanding severe winter weather. There is no doubt that the pheasant will dominate in territory suitable to them.

Pheasants have been widely planted in Wisconsin. For the past six years extensive releases have been made, and every county has been given at least a seed stock. It can safely be stated that some survive in every county. In the extreme north if planting operations cease, the bird may disappear, but the southern portions will undoubtedly retain fair numbers. During the past years the State Conservation Department distributed annually 30,000 birds and 100,000 eggs to coöperating farmers and sportsmen besides large numbers liberated by shooting preserve operators and other individuals. It is estimated that approximately 250,000 pheasants have been planted in this state.

During the six-day open season at least 200,000 pheasants are added to the hunters' kill, not including the birds taken on private shooting preserves. Despite this heavy toll his oriental cackle is commonly heard from the marshes where formerly the Prairie Chicken sought shelter. Defying civilization, the hardy foreigner has moved into the highly agricultural districts. With brilliant display of feathers he struts boldly across the most traveled highways. Even in the dense cedar swamps and muskeg openings of northern Wisconsin it is not uncommon to have a pheasant bluster out from underfoot.

The farming sections of southeastern Wisconsin, with its many grass and brush marshes interspersed between cultivated fields, offers the most desirable habitat. Here, also is found excellent cover in the

growth of flag and sedges along the shores. Cover of this kind, joined by grain fields, is hard to beat. Good pheasant country is also found in the south-central portions, and for a width of two counties along Lake Michigan as far north as Green Bay. In the hilly western portion conditions for pheasants are less favorable. Here, cover is limited to the river bottoms, and to the brush and grass which grows up along the banks of streams in the valleys.

The northern half of the state, having a limited number of farms and much second-growth timber, has little chance for a heavy population of pheasants. In central Wisconsin it is primarily a matter of maintaining food patches. More than 400,000 acres of this brush land may possibly be established as a game management area and public shooting grounds. Sportsmen in Wisconsin still have hopes that this worthwhile project will materialize.

As the pheasant is primarily dependent upon farming environment, much attention should be given to its relation to the farm and to the farmer. In order to determine this, and be in a position to answer intelligently the question of how much damage the pheasant inflicts upon domestic crops, the Wisconsin Conservation Department investigated numerous complaints and through the coöperation of licensed shooting preserves examined the crop contents of 141 pheasants during a five-month period, from October, 1935 to February, 1936.

Farmers in several localities reported pheasants doing damage to corn fields and vegetable gardens. The writer made many trips afield to trace the direct source of such complaints. In most complaints over damage to corn during the planting season there were found to be other reasons why the corn did not come up. One farmer had planted corn in light loam soil, characteristic of marshlands. During a heavy rainstorm the sprouting corn was exposed by washing. Blackbirds and gophers found it easily accessible. Pheasants did take some: still, there were five gophers to every pheasant. They would fill their cheek pouches, run into their holes and return shortly for more. The farmer had little interest in controlling the gophers and blackbirds which had taken at least 90 per cent of his washed grain.

Another farmer finding a dozen rows of corn dug out near his timber tract, immediately blamed the pheasants. Investigating this early in the morning for three consecutive days, several grey squirrels were observed. Each one would take a row and with rapid digging, would take every kernel of corn planted there. In less than half an hour one squirrel destroyed thirty-two hills of grain. Only once did a cock pheasant visit the same area. It took the pheasant much longer

to dig up just one seed; he would hesitate, and spend considerable time delving in the soil in places where no corn was planted. The phcasant cock was collected, and, upon examination, had three kernels of corn and five grubs in his crop.

Several hundred domestic pigeons were also collected in farm districts, and found with their crops filled with planted grain.

There is no doubt that pheasants will often take planted grains; still, it is questionable whether the damage he does exceeds thc good. In view of all the pests that do so much more damage, is it fair to condemn the pheasant as an enemy of agriculture?

Collecting and examining pheasant crops has resulted in some very interesting findings. Above all, it attests the omnivorous feeding habits, and most of all their erafty methods of procuring subsistance through the tough winter months. No attempt was made to examine the gizzards, as crop contents give a clear picture of just how various feeds were proportioned. Shooting preserve coöperators were askcd to tear out the crop of each bird killed, dry it for a few hours near a fire, and send it in. A great deal more trouble is involved in removing and shipping gizzards. The preserve men tied strings around the skin of the crop and filled out cards explaining when the birds were shot, in what kind of cover, and how far from cultivatcd fields. Eighty-seven per cent of the birds were taken from brush and grass marshes. Others were shot in corn fields, grain stubble, fence rows, and similar places. It appears evident that without the marsh lands, phcasants in Wisconsin would be very scaree. The eombination of grain fields near marsh eover holds as the most popular place for pheasants. Few birds were killed—and probably few oecur—in fields more than half a mile from the marsh. Vast stretches of marsh land surrounded by soil of poor quality carries very few birds. However such places ean usually be changed by planting food patches. Hemp and millets will often prove valuable. It also pays to just plow up patches of such land, and leave it grow up with food bearing weeds which come up when soil is turned.

Field corn was the principal diet of pheasants during the fall and winter months. Even during August waste corn was found in a number of crops. When corn is in the milk stage the birds apparently preferred it to the abundant wceds and insects then available. It must also be remembered that it takes a goodly number of small weed sceds to equal a kernel of corn.

It is estimated that in one day upland game birds consumc the quantity of thcir crop filled twice. The greatest amount of eorn

found in one pheasant crop (moist weight) was 2.2 ounces. Where birds fed exclusively on corn the average crop weighed two ounces. From birds previously examined, together with the 141 crops here reported, it is concluded that about one-third of the pheasants' fall and winter diet in southern Wisconsin, consists of corn.

If then, a farmer had twenty-five pheasants on his property each bird would take one-third of four ounces (two feedings of two ounces each) per day, or 1.3 ounces of corn per day. On this basis it would take approximately sixty pounds of corn to feed twenty-five preasants per month in the wild. Assuming that corn was left in the fields for four months the farmer would invest possibly 240 pounds of corn, or about $3.60 worth, in pheasants. That is figuring the corn at a cent and a half per pound in the field which is usually a very good price.

Now in figuring the benefits of the twenty-five pheasants we have the insect and weed control, either of which might cost the farmer a much heavier loss. In Wisconsin there is a possibility of realizing a direct return through selling hunting privileges under the private shooting preserve law. Permitting the shooting of one-third of the twenty-five birds would net the farmer at least twice the price of 240 pounds of corn.

In some localities farmers find it profitable to plant food patches for game birds. Yellow kaffir corn, or wheatland milo maize has been found to be good for such patches. It should be left standing or placed in bundles along fence rows. Such grains broadcast over the surface, along the outside edges of newly planted corn fields tends to prevent pulling of corn by pheasants or other pests.

Kaffir, planted broadcast is often satisfactory roosting cover when natural grass and marsh are absent from the farm. The Wisconsin Conservation Department last year distributed to farmers and sportsmen seed enough for more than 2,000 patches. Most grains other than corn found in the crops was waste grain left after the threshing or it was taken from the manure spread in the field for fertilizer. The practice of spreading manure over the snow has served as good feeding stations.

As before stated the game birds find feeding conditions most favorable during the early fall months. Grasshoppers appeared in half of the fifty-three crops examined in October, and many of them were eaten as late as the month of November. In the October crops other feed in order of abundance was, common ragweed, yellow foxtail, nightshade bittersweet, and Canada thistle. Yellow foxtail being almost as prevalent as common ragweed. Commonly pheasants' crops

were found packed with Canada thistle seed, as many as 4,000 being taken from one bird. Similar quantities of foxtail and ragweed were counted. Twenty-two grasshoppers was the greatest quantity of insect life found in one crop. Nightshade bittersweet proved to be an excellent fall and winter food and it is well distributed in most of the state. Acorns were taken in less quantity, but the fact that acorns were found in crops at a time when other feeds were abundant indicated that they are not a starvation diet. At the Wisconsin state experimental game farm some pheasants were penned and fed exclusively on acorns while in an adjoining pen the birds were fed strictly on corn. After several months the experiment revealed that the birds fed on acorns weighed more than the birds fed on corn. Otto Beyer, of Portage, Wisconsin, also found acorns a good food and chopped up quantities, feeding it with mixtures of grains to birds in captivity.

The month of November showed the greatest variation of food. Ragweed stood out second in importance to field corn. Begger-ticks and Spanish needles were found packed in the birds' crops without sign of any other material. This was also noted on many other occasions in other years when crops were examined.

Of special significance is the discovery that the pheasant eats an immense amount of poison sumac during December and January. Sumac eating began in November. In December it was nearly as important as corn, and in January more poison sumac was eaten; 32.5 per cent of the contents from twenty-four crops was sumac as compared with 24.1 per cent corn. It is difficult to explain this. There was an abundance of fruit on the sumac last season, and it may be a case of the birds taking what was most easily accessible. Poison sumac is common throughout the southern half of the state; it grows in tamarack marshes which constitute good cover. Fecal observations gave further evidence that both pheasants and quail were feeding much more extensively upon this than upon any other food. Poison ivy, which belongs to the same family, was also eaten during the winter, but not nearly in the same quantity. Poison sumac and poison ivy seeds look very much alike and probably are of similar nutritive value. Perhaps if the ivy had been as available as sumac the birds would have taken more of it. It is believed that thousands of birds were saved from starvation by finding such a great deal of sumac available during the pinch period.

TABLE 1. To show the frequencies and percentages of the various food items used by the Ring-necked Pheasant in Wisconsin. The data were obtained from 141 crops taken during August, October, November, December, and January.

	DOMESTIC FOODS	CROPS TAKEN IN									
		Aug.(4)		Oct.(53)		Nov.(38)		Dec.(22)		Jan.(24)	
		No.	%	No.	%	No.	%	No.	%	No.	%
1	Corn (zea maize)	3	62.3	29	25	20	33.8	10	23.3	8	24.1
2	Wheat (Triticum sativum)			1	.5	4	1.2	2	2	1	2
3	Barley (Hordeum vulgare)			3	.4	3	.2	1	3.2		
4	Oats (Avena sativa)	1	26.6	6	2.9	1	.5	1	.2		
5	Buckwheat (Fagopyrum fagopyrum)					1	1				
6	Soy Beans			1	.2						
7	Lima Beans			2	.3						
8	German Millet			1	.6						
9	Amber Cane					1	.3	1	.8		
10	Watermelon Seed									1	2.3
11	Timothy			1	.2						
12	Alfalfa and Clover Leaves (trifolium sp.)			7	1.2						
13	Squash Seed							1	2.6		
	WILD SEEDS, FRUITS, BERRIES										
14	Ragweed (Ambrosia artemisiifolia)			20	14	15	20.4	2	1.8	2	4
15	Yellow Foxtail (Chaetochloa glauca)			15	12.8			1	2.2		
16	Green Foxtail (Chaetochloa viridis)			1	.3	1	.4	1	.4		
17	Impatience (Impatiens biflora)			4	.4	3	2.5	2	4	1	.8
18	Lady's Thumb (Polygonum persicaria)			2	1.4	2	1.8	2	4.1		
19	Begger-tick (Bidens comosa)					2	4.3				
20	Spanish Needle (Bidens bipinnata)					3	3.2	5	14	3	7.4
21	Giant Ragweed			3	1.5	2	3.2			1	2
22	Wild Buckwheat (P. convolvulus)			4	1.1	3	.6	4	4		
23	Smartweed					1	.3			1	1.3
24	Bull Thistle			2	3.7						
25	Canada Thistle					1	.8				
26	Wild Hemp			1	2.5					1	.6
27	Agrimony					1	.4			1	3
28	Burdock					1	.2				
29	Sesame					1	.6				
30	Meadow Rue									1	.4
31	Blue-skull Cap (Scutellaria lateriflora)					1	.2	1	2.5	2	4.3
32	Panicum					1	.2				
33	Compass					1	.2	1	1.2		
34	Lopseed					1	.4				
35	Indian Mallow					1	.2				
36	Rough Avens (Geum virginianum)							1	.7	2	.7
37	Tick Trefoil							1	.2		
38	Scarlet Pimpernel									1	.3
39	Redroot									1	.3
40	Milkweed					1	.8				
41	Clevers Goose Grass Seed							1	.1		
42	Vetch Seed (Panicum capellare)			1	.2			1	.2		
43	Dead Hemp Nettle							1	1.3		
44	Skunk Cabbage (Sumplocarpus foetidus)					2	2.5	2	1.5	1	.6
45	Wild Bean (Strophostyles pauciflora)							1	1.1		
46	Water Plantain							1	.3		
47	Poison Sumac (Rhus vernix)					4	5.6	5	20.2	10	32.5
48	Smooth Sumac					2	1.4			1	.4
49	Poison Ivy (Rhus toxicodendron)							1	.5	1	4.1
50	Dogwood (c. asperifolia)			1	.2	1	1.7	1	.2		
51	Wild Rose					2	1.4			3	4.6
52	Wild Grape			5	3	1	2				
53	Nightshade Bittersweet			5	4.2	3	2			1	1
54	Hazel Nut					1	1.2				
55	Hills Oak Acorns			1	1.7	1	1.7	2	2.4	1	3.3
56	Wild Cherry Pits					2	.5	2	.5		
57	Grasshoppers	1	10.1	26	16.7	6	5.4				
58	Beetles (Coleoptera) and Larvae			3	.4	3	.6				
59	Lepidoptera larvae			1	.2						
60	Ants			2	.2						
61	Snails					1	.7				
62	Grass Blades and Organic Debris	1	.1	7	.6	1	.7	1	.3		

Poison sumae and ivy, eorn, ragweed, Spanish needle, wild rose hips, skunk eabbage, and blue skull cap were also important feeds during January, and undoubtedly eontinued to be of importanee throughout the winter.

In some localities where giant ragweed was abundant, there were indications of pheasants feeding upon it. More than thirty varieties of weed seed were found in the 141 crops examined, and sixty other foods including domestic grains.

In general, it ean be concluded that the pheasants, with their versatile feeding habits, their importance in helping to control noxious weeds and inseets, as well as their sporting value are worthy of continued eneouragement by the hunters and farmers.

Havana, Ill.

SOME COLD-WEATHER BIRDS OF THE UPPER PENINSULA OF MICHIGAN

BY RALPH BEEBE

The Upper Peninsula of Michigan was acquired by the state in lieu of the disputed strip of land upon which is now located the city of Toledo. Ohio, much to the disgust of thc citizens of the state at the time. Since that time it has become a rieh mining area, its vast forests have passed through the lumbering boom days with their sueeessive forest fire and seeond growth timber stages, its supposedly roekpile and iceburg surfaee has given way to fertile farms. Thousands of tourists, hunters, and fishermen travel over well surfaeed roads or thread barely discernible trails through the wilderness.

It has an abundant of varied fauna, little known until recent years and there is still great opportunity for study. In presenting this artiele the writer does not attempt to present a eomplete list or to name all speeies personally observed but to make notes of some of the more interesting speeies. The following notes refer to the vicinity of Newberry, Luee County, Michigan.

Eastern Goshawk. *Astur atricapillus atricapillus.* Often abundant during the fall migration and some may be found at all seasons.

Canada Spruce Grouse. *Canachites canadensis canace.* Formerly quite eommon but now found only in the deeper forests if at all.

Canada Ruffed Grouse. *Bonasa umbellus togata.* Probably as abundant now as at any time in the past.

Greater Prairie Chicken. *Tympanuchus cupido americanus.* Unknown at the time of my residence (1916) but said to have spread over the larger part of the country since them.

Eastern Screech Owl. *Otus asio naevius.* Rather rare and apparently near the northern limit of its range.

Great Horned Owl. *Bubo virginianus virginianus.* The most common owl. An early settler's farm was repeatedly raided by one of these birds, which carried away turkeys, chickens, and the family cat. It was subsequently found with a porcupine clutched firmly in its talons and, of course, both dead.

American Hawk Owl. *Surnia ulula caparoch.* Occasional. Noted October 31, 1909, February 19, and March 29, 1913.

Richardson's Owl. *Cryptoglaux funerea richardsoni.* Probably more common than the records indicate. A specimen, found dead in April, 1913, was probably killed the previous January. A young bird of the year was captured July 19, 1913, but unfortunately the specimen was not preserved.

Northern Hairy Woodpecker. *Dryobates villosus septentrionalis.* The prevailing form, intergrading into *Dryobates v. villosus.*

Northern Horned Lark. *Otocoris alpestris alpestris.* Abundant in flocks along the shores of the Great Lakes and occasional in the interior.

Prairie Horned Lark. *Otocoris alpestris praticola.* A regular and abundant migrant, arriving early (February 20, 1912) and remains late (December 2, 1898). Breeds rather sparingly.

Northern Raven. *Corvus corax principalis.* Formerly common but rare in late years.

Eastern Crow. *Corvus brachyrhynchos brachyrhynchos.* Occasionally winters. Two were distinctly heard during a blinding snowstorm January 31, 1916.

Hudsonian Chickadee. *Penthestes hudsonicus hudsonicus.* Noted in July, August, September, and October.

Eastern Robin. *Turdus migratorius migratorius.* Late birds were noted December 16, 1909, December 21, 1910, December 13, 1911, and December 3, 1913.

Eastern Evening Grosbeak. *Hesperiphona vespertina vespertina.* Formerly regarded as a rare winter visitor,* it is now established as a

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*Michigan Bird Life, p. 465.

breeding bird. I saw a flock of several adults and young of the year July 16, 1911. It was reported in summer by several observers and the nest was subsequently found at Whitefish Point in the eastern part.

Eastern Purple Finch. *Carpodacus purpureus purpureus.* Frequent at all seasons but more common in winter and during migration.

Canadian Pine Grosbeak. *Pinicola enucleator leucura.* The earliest recorded were August 15, 1909, and August 16, 1910. In spring to April 26, 1914, and April 27, 1915.

Hoary Redpoll. *Acanthis hornemanni exilipes.* Not very rare in autumn, appearing September 22, 1910, and September 28, 1911, remaining to March 13, 1911. In contrast to the other species, it occurs in scattering flocks, as far as my observation goes it is usually seen on foggy or frosty mornings and its note is harsh and irritating. It was noted feeding upon small moths, capturing them upon the wing like a flycatcher.

Common Redpoll. *Acanthis linaria linaria.* Often very abundant but its seasonal distribution is peculiar. It is another species formerly regarded as a winter visitor only, and is then seen with considerable regularity. I have seen single flocks which I estimated to contain 1600 birds. It becomes abundant with the approach of cold weather, October and November, but some appear in July and August. I saw a young of the year August 31, 1914, and Mr. M. J. Magee of Sault Ste. Marie has trapped numerous young birds in midsummer. I saw a flock containing males in rosy breeding plumage June 21, 1912, but as yet there are no breeding records. A southward migration in midsummer, bringing the birds commonly into the Upper Peninsula and as far south as Detroit (July 20, 1931, September 1, 1932) has no logical explanation. In March, 1911, a flock was observed feeding upon the Oyster-shell Scale (*Mytilaspis pomorum*) a destructive enemy of fruit trees.

Eastern Goldfinch. *Spinus tristis tristis.* My latest record is December 4, 1914.

White-winged Crossbill. *Loxia leucoptera.* Although usually regarded as a winter species, I saw only single individuals in summer.

Eastern Snow Bunting. *Plectrophenax nivalis nivalis.* An abundant fall and spring migrant and frequent in winter. Earliest date noted, October 9, 1909, and the latest, May 5, 1914.

Ecorse, Mich.

THE DANCE OF THE PRAIRIE CHICKEN

BY JOHN S. MAIN

We awoke at five o'clock, dressed hurriedly and started out at once for the blind. The sky was cloudy, the wind fresh and chilling. Keeping to the main road for a short distance, we presently turned off and followed a lane, flushing a pair of Hungarian Partridges by the wayside. At the end of the lane, we left the car and headed north, our path lined by a row of venerable willows. Open country stretched before us as far as the eye could see, and also toward the east, where the land lay low and flat to the river, a mile away.*

From a distance we could hear the mellow whistle of an Upland Plover, and from overhead the winnowing of a snipe. A pair of Short-eared Owls were sweeping the fields with their singularly rapid wing-beats, while from lagoons toward the river we could see ducks rising—Mallards, Teal, Baldpates, Pintails, and Shovellers. It was easy to understand why this was once a favorite resort of the Indian tribes, and of the mysterious people who built the pre-historic village of Aztalan, a few miles down the river.

As soon as we emerged on the prairie we could make out with our glasses the blind, and near it some cocks, whose booming we had been hearing, but so wet was the intervening ground from recent rains that much wading was required before we could reach the relatively dry area surrounding our observation post. Long before we arrived the birds had flown off, so that it was a matter of awaiting their return, sitting on a bench in the blind and watching through loop-holes left for the purpose. We could hear booms in the distance and were fearful lest our birds had chosen some other spot, but before long they began coming back, one at a time, stalking warily through the grass, pausing every few steps to look around and size things up. They kept on coming, however, until finally they were again in front of the blind, the nearest scarcely twenty feet away. When all were accounted for, there proved to be eleven of them, all cocks—this, according to our host, being the number that has commonly been present during the month or more since his observations began.

The so-called booming ground comprised a space some twenty-five yards in diameter and differed from the surrounding marsh only in the absence of the tall, dried stems of the prairie-dock, with which the latter was sparsely covered, and in the fact that the shorter and thicker

*The date was April 24, 1936; the place, Favill's Grove, near Lake Mills, Wisconsin; the host, Mr. Arthur Hawkins.

blue-joint had been well flattened down. Beneath this grass the ground was quite soft, differing in this respect from the locations usually chosen for these assemblies.

As each cock appeared on the scene he at once began his exhibition. He lowered his head, puffed out his feathers, and raised his tail to show its white under-coverts, the wings being held down, stiff and straight, so as to scrape the ground. He distended the hidden sacs on the sides of his neck until they were the size and color of oranges. He stamped the ground like a maddened bull. He made sudden rushes at a real or imaginary opponent. He gave sudden, upward leaps, often making complete revolutions in mid-air. When not otherwise engaged, he contented himself with walking slowly about with all the dignity of a turkey gobbler. There were two cocks off by themselves at either end of the line, out on the wings of the stage, and it was interesting to observe that they went through the same rôles as the others, each with complete absorption in his own performance. One of these took first prize as a high jumper, clearing the bar at a good four feet. During all this time every one of the cocks was giving vent to a varied assortment of booms, toots, calls, and cackles, which, combined with similar outbursts from all the others, produced an indescribable medley of sound.

Encounters were frequent. Every now and then one cock made a rush at another, whereupon the two stood face to face, each apparently trying to stare the other out of countenance. In this, one would eventually succeed and his opponent would turn and move slowly off, crestfallen. Often one or both would assume a crouching attitude, as though each thought to gain an advantage in this manner, like opposing tacklers in a line of scrimmage. On only a few occasions did they actually come to blows, at which times they flew at each other and came together with a resounding clash of wings. In the other cases it seemed largely a game of bluff. In fact, it was, at any time, difficult to tell whether the combatants were in earnest or were merely play-acting.

On two or three occasions a cock from outside, possibly the same one each time, tried to join the party, but each time was promptly attacked and driven off by the others. Who was he? Was he a former member of the inner circle who had been expelled for some cause, or was he an outsider seeking admission? If the latter, we can but wonder how and when the roll was completed and the doors closed to new arrivals.

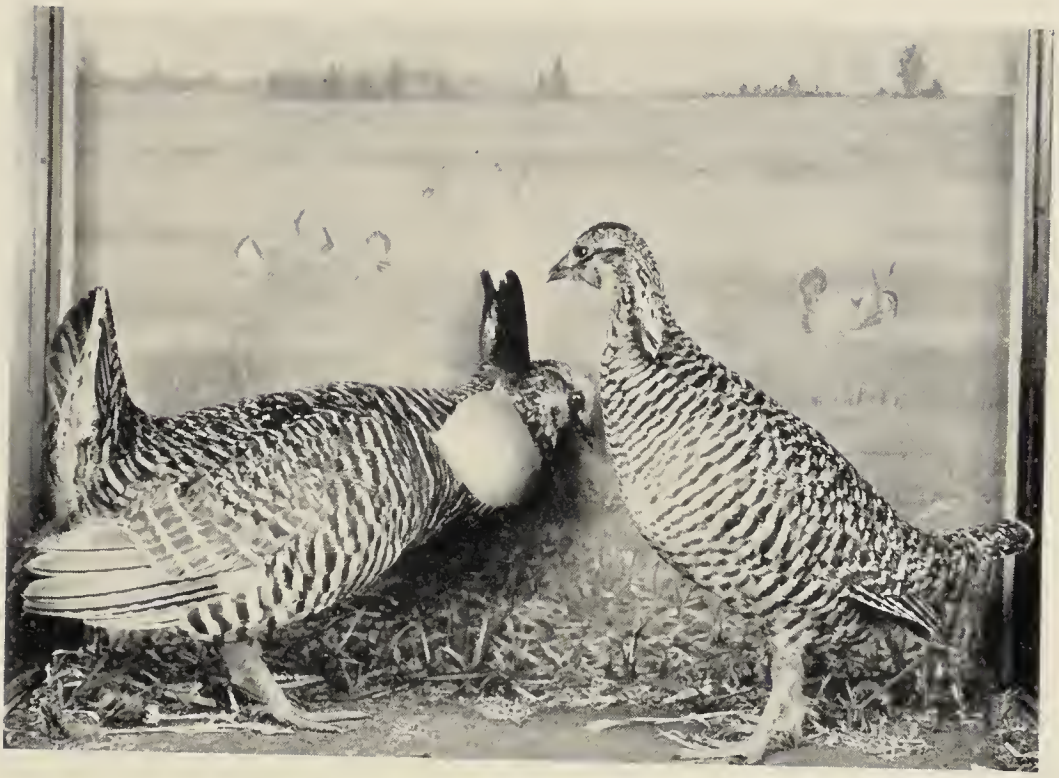

FIG. 5. Mounted specimens of the Greater Prairie Chicken. From the Milwaukee Public Museum.

FIG. 6. Mounted specimens of the Sharp-tailed Grouse. From the Milwaukee Public Museum.

After we had watched for some fifteen minutes, we saw that a hen had arrived, and had become the center of interest for several of the cocks. These cocks did not show any inclination to fight, being apparently content with showing off. Their efforts were not noticeably different from what they had been or from those of the other cocks, who went on just as before, each intent on his own affairs and wholly unmindful of the lady's presence. She, meanwhile, seemed equally indifferent to the attentions of her suitors. She remained motionless most of the time and apparently took no notice of them whatever. Experience may have taught her that this is by no means an ineffective way of attracting admirers, but at any rate none of the males was given preference and no mating took place.

An interesting question arises as to the presence of this hen. Our host states that out of a dozen mornings spent in the blind this spring, he saw hens on the booming grounds only twice—one at the time mentioned above, and two at a later date. This is in accord with the testimony of other observers, many of whom have never seen a hen present, while few appear to have seen more than one at a time, and these usually at long intervals. What does this mean? Why was the hen there? Was it for the purpose of mating? Being unsuccessful this time, would she come again? Had she been successful might she have come again? Is a single mating sufficient to fertilize a clutch of eggs? Does mating usually take place on or off the booming ground?

Intriguing as these questions may be, it is the behavior of the cocks themselves that excites our curiosity most; and this brings us to inquire the meaning of the whole performance. It should be, one would suppose, a fascinating employment for an ornithologist. Though many observers have described the scene, not one has yet offered an interpretation that is wholly satisfactory, nor has any one made any serious attempt in that direction. It has usually been thought sufficient to define it as a courtship ceremony attended by nuptial displays and more or less fighting between rival males—a description which could be applied just as well to the courtings of countless other species, from bluebirds to penguins. Another authority has stated that these exhibitions are merely an outlet for the surplus physical energy incident to the mating season, but he does not explain why such single-handed performances as the drumming of the Ruffed Grouse or the thrilling head-dives of the male Marsh Hawk do not come in the same category. We would all probably agree that the mating instinct is the actuating force behind our little drama, but the question as to why it expresses itself in this singular form is still unanswered.

Let us take the fighting, for example. Many of the older writers such as Audubon, Nuttall, and Brewer believed that this was the primary purpose of the gathering. According to Audubon's lively description, the males "to the number of a score or so, before the first glimpse of day lightens the horizon, fly swiftly and singly from their grassy beds, to challenge and to fight the various rivals led by the same impulse to the arena." ("Birds of Ameriea", Vol. V, p. 96). Modern observers, however, generally agree that the fighting plays a less important rôle and this opinion was well borne out in our own case by the fact that no encounters took plaee until the cocks had been for some time on the field. Aeeounts also differ as to the character of the fighting. The battles are sometimes described as extremely fieree, with much shedding of blood and feathers, but in our case, at least, such fights as took plaec were hardly worthy of the name. They were very brief affrays and though some spirit was shown there was never the least sign of injury or exhaustion. Again, most observers have assumed that these battles are analogous to those eommonly indulged in by rival males contending for a female—battles in which one or the other is decisively whipped and thereby eliminated for all time as a contender. In the case of the prairie coeks, however, there is an important difference in that there are usually no females present. Moreover, this analogy fails to account for the fact that the same eombatants return eaeh morning throughout the mating season, and re-enact the same seenes as though nothing had happened.

Finally, there is the rest of the performanee, the displays, the daneing, and aerobatics. We saw, as already stated, but one hen, and while it is possible that there were others eoncealed in the grass near by, it was doubtful if such was the casc. If, therefore, we should assume that the whole show is staged for the benefit of the hens, we must be ready to believe that the actors would continue day after day, and week after week, playing to empty seats. Moreover, even though the coeks thought that members of the other sex were looking on, we would still be in the dark as to what they were trying to accomplish. We ean not believe that any one of them had in sight any particular lady-love whom he was seeking to captivate. Was he, then, going through his aet on the mere chanee that some susceptible female might be entieed from her hiding plaee? If so, he should have borne in mind that she would be equally exposed to the solicitations of his rivals. Or was he hoping so to charm his imaginary admirer that when he had finished his aet and left the stage he could make an easy eonquest? Or are all these antics, as they are called—the puffing out

of feathers, the stamping, leaping, and rushing, and the threatening attitudes—are they only meant to intimidate the other eoeks and thus better his prospeet of victory over them? Similar instanees are innumerable; for example, a eat raising its baek, a bristling dog, a gorilla pounding its ehest, thc hunting ery of a tiger.

It may be that we shall never find a satisfactory answer to the questions here raised, but if we are to attain any measure of sueeess we should not overlook the really distinguishing feature of the performanee, whieh lies in there heing not one but several participants. It is a *communal* affair, and if we are to explain the eonduet of the individuals we must first ask ourselves why they come together. Whether thcre is any end, important to the welfare of the species, which is better served hy them if aeting as a group than if aeting singly. One thing we know, that there is a eontagion in numbers wherehy emotions are greatly aroused, well shown in the actions of a moh, or in the war dances of the Indians. It is also known that the physical forees respond to the increase in emotional ardor, so that feats of strength are performed whieh eould ncver he done without the emotion. So, in thc ease of our prairie eoeks, we must assume that their passions and vigor are, at sueh times, inordinately heightened, and it does not seem difficult to believe that some relation may exist between this eondition and the all-important mating.

Edmund Selous, in his notable hook entitled "Bird Watehing", makes the suggestion that aetions which were at first performed for a definite purpose may in time heeome only a eeremony. To quote his words: "In this ease we should have a pure antie or display, the reason for it being unobvious and its origin a mystcry." If anything is needed to eorroborate this theory we need only citc the yearly flights of Golden Plovers hy land and sea, which ean only he explained as a habit that has outlived its original purpose and the environment under which it was formcd. To say that thc dance of the Prairie Chieken may be a similar case of survival, though of less aneient origin, may he unwarranted; hut it would seem, at least, that some student of eeology might well make an effort to determine whether it serves any useful end; or whether it is only a eeremony, an empty ritual whose meaning lies hidden somewhcre in the past history of the speeies.

Madison, Wis.

BIRD BEHAVIOR AS A RESULT OF EMERGENCE OF SEVENTEEN YEAR LOCUSTS

BY WILLIAM JOHNSTON HOWARD

On May 31, 1936, the writer visited the Crown Hill Cemetery, Indianapolis, Indiana, to witness the emergence and behavior of periodical cicadas, or seventeen year locusts (*Magicicada septendecim*). The locusts were not only in great abundance, but their numbers caused an unusual concentration of insect-eating birds within the cemetery grounds.

The cemetery is a tract of between five and six hundred acres of gently rolling land, surrounded upon all sides by the City of Indianapolis. Although the cemetery is not a new one, some of the stones being dated 1862, slightly more than half of the grounds are yet utilized as burial lots. There are numerous large hardwood shade trees, and fair-sized plots of trees and dense undergrowth. The largest of the numerous wooded parts would probably not exceed eight or ten acres in size. From all appearances, the cemetery, with its specimen trees, woodlands, and open fields, makes an ideal place for a variety of song birds. The superintendent informed the writer that for several years past there had been a covey of Bob-whites on the area, until an old field had been converted into lawn.

Not only were the locusts audible as one drove into the grounds, but they were visible at a number of different places. Many of the tree trunks had numerous pupa-skins upon them, and at the bases of these trees the skins were lying in great numbers. Some of the old rough-surfaced tombstones had skins and live locusts upon them. In the areas of concentration it was difficult, not to locate the insects, but to prevent having numbers of them light upon the clothing. It was of interest to note that the distribution of the locusts was not uniform over the whole area; some parts were practically devoid of them, while in others they were very numerous.

An interesting feature of the appearance of the brood was the presence of numbers of insect-eating birds, which had no doubt been attracted by a large supply of easily procurable food. It was noted that the largest numbers of birds were to be found adjacent to good, shrubby cover.

No attempt was made to list all species of birds found feeding upon the locusts, the purpose being to observe the behavior of the birds most in evidence. Birds noted actually feeding upon the locusts, in order of their abundance in open places, were English Sparrow

(*Passer domesticus domesticus*), Eastern Robin (*Turdus migratorius migratorius*), Starling (*Sturnis vulgaris vulgaris*), Bronzed Grackle (*Quiscalus quiscula aeneus*), Eastern Cowbird (*Molothrus ater ater*), and Red-headed Woodpeeker (*Melanerpes erythrocephalus*). Other inseet-eaters were seen, but were not observed to eat any locusts.

The English Sparrows were by far the most numerous and were the speeies whieh might be said to have been in mueh larger numbers than would have ordinarily been found in sueh a loeation. Although there were multitudes of dead and dying inseets upon trees and the ground, the sparrows were very aetive in pursuing flying loeusts. As many as three sparrows were seen to ehase a single inseet, and the squabble and fight eharaeteristie of this bird usually ensued when one of the birds eaught an inseet. In several instances adult sparrows were seen feeding parts of loeusts to their young.

The number of Robins appeared to be but little more than would ordinarily have been found within sueh a favorable loeation. While many of them were seen to feed upon loeusts, a few were observed pulling earthworms from the sod, in a land of plenty.

Fewer Starlings were observed than might have been expeeted, as a large summer population is usually present in Indianapolis.

Although Bronzed Graekles are usually not seen in other parts of the eity at this time of year, they were frequently seen in the eemetery. Their method of feeding seemed more deliberate than that of the sparrows; they did not ehase the inseets, but rather daintily ate those easily eaught.

Three Cowbirds were observed, gleaning the lawns and leisurely eating a loeust now and then.

Two Red-headed Woodpeekers were observed in the aet of eonsuming parts of loeusts.

Although four Northern Fliekers (*Colaptes auratus luteus*) were seen, none of them appeared interested in feeding upon the abundant supply of materiał, but fed in their usual manner by pieking inseets from the sod.

From the observations made, it appeared to the writer that English Sparrows were attraeted in large numbers to an easily available supply of food and aeted in a "elean-up" eapaeity to a greater extent than any of the other birds seen. Although present in lesser numbers than the English Sparrows, Robins and Bronzed Graekles seemed to be the other species whieh were attraeted by the inseets.

National Park Service,
Richmond, Virginia.

EDITORIAL

The Twenty-second Annual Meeting of the Wilson Ornithological Club was held at the Chicago Academy of Sciences on November 27, 28, and 29, 1936, the Inland Bird Banding Association meeting in conjunction. It had been ten years since our last meeting in Chicago. At this meeting we missed the presence of a number of our Chicago colleagues who have added to the pleasure of other meetings. Messrs. P. B. Coffin and Chreswell J. Hunt have passed away since we last met. Messrs. B. T. Gault and E. R. Ford were unable to be present. It is a common experience that friendships are made at these gatherings, the renewal of which is looked forward to from year to year. The twenty-third annual meeting will be held at Indianapolis during the Holidays of this year.

The following figures give a statistical summary of the organization for the past five years:

	New Orleans 1931	Columbus 1932	Pittsburgh 1934	St. Louis 1935	Chicago 1936
Local Attendance	11	92	49	24	62
Out-of-town Attendance	81	65	129	88	70
Total Attendance	92	157	178	112	132
Dinner Attendance	35	69	72	70	54
Titles on Program	27	35	39	38	27
Honorary Members	7	7	6	6	5
Life Members	7	10	12	11	11
Sustaining Members	57	75	44	42	40
Active Members	214	175	154	189	212
Associate Members	461	469	507	538	640
Total Membership	744	734	721	784	906
New Members Added	162	113	112	141	170
Pages in Bulletin	334	256	288	318	336
Total Income	$2686	$2191	$2230	$2494	$2222
Fiscal Balance	$731	$547	$842	$767	$581

Several Changes in our official personnel are to be recorded. During the years since our Library was first established Mr. F. P. Allen, of the University of Michigan Library Staff, has served as our Librarian. Those of us who have been in a position to see him and know his work have realized his interest in building a substantial and useful library. Within the past year Mr. Allen has been called from our territory, thus automatically severing his relations with us. His successor in the University is Mr. F. Ridlen Harrell, who has consented to assume charge of the W. O. C. Library. We express our gratitude to Mr. Allen for services rendered, and our greetings and best wishes to Mr. Harrell.

Dr. L. E. Hicks resigned as Secretary after having served for five years. This is the longest service in this office in our history, and has been equalled only by Mr. B. T. Gault and Mr. A. F. Ganier. Dr. Hicks' term has been one of marked activity. During these years a total of 650 new members have been added to the roll. He has built four annual programs and has managed four annual meetings. The number of pieces of mail sent out from his office has been many thousands. In addition to this work for the Club he has published 105 notes or longer articles in the various fields of his interest. He is succeeded in office by Dr. Olin S. Pettingill, Jr., of the Department of Zoology, Carleton College, Northfield, Minn. We welcome him as a co-worker, and with the gentle admonition that he is in a line of able men; and for him we wish the utmost success.

At the beginning of 1925 Professor M. H. Swenk joined the writer in assuming editorial direction of the Wilson Bulletin. Through twelve years that association has continued. Professor Swenk now feels that he must relinquish this duty. During these years he has most faithfully performed his allotment of work on the Bulletin. The record shows that he has prepared for the printer 638 short communications, covering 363 pages of the magazine. As a further measure of achievement we wish it were possible to indicate the number of readers of this material. It is only by such a cumulative retrospect that it is possible to appreciate labor of this kind. We express our own personal appreciation for Professor Swenk's unfailing services and loyalty. We hope there is ample reward in the knowledge of work well done. This work will be carried on by Professor O. A. Stevens, of the North Dakota Agricultural College.

The normal size of the Wilson Bulletin is sixty-four pages. The last two issues for 1936 contained, however, ninety-six pages each. This increase was made possible by the splendid work of Dr. Hicks in enrolling new members to fill the places of those who dropped out. Credit is due no less to our many loyal members who assisted by securing new members or by sending names of prospective members to the Secretary. It is our policy to increase the size of the Bulletin to the extent of our financial resources. We do, however, try to begin the year modestly, with reference to volume, and make our best showing in the last two issues of the year. We feel sure that our members and readers will be just as generous in their support of Dr. Pettingill's efforts to build up our membership as they have been with past secretaries.

In January of this year the National Association of Audubon Societies announced the establishment of two Audubon Research Fellowships. One is located at Cornell University under the direction of Dr. A. A. Allen, and has for its objective the study of the status, ecology, and best methods of preventing the extermination of the Ivory-billed Woodpecker. Mr. James Tanner has been appointed to this fellowship. A second fellowship has been located at the University of Arizona under the direction of Professor Charles T. Vorhies, and has for its objective the study of the status, ecology, and best methods of preventing the extermination of the Desert Mountain Sheep of the southwest. Mr. A. A. Nichol has been appointed to this fellowship. The project of these fellowships now seems to be launched under the most favorable conditions.

GENERAL NOTES

Conducted by O. A. Stevens

The Starling in Moody County, South Dakota.—Moody County is in the extreme east-central part of South Dakota and is adjacent to the Minnesota state line. The writer saw several pairs of European Starlings (*Sturnus vulgaris vulgaris*) west of Colman, in that county. One pair of birds was seen a short distance from the Lake County line. The Starling has been reported from both the northeastern and southeastern corners of South Dakota and is now apparently starting its invasion into the central part of the state.—Wm. Youngworth, *Sioux City, Iowa.*

Birds Apparently Electrocuted.—Near Youngstown, Ohio, an unusual "bird killer" was noted on August 29, 1936. Birds that alighted upon a certain electric light wire had been electrocuted. After death the bodies hung there until wasted away. At the time of our visit seven bodies were hanging on the wires, mostly Starlings but one was a Flicker. The wires are not close together so we were at a loss to explain the tragedy.—Merit B. Skaggs, *Cleveland, Ohio.*

Effect of the Drouth on Water-Fowl.—The past breeding season has been the most unfavorable for water-fowl that this area has ever known. About seventy-five per cent of my sloughs have dried up. Indications early this spring were for a favorable hatching, but a large number either moved out in July or succumbed to drouth. There were far less broods this August than last. This area has always been particularly favorable for Canvas-backs and now it is ruined unless we receive a tremendous fall of snow this winter. This species is one of the most threatened. I think it is high time that something more drastic should be done regarding hunting, and am very disappointed that the regulations passed this year are so lenient.—O. C. Furniss, *Prince Albert, Sask.*

Incidents in Bird Behavior.—The severe wind and rain storm of June 26, 1936, was the cause of a considerable mortality of young birds at Sioux City, Iowa. At the home of Mrs. L. L. Kellogg, the gardener found a Robin's nest with young birds which had been blown from a tree. He put the nest together as best he could, using rubber bands, and placed it on a food-shelter in the tree from which it had blown. When the young birds were placed in the reconstructed nest, the old birds took up the task of feeding and rearing the young as if the nest had not been disturbed. On the same premises Mrs. Kellogg observed a mature Catbird feeding a half-grown Flicker. She thought the young Flicker had been dislodged from its nest or separated from its parents during the same storm. —W. J. Hayward, *Sioux City, Iowa.*

White Herons in Ohio.—On September 27, 1936, a Snowy Egret (*Egretta thula thula*) was observed at Linesville Lake which is part of the Pymatuning Reservoir project, located just east of the Pennsylvania-Ohio state line. The bird was watched as it fed at a distance of about fifty feet and the yellow toes and black legs and bill carefully noted by Vera Carrouthers, Mrs. Skaggs, Ralph O'Reilley, and the writer. Nearby we saw an immature Little Blue Heron and an American Egret, thus giving us the unusual opportunity of seeing all three "white herons" that visit us in late summer. On October 4 we saw a Snowy Egret (probably the same bird) in exactly the same place and noted that in feeding it stood on one foot and stirred up the water with the other. There are very few records of the Snowy Egret in this region.—Merit B. Skaggs, *Cleveland, Ohio.*

The Alder Flycatcher in Upland Situations.—I was interested to note that Mr. Louis W. Campbell in his article on the Alder Flycatcher in the September Wilson Bulletin, appears to consider the occurrence of these flyeatchers on unwatered uplands markedly unusual. All observations I have made on this species in the State of Iowa have taken place in dry, upland pastures, especially where there were rank growths of hazel bushes, wild crab, and hawthorn. I have noted specific instances in northwest Iowa in Woodbury County, in the southwest in Taylor County, and in the southeast in Keokuk County. I have observed the species as common in New York, and have found them all in boggy situations where alders, buttonbush, and other marsh shrubs grow abundantly. It occurs to me that the presence of this species in such surroundings in summer as those described by Mr. Campbell may be fairly typical of its haunts farther west. Perhaps observers in Indiana and Illinois could give additional information on the question.—Chas. J. Spiker, *Branchport, N. Y.*

Further Notes on the Water Birds of Rockbridge County, Virginia.—The following notes are supplementary to an article, "Water Birds of a Virginia Mountain County", which appeared in the Wilson Bulletin (Vol. XLVII, No. 1, March, 1935). I then listed fifty species and subspecies known to have occurred in Rockbridge County, Virginia, with two additional species in a footnote. Since then four other species have been added. We have recorded 169 land birds from the same area.

Red-throated Loon. *Gavia stellata.* This bird I then mentioned as hypothetical. Now a young man has given me a careful description of a bird captured just outside Lexington in late spring in 1924 or 1925 which could only have been a Red-throated Loon in breeding plumage.

European Teal. *Nettion crecca.* One was collected at Big Spring Pond on February 1, 1936, which had probably been there for over a month. The identification has been confirmed by Dr. H. C. Oberholser. (See the *Auk*, Vol. LIII, No. 2, April, 1936, p. 208). Curiously enough, I saw at the same pond on November 30, 1936, a male Green-winged Teal which had neither the white bar before the wing nor the white scapular stripe.

Black-bellied Plover. *Squatarola squatarola.* A highly-colored individual spent two days, May 25 and 26, 1935, at a large rain pool near Lexington.

Common Tern. *Sterna hirundo hirundo.* On September 6, 1935, a number of terns were flying over the North River at the East Lexington Bridge. I was told that before I arrived there were ten or fifteen of them. When I came in sight there were only four, and they were leaving. But I had the opportunity to study one of them in good light. The white inner webs of the outer tail feathers indicated that it was a Common Tern, although I realize that my identification was not beyond question.

Additional records of some of the birds already on the list may be worthy of note. On January 7, 1937, a Common Loon was shown to me that had been taken alive. It was later liberated. Prof. Ruskin S. Freer reports a Double-crested Cormorant in James River, at Snowden, just outside this county, on May 1, 1936. The American Egret was not uncommon in late summer in 1935 and 1936. I now have two other records, April and September, for the Black-crowned Night Heron. A male Gadwall, seen on James River, at Glasgow, gives a very late date for Virginia. A male Canvas-back was seen at Cameron's Pond on April

3, 1935. A female Old-squaw was captured on a street in Lexington on Christmas Day, 1933, by some boys. The Buffle-head was fairly common in 1935. I now have a December date for the Wood Duck, and a number of winter records for the Black Duck, Baldpate, Green-winged Teal, and Hooded Merganser; and additional fall dates for the Blue-winged Teal, Wood Duck, and Hooded Merganser. A flock of at least thirty Wood Ducks was seen on North River, September 28, 1936. I now have good reason to think that this duck is breeding in the county. Ducks were very common in the spring of 1935. On April 4 I saw 107 ducks, mostly scaups but including nine species, on the small expanse of Cameron's Pond. I have other January and February dates for the American Merganser, and another date, April 3, 1935, for the Red-breasted Merganser.

I would now rate the Semipalmated Plover as fairly common in May, with one fall record, September 14, 1936; and would rate the Least Sandpiper as common and the Semipalmated Sandpiper as fairly common in spring, with both as uncommon in fall. A late date for the Spotted Sandpiper is October 10, 1936. I have one fall date for the Greater Yellow-legs, October 14, 1935; and several for the Lesser Yellow-legs. The Ring-billed Gull was rather common in April, 1935, fourteen being seen on the 6th. Two Black Terns were seen with the Common Terns on September 6, 1935.—J. J. Murray, *Lexington, Va.*

The Speed of Flight of the Ruffed Grouse.—On May 24, 1936, while driving southeast from Mio, Michigan, toward South Branch, a Ruffed Grouse (*Bonasa umbellus*) flushed from the side of the gravel road and flew parallel with the right side of our car for a distance of about 250 feet. The bird took wing when we were about ten feet away, and in order to bring it alongside our line of vision we increased our speed from forty-five to fifty miles per hour. The grouse kept up this pace for a distance of 100 to 150 feet, after which it went into a glide, still keeping parallel to the road, which was straight at this point. It glided for about 100 feet and during this glide the speedometer registered approximately forty-seven miles per hour. The time of the observation was approximately 7:15 P. M. and the visibility was still good, although the sun was very near the western horizon. There was no wind. The observation was made from a 1935 Chevrolet and so far as is known the speedometer is accurate. The observers were J. S. Leonard and the writer.—David S. Shetter, *Institute for Fisheries Research, Ann Arbor, Mich.*

White-winged Scoter in Missouri.—On December 30, 1935, while quail hunting in the Ozark highlands near Current View on the Arkansas-Missouri line south of Doniphan, Ripley County, Missouri, I found a disabled White-winged Scoter (*Melanitta deglandi*). Quoting from my journal: "In passing through an oak thicket near a farmhouse, a duck, apparently disabled, was seen flopping over the snow. I thought at first it must be some barnyard duck which had been chased out into the woods by dogs. On close approach it proved to be a scoter. The mark on the snow showed that it had alighted on the spot from which I had first flushed it, all tracks and wingmarks being those just made in its struggle to escape. Presumably the bird either had lead-poisoning or was exhausted while flying in the recent storm."

There is no water suitable for scoters within a hundred miles.

The person who skinned the bird unfortunately discarded the carcass without sexing and without dissection. He had found a single shot wound in the head and thought that no other information was needed. The skin is in the University collection. Its colors are those of a female or immature.—Aldo Leopold, *University of Wisconsin, Madison, Wisconsin.*

Partial Albinism in Certain Species of Birds.—The following sight records taken direct from my field notes may be of interest to bird students.

On April 1, 1927, near Syringa on the Lochsa River, northern Idaho, I was attracted by what at first appeared to be a Rocky Mountain Jay perched on a fence post. A second glance proved it to be a Robin with head, neck, upper breast and a large part of the wings and tail pure white. It was not my fortune to remain long in that locality so I did not see the bird again but was told later by friends that it remained all summer, mated with a normal Robin and raised a family of young, all normal birds. The abnormal specimen proved to be a male.

On October 11, 1932, in a mixed flock of Bendire's Crossbills, Pine Siskins, and Cassin's Purple Finches, two of the latter were noted with a considerable amount of white in their plumage. A large part of the wing coverts of one were white while the other had two irregular shaped white spots in the wings and some white in the tail. This was at Spokane Meadows on the upper Little North Fork of the Clearwater River, St. Joe National Forest.

In a marsh near St. Maries, Idaho, on May 5, 1934, I saw a male Redwing (*Agelaius phoeniceus* subsp.?) with prominent white longitudinal bars near the base of the primaries and immediately adjoining the red and yellow shoulder patches. These spots were so similar to those of the Yellow-headed Blackbird that hybridism might be suggested but for the fact that otherwise the bird was a typical redwing in notes as well as in plumage. I saw it again on May 20 of the same year and apparently it returned the year following, for on May 22, 1935, I saw a bird with identical plumage at almost exactly the same spot.

June 1, 1934, is the next record. On that date and very near the spot where the abnormal Cassin's Purple Finches were seen, I had an excellent view of a Pine Siskin with the entire head and neck creamy white. The bird was otherwise normal and was associated with normal birds of the same species.

February 20, 1936, in the town of St. Marics, one of a flock of English Sparrows, apparently a female, was noted with the first primary largely white and with conspicuous white outer tail feathers.

I should also like to mention two individuals of which I have no written record but which stand out clearly in my memory even though seen more than a quarter of a century ago. One was a Slate-colored Junco with a pure white head seen in what is now known as Allen Park in the City of Jamestown in western New York. It was in a large flock of normal individuals of its kind in the spring of 1909, I think. The other was a Robin similar to the one mentioned above but as I recall, with somewhat less white in the wings and tail. It was seen just south of Jamestown in a migrating flock of normal Robins in the early spring of 1910.—R. L. Hand, *St. Maries, Idaho.*

An Old Record of a Chimney Swift Roost.—An interesting description of a Chimney Swift roost in a hollow sycamore near Marietta, Ohio, is contained on page 180 of T. H. Harris' "Journal of a Tour into the Territory Northwest of the Allegheny Mountains; Made in the Spring of the Year 1803". Boston (1805). It reads as follows:

"In connexion with this I may mention a large collection of feathers, found within a hollow tree, which I examined with the Rev. Mr. Story, May 18 ,1803. It is in the upper part of Waterford, about two miles distant from the Muskingum. A very large sycamore, which, through age, had decayed and fallen down, contained in its hollow trunk, five and a half feet in diameter and for nearly fifteen feet upwards, a mass of decayed feathers, with a small admixture of brownish dust and the exuvies of various insects. The feathers were so rotten that it was impossible to determine to what kind of birds they belonged. They were less than those of the pigeon; and the largest of them were like the pinion and tail feathers of the swallow.

"I examined carefully this astonishing collection, in the hope of finding the bones and bills, but could not distinguish any. * * *

"One circumstance which makes me suppose these the plumage of one vast flock of birds which took up winter quarters in this tree, and perished there; and not the moultings of annual visitors, is, that the feathers at the top were as much decayed as those at the bottom. As the trunk had split in falling down, I was able to examine the whole mass and found it of uniform appearance throughout. We judged that there were enough to have filled two waggons."

The above antedates the publication of Audubon's somewhat similar account by about thirty years.—A. W. Schorger, *Madison, Wis.*

Great Blue Heron Using Its Beak as a Spear.—This behavior, mentioned by the writer in a note on the bird life of southern Iowa, (Wilson Bulletin, March, 1936) has been questioned by William P. Hainsworth (*ibid.*, June, 1936). Once in the Green Bay region of Iowa, the writer observed a Great Blue Heron (*Ardea herodias*) spearing a fish. Securing the fish he found a single hole through it, indicating that the mandibles were closed at the time of the strike. Again in the Ozark Mountains, he saw a bird of the same species spear a fish which was estimated to weigh one pound. While making a photographic study of herons at Reelfoot Lake in northwestern Tennessee, he once more observed such a spearing. He also made note of immature herons striking at the object of their anger with open and also with closed beak.

The writer has seen the American Bittern (*Botaurus lentiginosus*) in the act of spearing food. The New Natural History states: "In the bittern's stomach may be found mollusks, crayfish, frogs, lizards, small snakes and fishes as well as insects. Such prey is captured with great address, by spearing, as the bird wades or walks stealthily along." Dr. Frank M. Chapman states (letter to present writer, August 27, 1936): "I have submitted your letter of August 23rd to the members of the ornithological staff of the American Museum of Natural History. It appears that there are on record two instances of a Great Blue Heron striking a dog in the eye in which only one hole was made and the bill apparently, therefore, was closed. In regard to the striking of fish the evidence advanced indicated that both methods of striking were used; possibly with larger fish the bill was closed and the fish was struck, but with smaller ones the bill

might be open." Dr. T. Gilbert Pearson has stated in the *National Geographic Magazine*, that "the sharp dagger of the heron spears fish". Presumably most of the species of herons are capable of using their beaks as spears, though the Boat-billed Heron (*Cochlearius cochlearia*) has a broad, blunt bill and would be unable to use it in this manner.—Lawrence E. Hunter, *Dallas City, Illinois.*

[Coues (*Key to North American Birds*, 5th ed., 2:863) states: "Food... generally procured by spearing." Surber (in Roberts, "The Birds of Minnesota", 1:186) referring to the Black-crowned Night Heron, states: "So far as I could observe, the Herons seemed to grasp the fish between the mandibles and not to pierce the body as is usually done by the Heron Tribe." The Boat-billed Heron is placed in a separate family.—O. A. S.].

CORRESPONDENCE

In the review of Pettingill's recent monograph on The American Woodcock* written by Dr. T. C. Stephens in the Wilson Bulletin (Vol. XLVIII, No. 4, December, 1936, p. 317) occurs this statement: "The author discounts the claim that the Woodcock carries the young away in the event of danger." Since this seemed to me a misinterpretation of Dr. Pettingill's text I wrote Dr. Stephens concerning the matter, and he has been kind enough to agree that such a misinterpretation might arise, and to suggest that I discuss briefly my views and experience relative to such an act on the part of the Woodcock. I therefore suggest as being more nearly in accord with Dr. Pettingill's discussion the statement, "The author discounts the claim that the Woodcock *purposely* carries the young away in the event of danger."

It is easy to realize that to a person who has not seen it the carrying of a young bird by a parent Woodcock must seem a fantastic performance. Nevertheless, on pages 333 *ff.* of Dr. Pettingill's volume there are a number of eye-witness accounts of the act to which credence is given, among them an account of two such occurrences observed by the writer. I shall attempt below to amplify the notes quoted there, part of which had already appeared in the *Auk* (Vol. 47, pp. 248-249, 1930).

The first of the two observations was made on May 7, 1926. My father, a trained observer, Mr. Charles Hefner, and the writer were engaged in spraying an apple orchard near French Creek, Upshur County, West Virginia. An adult Woodcock and two young were flushed, the young birds appearing to be well under half-grown. The birds scattered, but we followed the adult, our attention being called to its peculiar flight and appearance. Since there was little cover nearby we were able to follow it closely and to flush it almost immediately. When it rose again we could see clearly that it was carrying a young bird, apparently holding it between its (the adult's) thighs. The young bird dangled below the feet of the adult, and the flight had much the appearance of the ordinary "injury feigning" behavior, with which we were familiar. All three of us again pursued closely, and a third such flight was made, the young bird still in plain view. These flights did not average more than ten feet in length, and we could easily

*The American Woodcock. By Olin Sewall Pettingill, Jr. Vol. 9, No. 2, Memoirs Boston Society of Natural History. Boston, 1936. Pp. 168-391.

keep up with them. All three of us were in complete agreement as to what we saw.

On the fourth flight the old bird had dropped her burden, and this time she flew much farther. We examined the last point of departure and found there a young bird in downy plumage. I must confess that we made no attempt to weigh the young bird, nor did we consider, at the time, that we had seen an especially unusual sight. My father had had an account of such a performance from Dr. Edward A. Preble, of the U. S. Bureau of Biological Survey, and we accepted our own experience as a matter of course. It should be emphasized again that conditions for observation were unusually good, due to the poor cover nearby.

My second observation was made on the same farm on July 11, 1929. From the neighborhood of a small seep hole in a meadow an adult Woodcock and three young were flushed. As the old bird rose a fourth young bird was seen hanging between her(?) legs. This time I was so fortunate as to be carrying a good 6x glass. I ran to her quickly, and forced her into three more short flights before the young bird was abandoned. I should say that the young in this case was nearly half-grown. My impression is that the flights were made with the feet of the adult uncrossed, but I cannot be certain of this. The young bird carried was held well between the legs of the adult, and there was certainly no grasping of the young in the feet as has been reported by some observers. Th young bird appeared perfectly limp, and its feet dangled a considerable distance below those of the old bird.

Dr. Pettingill, who has not been so fortunate as to see this performance by the Woodcock, suggests a possible explanation for it. His theory (as given in his monograph) is that as an adult with young flushes to feign injury its feet become braced and its muscles grow tense with fear. If a young bird happens to be between the feet and legs at the moment of tension and flight it is raised from the ground and carried for a short distance. To this theory I can add nothing. Dr. Pettingill believes (and I agree) that a purposeful act of this nature on the part of the Woodcock is out of the question. Such intelligenee is entirely too much to expect from a shore bird. For the fact that I have seen three and four such flights made in series I can only propose the explanation that the birds were followed so closely that their muscles did not relax between flights. It is common experience that after an "injury-feigning" flight a Woodcock will squat close to the ground and look around before it attempts to move away. In the cases noted above this pause each time was very brief, since we were within a few feet of the points of alighting.

Until the miracle of a moving picture camera in exactly the right hands at exactly the right time and place we shall in all probability have to be content with eye-witness accounts of this phenomenon. I am abundantly aware of human frailties of sight, as well as human abilities to stretch facts, but in my own case I can only fall back on the comforting reflection that "seeing is believing".

Maurice Brooks,
Department of Botany and Zoology,
West Virginia University,
Morgantown, W. Va.

PROCEEDINGS OF THE WILSON ORNITHOLOGICAL CLUB

By Lawrence E. Hicks, Secretary

The Twenty-second Annual Meeting of the Wilson Ornithological Club was held at Chicago, Illinois, on November 27, 28, and 29, 1936. The business and program sessions were held at the auditorium of the Chicago Academy of Sciences. Short business sessions were held Friday morning and Saturday afternoon. The Saturday morning session was devoted to the various aspects of the bird banding field, being a joint session with the Inland Bird Banding Association. The four program sessions included twenty-seven papers, slide talks, and movie presentations. The maximum attendance at each session was 52, 74, 71, and 84.

Saturday evening the Wilson Ornithological Club Annual Dinner was held at the Parkway Hotel. Dr. R. M. Strong, one of the three living founders of the Wilson Club, served as Toastmaster. Dr. Strong related some fascinating bits of the early history of the organization and exhibited early copies of the Wilson Bulletin and of other amateur bird journals of the period. Another highlight of the evening was the showing of three reels of wildlife movies by Mr. F. R. Dickinson which had been taken by Alfred M. Bailey and himself in the American Rockies.

On Friday evening sixty-one members attended the Open House held at the Chicago Academy of Sciences. Everyone greatly enjoyed the opportunity afforded to renew acquaintances and to observe the study and exhibit collections. Some of the local habitat groups with the colored photographic enlargements for backgrounds were particularly fine. Among the special exhibits arranged for the meeting were twenty-six splendid bird paintings by Mr. Earl G. Wright and 120 photographic enlargements depicting most of the present day prominent ornithologists of America.

On Sunday morning a number of members participated in a field trip arranged for by the local committee to the extensive Brookfield Zoo.

Business Sessions

Short business sessions were held Friday morning and Saturday afternoon, President Van Tyne presiding.

The minutes of the 1935 meeting were approved without being read since they had previously been published in the Wilson Bulletin (Vol. XLVIII, No. 1, pp. 56-70). The Secretary's and Treasurer's reports for the year 1936 were next read and approved. The Secretary's report indicated that during the past year 27 members had assisted in the membership campaign by making nominations resulting in the securing of one or more members each. A list was presented of the 170 new members secured during 1936, and previously confirmed by the electoral board. These were elected to membership. The report showed that there had been a net gain of 122 members in 1936, resulting in a total membership of 906, which exceeds by 122 members the previous high in membership total of 784 established in 1935. The largest size reached by the Wilson Ornithological Club in pre-depression days was 765 members in 1930. Thus the 650 new members secured during the five-year term of the retiring Secretary, have enabled the organization to offset the extremely heavy depression losses and emerge from that period of trying economic conditions with 141 more members than when it began.

The Secretary also presented a bundle of 148 letters received from members in thirty-one states, eaeh of which, though unable to attend the Chicago meeting, had written a letter or note aeknowledging the meeting notiee, expressing regret at being unable to attend, and sending best wishes for the success of the meeting. Excerpts were read from several of them. The receipt of so many unsolicited letters indieates that the great bulk of the Wilson Ornithologieal Club membership consists of persons actively interested in furthering the ornithologieal studies and the edueational and eonservation work sponsored by the organization.

The Editor next summarized briefly the important phases of his work during the past year. In the absence of the Librarian, his report was read. President Van Tyne appointed Mr. F. Ridlen Harrell as the new Librarian to sueeeed Mr. F. P. Allen, the latter no longer residing in Ann Arbor, having aeeepted a new position in the East. The well prepared Treasurer's report, which was read and approved, indicated that the organization was in splendid financial condition.

The following temporary eommittees were appointed by the President: Nominations, Mrs. H. J. Taylor, R. M. Strong; Resolutions and Amendments, Olin S. Pettingill, Jr., A. F. Ganier, S. Charles Kendeigh; Auditing, Leonard W. Wing and Miles D. Pirnie.

The Committee on Resolutions offered the following resolutions, all of whieh were adopted by motion:

Resolved, that the Wilson Ornithologieal Club expresses its gratitude to the Chieago Academy of Seienees for providing an excellent place of meeting and for plaeing sueh splendid faeilities at its disposal; to the Inland Bird Banding Asso-eiation and the five loeal eoöperating organizations for the good will and courtesies whieh they have extended, to the offieials of the Brookfield Zoo for their kind invitation to visit the Zoo's interesting exhibits, and to the members of the loeal eommittee, Wiiliam I. Lyon, Howard K. Gloyd, Earl G. Wright, Edward R. Ford, Margaret M. Nice, and Graee Z. Harsh, for their exeellent arrangements which contributed so mueh to the sueeess of the meeting.

Resolved, that the Wilson Ornithologieal Club eommends the untiring, eareful work of its Editor, Secretary, Treasurer, President, and its other officers, who by their faithfulness to heavy duty, have enabled the organization to add another suecessful year to its long existenee.

The Committee on Nominations offered the following report:

President—Josselyn Van Tyne, Museum of Zoology, Ann Arbor, Miehigan.
First Vice-President—Margaret M. Niee, Chicago, Illinois.
Second Vice-President—Lawrenee E. Hieks, Ohio State University, Columbus, Ohio.
Secretary—Olin S. Pettingill, Jr., Carleton College, Northfield, Minnesota.
Treasurer—S. E. Perkins, III, 709 Inland Building, Indianapolis, Indiana.
Councillors—Albert F. Ganier, Nashville, Tennessee.
Alfred M. Bailey, Denver, Colorado.
S. Charles Kendeigh, Champaign, Illinois.

The report was adopted by motion, and the Secretary was instructed to cast a unanimous ballot for the nominees. This being done all were deelared elected for the coming year.

The 1937 meeting was set for late December in connection with the meetings of the American Association for the Advancement of Science, at Indianapolis, Indiana. It was also voted that in the future, income from the endowment fund of the Wilson Ornithological Club would be used each year to pay for some special features of the Wilson Bulletin, such as additional illustrations or an occasional color plate.

Another important item of business included a clarification of the duties of a number of the officers of the organization, in order to more effectively utilize the man power at its disposal in furthering the work of the Club. By agreement it was decided that the President would be responsible for preparing or delegating the preparation of obituary notices for the Bulletin of all deceased members, the other officers and members to coöperate by reporting all deaths to the President or Secretary as promptly as possible. The First Vice-President assumes the task of canvassing the members for life memberships or for raises in membership status. The Second Vice-President agrees to aid the work-burdened Secretary by assisting in the membership campaign, assuming a quota of at least twenty-five new members secured each year. The Treasurer, as in the past, will make every attempt to maintain the size of the membership list, by special correspondence to regain where possible delinquent members. It is hoped that special appointees can work to enlarge the subscription list of the Bulletin in institutions, high schools, and libraries, and that the three councillors will contribute to the membership drive by assuming a quota of five or ten new members per year each.

Program of Papers

The papers were presented in the following order, which is very slightly different from the announced program. All meetings were held in the Auditorium of the Chicago Academy of Science, except the Annual Dinner, which was held at the Parkway Hotel.

Friday Morning Session

1. The Chicago Academy of Sciences and Its Collections. (15 minutes). Earl G. Wright. Chicago Academy of Sciences, Chicago, Illinois.
2. Notes on the Summer Birds of Roan Mountain, Tennessee. (20 minutes). Albert F. Ganier, 2507 Ashwood Avenue, Nashville, Tennessee.
3. Ornithological Opportunities. (15 minutes). (Lantern). Leonard W. Wing, University of Wisconsin, Madison, Wisconsin.
4. Report on Progress of Publication of a Bibliography of Birds. (15 minutes). R. M. Strong, 5840 Stony Island Avenue, Chicago, Illinois.
5. Striking Cases of Intelligent Behavior in the Clapper Rail. (20 minutes). (Lantern). Olin S. Pettingill, Jr., Carleton College, Northfield, Minnesota.
6. Dr. J. M. Wheaton—A Pioneer Ornithologist of Ohio. (15 minutes). Mrs. H. J. Taylor, 900 Santa Barbara Road, Berkeley, California.
7. A Yucatan Swift Roost. (15 minutes). Josselyn Van Tyne, Museum of Zoology, Ann Arbor, Michigan.

Friday Afternoon Session

8. Wildlife Cycles. (20 minutes). (Lantern). Leonard W. Wing, University of Wisconsin, Madison, Wisconsin.

9. Variations in the Weight of Birds. (20 minutes). (Lantern). S. Charles Kendeigh, Experimental Zoology Laboratory, Champaign, Illinois.
10. Wildlife Research at the W. K. Kellogg Bird Sanctuary of Michigan State College. (20 minutes). (Lantern). Miles D. Pirnie, Box 174, Battle Creek. Michigan.
11. Observations on the Prairie Chicken in Central Illinois. (10 minutes). Ralph E. Yeatter, State Natural History Survey, Urbana, Illinois.
12. A Woodcock Biography. (30 minutes). (Lantern). Olin S. Pettingill, Jr., Carleton College, Northfield, Minnesota.
13. Black-crowned Night Heron and Upland Plover Orphans. (25 minutes). (16 mm. motion pictures). Elizabeth A. Oehlensehlaeger, 926 E. Kilbourn Avenue, Milwaukee, Wisconsin.
14. An Analysis of the Weights of 12,000 Birds of 217 Species. (20 minutes). (Lantern). Lawrence E. Hicks, Ohio State University, Columbus, Ohio. (Read by Title).

Saturday Morning Session

15. Bird Banding Report from North Dakota. (15 minutes). (Charts). O. A. Stevens, State College, Fargo, North Dakota.
16. Homing Experiments with Birds. (20 minutes). (Lantern). William I. Lyon, 124 Washington Street, Waukegan, Illinois.
17. Do Young Birds Return to the Place of Their Birth? (15 minutes). Margaret M. Nice, 5708 Kenwood Avenue, Chicago, Illinois.
18. The Importance of Banding in Waterfowl Conservation. (15 minutes). (Lantern). Miles D. Pirnie, Box 174, Battle Creek, Michigan.
19. Studies of 60,000 Captured and 35,000 Banded European Starlings. (30 minutes). (Slides). Lawrence E. Hicks, Ohio State University, Columbus, Ohio. (Read by Title).

Saturday Afternoon Session

20. The American Coot in Iowa. (15 minutes). George O. Hendrickson, Logan J. Bennett, Charles E. Friley, Jr., Department of Zoology and Entomology, Iowa State College, ,Ames, Iowa.
21. Three Years' of Hawk Mountain Sanctuary. (30 minutes). (16 mm. motion pictures). Maurice Broun, Route 1, Orwigsburg, Pennsylvania.
22. A Rational Basis for Conservation. (30 minutes). (Lantern). William Vogt, National Association of Audubon Societies, 1775 Broadway, New York City.
23. From the Top of a Tamarack Tree. (20 minutes). (Lantern). S. E. Perkins, III, 709 Inland Building, Indianapolis, Indiana.
24. Nesting of the Red-tailed Hawk in Northern Indiana. (20 minutes). (16 mm. motion pictures). A. Trevenning Harris, 504 Broadway, Gary, Indiana.
25. The Changing Status of Some of Our Birds as Regards Abundance. (25 minutes). C. W. G. Eifrig, 1029 Monroe Avenue, River Forest, Illinois.
26. Nesting of Cliff Swallows on a River Lock and Dam. (15 minutes). (16 mm. motion pictures). H. S. Vaughn, Nashville, Tennessee. (Read by Title).

REPORT OF THE SECRETARY FOR 1936*

To the Officers and the Members of the Wilson Ornithological Club:

During the past year, the intensive eampaign for new members was continued by the Seeretary, in an attempt to inerease the size of the organization to at least 900 members and thus make available suffieient ineome to expand the organization's aetivities and finanee a larger Wilson Bulletin. It is a pleasure to report that this goal has now been reaehed. The membership now totals 906. This is 122 more than the 784 of last year, and 141 more than the pre-depression high of 765 in 1930. Thus the Wilson Ornithologieal Club is deeidedly larger than ever before.

This eampaign has required the expenditure of no little time and effort, as 2,732 membership prospeets were solieited and 1,073 additional letters written by the Seeretary in 1936. Members of the Club gave splendid assistanee by sending in numerous names of prospeetive members for solieitation. Our membership is espeeially urged during the eoming year to aequaint friends with the benefits of the organization and forward to the offieers the names of all membership prospeets. We will do the rest.

New members seeured during the five-year term of the retiring Seeretary were as follows: 1932, 113; 1933, 114; 1934, 112; 1935, 141; and 1936, 170. Total for the five years, 650. The 170 new members for 1936 were: Sustaining, 1; Aetive, 37; and Assoeiate, 132. The new members were distributed through 42 states and provinees: Illinois, 25; Ohio, 18; California, 14; Wiseonsin, 14; Miehigan, 11; Iowa, 8; Missouri, 6; Indiana, 5; Kentueky, Nebraska, and Texas, 4 eaeh; Maine, Georgia, Minnesota, New York, Pennsylvania, New Hampshire, Arkansas, and Conneetieut, 3 eaeh; Alabama, Oklahoma, New Jersey, Colorado, Florida, North Dakota, Maryland, New Mexieo, Utah, and British Columbia, 2 eaeh; Arizona, South Carolina, Tennessee, Alberta, Oregon, Delaware, Quebee, Virgin Islands, Virginia, South Dakota, Washington, D. C., Kansas, and Massaehusetts, 1 eaeh.

Disregarding some duplieations in nominations, the various members responsible for the applieations of new members, were as follows: Lawrenee E. Hieks, 149; T. C. Stephens, 10; S. E. Perkins, III, 8; Mabel Slaek, Warren W. Chase, and Frank Blaneliard, 3 eaeh; Josselyn Van Tyne, A. F. Satterthwait, John J. Stophlet, P. F. English, and G. A. Ammann, 2 eaeh: and the following 16 persons, 1 eaeh: Lynds Jones, R. E. Yeatter, Olin S. Pettingill, Jr., Ward Klepfer, William R. Lodge, A. P. Larrabee, D. Elmer Johnson, Elmer Knapp, Dora Moore, H. H. Forsthoefel, Elizabeth Oehlensehlaeger, Mrs. Annabel K. Hinman, William C. Baker, J. J. Murray, W. H. Burt, and David Damon.

The total number of members lost during the year 1935 from all eauses was 49, 1 being Honorary, 3 Sustaining, 14 Aetive, and 31 Assoeiate. A eonsiderable number of former members have reinstated during the year. Thus there has been a net gain of 122 members during 1936.

This leaves the present membership of the Club at 906, distributed as follows: Honorary, 5; Life, 11 (2 also are Honorary); Sustaining, 40; Active, 212; Associate, 640.

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*Revised to the end of 1936.

The Secretary wishes to take this opportunity to thank the many members who have assisted in the membership campaign, helped with the staging of the annual meeting, or otherwise advanced the work of the Wilson Ornithological Club during the past year. It has been particularly gratifying to have received in all several hundred letters from members during the year giving news of their own work, ideas and suggestions on ornithological and conservation topics, or words of encouragement and constructive criticisms of the work being done. It is greatly regretted that the pressure of other duties has made it impossible to answer many of these directly or to reply save by abbreviated note.

The Secretary values highly the various experiences, the multitude of contacts and the innumerable friendships gained during his five-year term of office now completed. He wishes to thank all concerned for the countless courtesies extended and the W. O. C. for the opportunity to have served a most deserving organization.

Respectfully submitted,

Lawrence E. Hicks, *Secretary.*

REPORT OF THE LIBRARIAN FOR 1936

I have the honor to present herewith the sixth annual report of the Librarian of the Wilson Ornithological Club.

I accept the position of Librarian of the Wilson Ornithological Club with pleasure. I am sure that I shall enjoy this relationship.

I find the library in a well organized and workable condition. The material has been classified and arranged on the shelves to give the greatest amount of service. I shall endeavor to keep the library as I find it and add to it whatever my experience tells me will be beneficial.

In a general survey of the library I find that all the sets are not complete. Dating from 1932 or 1933 I find many volumes missing from the sets. An early shipment of the exchanges from the Editor would give me an opportunity to find out what is needed to complete sets and know which sets are actually complete. This valuable exchange should not be permitted to lag as it affects the service and efficiency of the library.

We have received gifts from those interested in the bird collection and from members of the Wilson Ornithological Club. This past year we received 101 pieces of unbound material. This brings the unbound material to a total of 1578 pieces. The total for bound volumes remains 190. Some sets that have had noticeable omissions in them have been filled and new subscriptions have been received. I wish to thank the donors for this fine spirit of coöperation.

Respectfully submitted,

F. Ridlen Harrell, *Librarian.*

Ann Arbor, Michigan, November 21, 1936.

REPORT OF THE TREASURER FOR THE YEAR 1936

Receipts for 1936

January 6, 1936, Balance from W. M. Rosene			$ 766.75
From Membership Dues:			
1	Associate member for 1933	$ 1.50	
1	Associate member for 1934	1.50	
5	Associate members for 1935	7.50	
325	Associate members for 1936	487.50	
	Remainder on two for 1936	1.25	
10	Associate members for 1936 ($1.75)	17.50	
73	Associate members for 1937	109.50	
1	Associate member for 1937 ($1.75)	1.75	
1	Associate member for 1938	1.50	
1	Active member for 1934	2.50	
3	Active members for 1935	7.50	
131	Active members for 1936	327.50	
33	Active members for 1937	82.50	
2	Active members for 1938	5.00	
24	Sustaining members for 1936	120.00	
10	Sustaining members for 1937	50.00	
	Total received from membership dues		$1,224.50
From Subscriptions:			
1	Subscription for 1935	1.50	
33	Subscriptions for 1936	49.50	
5	Subscriptions for 1936 ($1.75)	8.75	
1	Subscription for 1936 ($2.50)	2.50	
17	Subscriptions beginning September, 1936	25.50	
2	Subscriptions, fractional	2.13	
4	Subscriptions for 1937	6.00	
1	Subscription beginning September, 1937	1.50	
	Total received from Subscriptions		97.38
Miscellaneous receipts:			
	Back numbers of the Bulletin sold	20.20	
	Contributions to publication fund	110.98	
	Replacement of check	2.50	
	Total miscellaneous receipts		133.68
	Total receipts, including old balance		$2,222.31

Disbursements for 1936

Printing four issues of the Bulletin	$1,085.51	
Cost of halftones, cuts, etc.	193.93	
Other expenses in Editor's Office	92.26	
Total publication costs		$1,371.70
Expenses in Secretary's Office	131.89	
Expenses in Treasurer's Office	68.35	
Printing	49.27	
Refunds and miscellaneous expenses	20.08	
Total general costs		$ 269.59
Total disbursements for 1936 (itemized in report)		1,641.29
Balance on hand November 24, 1936		581.02
Total		$2,222.31

Endowment Fund

January 8, 1936, Balance by check from W. M. Rosene	$ 5.09
September 23, 1936, Securities from W. M. Rosene, as follows:	
U. S. Savings Bonds in the sum of	675.00
U. S. Postal Savings Bonds (coupon) in the sum of	780.00
Interest coupons on Postal Savings Bonds, due January 1, 1936, and July 1, 1936, and deposited in savings account with the Fletcher Trust Company at Indianapolis	19.50
Total Endowment Fund, November 24, 1936	$1,479.59

The bond numbers have been sent to the Secretary for record.

Respectfully submitted,

S. E. Perkins, III, *Treasurer*

Indianapolis, Indiana, November 24, 1936.

Report of the Auditing Committee

The undersigned have examined the report of the Treasurer of the Wilson Ornithological Club for the fiscal year ending November 24, 1936, and vouchers accompanying the same, and have found them correct.

Respectfully submitted,

Miles D. Pirnie.
Leonard W. Wing.

Fig. 7. Group at the Annual W. O. C. Meeting, Chicago, 1936.

Attendance

The 1936 meeting was one of the most successful in the history of the organization. Although the out-of-town attendance was only fair, fifteen states were represented. The local attendance was the second largest and the total attendance the fourth largest of the twenty-two annual Wilson Ornithological Club meetings held to date. Many local visitors failed to register. Additional unregistered visitors attended the Open House, the annual dinner, or the field trip.

Thirty-two universities, colleges, museums, and other institutions were represented in the attendance at the Chicago meeting. These included: National Association of Audubon Societies, University of Nebraska, Morningside College, Ohio State University, University of Chicago, Chicago Medical School, Northwestern University, Ohio Wildlife Research Station, Michigan Museum of Zoology, Michigan State College, University of Michigan, Yankton College, University of Wisconsin, Illinois Natural History Survey, University of Illinois, Loyola University of Medicine, Chicago Academy of Sciences, Field Museum, Principia College, U. S. Soil Conservation Service, U. S. Biological Survey, Iowa Wildlife Research Station, Kennicott Club, Illinois Audubon Society, Chicago Ornithological Society, Inland Bird Banding Association, Carleton College, Iowa State College, Kellogg Bird Sanctuary, University of Louisville, Emergency Conservation Committee, Isaac Walton League of America, and Denison University.

KEY TO GROUP PHOTOGRAPH OF THE W. O. C. MEETING AT CHICAGO, 1936

1, Lawrence E. Hicks. 2, Mrs. Paul Downing. 3, Margaret R. Knox. 4, Mrs. Clyde C. Ohliger. 5, Mrs. Olin J. Pettingill, Jr. 6, Mrs. H. J. Taylor. 7, Mrs. Myron H. Swenk. 8, Grace Graves. 9, Exean Woodard. 10, Mrs. F. J. Hamerstrom, Jr. 11, Myron H. Swenk. 12, Miles D. Pirnie. 13, Paul Downing. 14, Thursten I. Wright. 15, Grace Harsh. 16, Roy V. Komarek. 16, Miss Mitchell. 17, Elizabeth A. Oehlenschlaeger. 18, Mrs. Lawrence E. Hicks. 19, Mrs. Leonard W. Wing. 20, S. E. Perkins, III. 21, Josselyn Van Tyne. 22, Olin S. Pettingill, Jr. 23, C. W. G. Eifrig. 24, S. Charles Kendeigh. 25, Margaret M. Nice. 26, William Vogt. 27, Orion O. Smith. 28, Albert F. Ganier. 29, Harold A. Hayes. 30, Mr. Smith. 31, William I. Lyon. 32, Robert W. Glenn. 33, John F. Gall. 34, Earl G. Wright. 35, Charles E. Gillham. 36, James S. White. 37, Sidney H. Horn. 38, Pierce Brodkorb. 39, Walter L. Necker. 40, Howard K. Gloyd. 41, Leonard B. Nice. 42, T. C. Stephens. 43, Leonard W. Wing. 44, F. J. Hamerstrom, Jr. 45, Gordon Pearsall. 46, L. V. Domm. 47, George O. Hendrickson. 48, Charles T. Clark. 49, Mr. Brown. 50, C. T. Black. 51, Karl Bartel. 52, Harold Hanson. 53, Frank Bellrose, Jr. 54,————. 55, Frank Pitelka. 56, B. J. Bujak. 57,————. 58, S. Camras. 59,————. Copies of this 1936 photograph may be obtained for fifty cents each by addressing the Ray Studio, 130 Washington Street, Waukegan, Illinois.

REGISTER OF ATTENDANCE AT THE CHICAGO MEETING

From California: Mrs. H. J. Taylor, Berkeley. From Illinois: Paul A. Jones, Berwyn; Karl Bartel, Blue Island; Mr. and Mrs. Cyril E. Abbott, Mrs. Mabel Andrew, S. C. Bacon, Amy G. Baldwin, Walter Bateman, James E. Beecher, W. J. Beecher, Mary A. Bennett, C. T. Black, Harvy Blank, E. M. Bolton, Frank H. Booth, Bay Brice, Mr. Brown, S. Camras, Charles T. Clark, Aulden D. Colbe, Margaret Dayer, L. V. Domm, W. H. Dornke, Walter M. Dorys, Donald P. Duncan, J. M. Essenberg, John F. Gall, Howard K. Gloyd, V. O. Graham, Grace Graves, Harold Hanson, Flora E. Halliney, Harold Hanson, Grace Harsh, Mrs. M. Hausler, O. C. Hynning, William L. Kannapel, Adelbert Klaptoz, Roy V. Komarek, Sally H. Lawson, Dr. Alfred Lewy, S. B. Locke, Mrs. Charles F. McElroy, Miss Mitchell, Walter L. Necker, P. Delno Nelson, Leonard B. Nice, Margaret M. Nice, M. Neptune, Anna Newman, Mr. and Mrs. Clyde C. Ohliger, Fred Pattee, Robert E. Smart, Helen Lea Smith, R. M. Strong, C. H. Thordarson, Harold O. Wiles, Mrs. Helen M. Miles, Burtis H. Wilson, Exean Woodard, Earl G. Wright, Thursten I. Wright, E. W. Youngren, Chicago; George B. Happ, Elsah; Albert A. Borden, Jr., Howard Berolzheimer, L. W. Crow, S. C. Denham, R. V. Hagen, Mrs. F. Pattee, Evanston; Mr. and Mrs. Paul Downing, James S. White, Highland Park; Harold A. Hayes, Hubbard Woods; Leslie Wheeler, Lake Forest; Frank Pitelka, Lyons; Ruby E. Nolin, Milford; Mr. and Mrs. Arthur W. Wood, Moline; Gordon Pearsall, Oak Park; Marion Clow, Lake Forest; Frank Bellrose, Jr., Ottawa; Alma Kannapel, Peoria; C. W. G. Eifrig, Mrs. Walter D. Harrick, River Forest; Orpheus Moyer Schantz, Riverside; Orion O. Smith, Rockford; R. A. Huggin, Mr. and Mrs. S. Charles Kendeigh, Ralph E. Yeatter, Urbana; William I. Lyon, Waukegan; Louis G. Flentge, Wheeling; V. H. Condon, Stephen S. Gregory, Jr., Mary S. King, Winnetka. From Indiana: A. T. Harris, Gary; Margaret R. Knox, Mr. and Mrs. S. E. Perkins, III, Indianapolis. From Iowa: C. E. Gillham, George O. Hendrickson, Sidney H. Horn, Ames; T. C. Stephens, Sioux City; Mrs. C. A. Michael, Walker. From Kentucky: Cleveland P. Grant, Covington; William M. Clay, Louisville. From Massachusetts: Maurice Braun, Orleans. From Minnesota: Mr. and Mrs. Olin S. Pettingill, Jr., Northfield. From Michigan: Pierce Brodkorb, Josselyn Van Tyne, Ann Arbor; Miles D. Pirnie, Battle Creek; B. J. Bujak, East Lansing. From Nebraska: Mr. and Mrs. Myron H. Swenk. From New York: William Vogt, New York City. From Ohio: Mr. and Mrs. Lawrence E. Hicks, Columbus; Ward Klepfer, Granville. From Pennsylvania: Robert W. Glenn, Pittsburgh. From South Dakota: A. P. Larrabee, Yankton. From Tennessee: Albert F. Ganier, Nashville. From Wisconsin: L. J. Cole. Mr. and Mrs. Leonard W. Wing, Madison; Mr. and Mrs. F. J. Hamerstrom, Jr., Necedah; Elizabeth A. Oehlenschlaeger, Mrs. Louis Roberts Taylor, Milwaukee.

Summary of Attendance: California, 1; Illinois outside of Chicago, 35; Chicago, 62; Indiana, 4; Iowa, 5; Kentucky, 2; Massachusetts, 1; Minnesota, 2; Michigan, 4; Nebraska, 2; New York, 1; Ohio, 3; Pennsylvania, 1; South Dakota, 1; Tennessee, 1; Wisconsin, 7. Total attendance, 132. Total outside of Chicago, 70. Maximum at each program session: Friday morning, 52; Friday afternoon, 74; Saturday morning, 71; Saturday afternoon, 84. Number at Open House at the Academy, 61. Number at annual dinner, 54. Number of papers listed on the program, 27.

TO OUR CONTRIBUTORS

Our members are urged to submit articles for publication in the BULLETIN. Short items are desired for the department of General Notes, as well as longer articles pertaining to life-history, migration, ecology, behavior, song, economic ornithology, field equipment, methods, etc. Local faunal lists are desired, but limited space makes slower publication inevitable. In preparing such lists for publication in the BULLETIN follow our existing style, and use the nomenclature of the fourth edition of the A. O. U. Check-List.

THE MANUSCRIPT. The manuscript, or copy, should be prepared with due regard for literary style, correct spelling and punctuation. We recommend the *Manual of Style*, of the University of Chicago Press, as a guide in the preparation of manuscripts. Use paper of good quality and of letter size (8½x11). Avoid the use of thin paper. Write on one side only, and leave wide margins, using *double spacing* and a reasonably fresh, black ribbon. The title should be carefully constructed so as to indicate most clearly the nature of the subject matter, keeping in mind the requirements of the index. Where the paper deals with a single species of bird it is advisable to include the scientific name of the species in the introductory paragraph. If the author will mark at the top of the first page the number of words in the paper, a little of the Editor's time will be saved.

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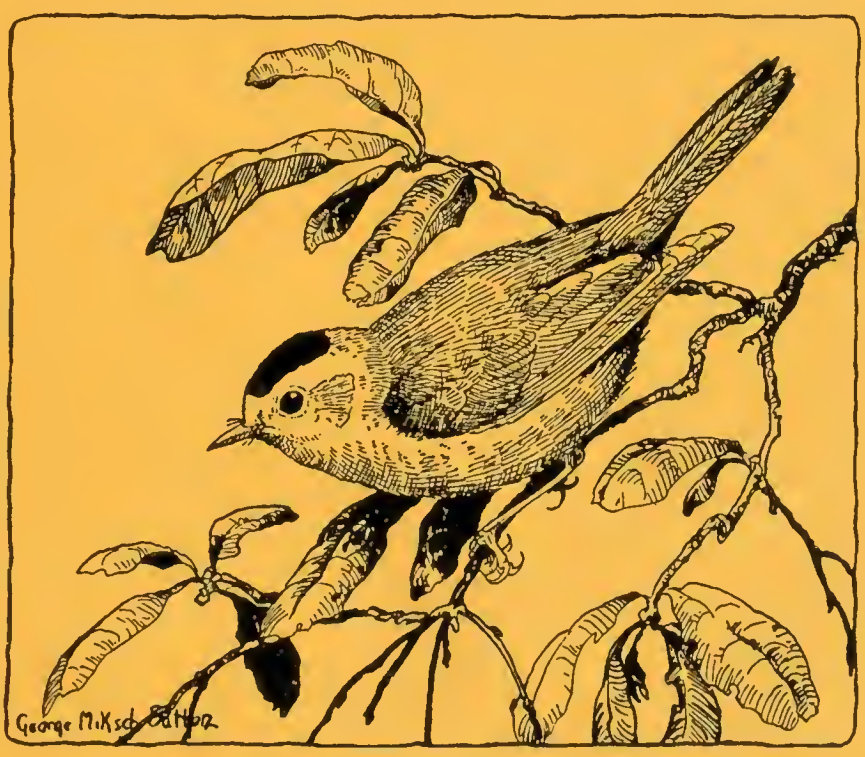
Annual Meetings of the Wilson Ornithological Club

	Retiring President
1914—Chicago. February 5.	
1914—Chicago. December 29-30.	
1915—Columbus. December 28-29.	
1916—Chicago. December 27-28.	
1917—Pittsburgh. January 1-2, 1918.	
1919—St. Louis. December 29-30.	
1920—Chicago. December 27-28. With the A. A. A. S.	R. M. Strong
1921—Chicago. Deeember 26-27. The Field Museum	R. M. Strong
1922—Chicago. October 26	T. L. Hankinson
1923—Cincinnati. Dec. 31, 1923-Jan. 1, 1924. With the A. A. A. S.	T. L. Hankinson
1924—Nashville. November 28-29-30. Peabody College	A. F. Ganier
1925—Kansas City. December 28-29. With the A. A. A. S.	A. F. Ganier
1926—Chicago. November 26-27. Chicago Aeademy of Sciences	A. F. Ganier
1927—Nashville. Dec. 30, 1927-Jan. 1, 1928. With the A. A. A. S.	Lynds Jones
1928—Ann Arbor. Nov. 31-Dec. 1, 1928. Museum of Zoology	Lynds Jones
1929—Des Moines. December 27-28. With the A. A. A. S.	Lynds Jones
1930—Cleveland. Decembcr 29-30. With the A. A. A. S.	J. W. Stack
1931—New Orleans. December 28-29. With the A. A. A. S.	J. W. Stack
1932—Columbus. Novembcr 25-26. The Ohio State Museum	Jesse M. Shaver
1934—Pittsburgh. December 28-29. The Carnegie Museum and A. A. A. S.	Jesse M. Shaver
1935—St. Louis. December 29-30-31. With the A. A. A. S.	Josselyn Van Tyne
1936—Chicago. Novembcr 27-28. Chicago Academy of Sciencss.	Josselyn Van Tyne

Vol. XLIX JUNE, 1937 No. 2

THE WILSON BULLETIN



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CONTENTS

THE WILSON BULLETIN

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THE WILSON ORNITHOLOGICAL CLUB

Founded December 3, 1888. Named after Alexander Wilson, the first American ornithologist, and called the "Father of American Ornithology".

The officers for the current year are:
President—Dr. Josselyn Van Tyne, University of Michigan, Ann Arbor, Mich.
First Vice-President—Mrs. Margaret M. Nice, Chicago, Ill.
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The membership dues are—sustaining membership, $5.00; active membership, $2.50; associate membership, $1.50 per year.

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Vol. XLIV (New Series) Whole Number 180

FOOD AND FEEDING HABITS OF THE TREE SPARROW*

BY A. MARGUERITE BAUMGARTNER

The immense quantities of weed seeds eonsumed by the sparrow tribe early attraeted the attention of the United States Biologieal Survey, and the elassie studies of Beal and Judd are known to every serious ornithologist. The winter food of the Tree Sparrow (*Spizella arborea*) has been adequately eovered in these papers; the one by F. E. L. Beal ('97) estimated the amount eaten, while the one by S. D. Judd ('01) listed the preeise nature of the food. Sinee that time occasional observations and a eonsiderable amount of material hitherto unpublished have aecumulated to amplify this winter list. As far as the writer has been able to determine, however. no information has been published on the summer food of this speeies. With the purpose in view of gathering some facts on the summer food, a representative series of birds, ranging from one day old to adults, and eovering the period from June 5 to August 19, was eolleeted at Churehill, Manitoba. during the summers of 1933 and 1934. It is the purpose of this paper to assemble the known data concerning the food and feeding habits of the Tree Sparrow (*Spizella arborea*), summarizing and amplifying the standard publieations by more reeent papers and personal investigation.

Assistance is gratefully aeknowlcdged to Miss Phoebe Knappen for a detailed report of the stomaeh analyses on file at the U. S. Biologieal Survey; and to Mr. Clarenee Cottam and Mr. Leon Kelso for analysis of the material eollected at Churehill; and to a host of banding operators who have reported on the nature of bait used at their stations for the Tree Sparrow.

Winter Food

Amount of Food. Beal ('97) found that a single Tree Sparrow eats about one-fourth ounce of seeds per day; allowing the conservative estimate that ten birds per square mile spend an average of 200 days in this country, then in the state of Iowa. this speeies alone de-

*A portion of a doctoral thesis submitted to Cornell University in 1935.

stroys 875 tons of weed seed annually. This figure, enormous as it sounds, Beal thought could, without exaggeration, be multiplied by four.

In the stomach of an individual bird he recorded 700 seeds of pigeon grass, a figure which the writer found to be similarly conservative; for a specimen collected at Ithaca, New York, contained 982 seeds in the crop alone, with another 200 in a crushed mass in the stomach.

Nature of the Food. During the sojourn of the Tree Sparrow in the United States its food was found by Judd ('01) to consist almost entirely of weed and grass seeds. His examination of 517 stomachs collected from Massachusetts to Kansas and from October to May disclosed 98 per cent of seed food, with about 2 per cent of animal matter, and a minute quantity of fruit. Mineral matter plays a not inconsiderable part in the digestive processes, and Judd found coarse bits of sand and tiny stones making up 10 per cent of the stomach contents. The Tree Sparrow shows the essential difference from associated fringillids in the large consumption of grass seed, which makes up fully 50 per cent of his vegetable diet. Panicums, pigeon grass, and allied grasses seem to be preferred, after which ragweed, lamb's quarters, and the Polygonums compose two-thirds of his food, the remaining 10 per cent being a variety of insignificant seeds.

The animal food was found by Judd to consist chiefly of weevils and other beetles, ground beetles, rose beetles, wasp-like insects, ants, caterpillars, bugs, grasshoppers, and spiders. Knight ('08) found them eating small beetles, smooth caterpillars, flies, grubs, and larvae, especially in the spring and fall, though seeds were predominant even then. Downs (1866) saw them frequently at horse droppings, probably in search of the insects which infest such matter.

Hamilton ('33) found small stoneflies (*Allocapnia recta*) in the stomachs of four out of five Tree Sparrows collected along a small stream near Ithaca, New York, in midwinter. He suggests that any warm day throughout the winter will bring thousands of transformed imagos to the vegetation surrounding such streams, and that since probably few birds would refuse them, this would account for the little flocks of sparrows, kinglets, and other birds which haunt these brushy streams.

Miss Knappen ('34) in summarizing the material in the Biological Survey files states that in the fourteen midwinter stomachs containing animal food, this constituted about one-third of all food taken, the proportions varying from 1 to 90 per cent of the total stomach content.

In form it consisted of insects and spiders as eggs, larvae, pupae, and adults. As spring advanced the animal content increased. The analysis of a May 12 specimen from North Dakota is worth recording:

Three small Coleoptera larvae	....
One large Carabid larvae	56
One large Carabid larva	56
Two caterpillars (one cutworm)	30
One spider	5
One grasshopper	4
Total	100 per cent

The accompanying graph (Graph I), compiled from data sent to the writer by Miss Knappen, shows the progressive change through the winter season in the proportion of individuals eating animal food.

In the following tables (Tables 1 and 2) are shown all the forms upon which the Tree Sparrow has been found to feed in winter, so far as I have discovered in the literature. Unless otherwise specified the plants are listed on the authority of Judd, and the animals on the authority of the Biological Survey files.

TABLE 1. Plant matter used as food by the Tree Sparrow in winter, chiefly from Judd ('01).

GRASS SEEDS
(50 per cent of vegetable diet)

Andropogon virginicus L.—Beard grass.
Aristida dichotoma Michx. — Poverty grass.
Digitarium sanguinale (L.) Scop.—Crab grass.
Eleusine indica Gaertn.—Yard grass.
Panicum sp.—Panic grass.
Phleum pratense L.—Timothy.
Pig grass.
Poa compressa L.—Wire grass.
Poa pratensis L.—June grass.
Setaria glauca (L.) Beauv. — Pigeon grass.
Setaria viridis (L.) Beauv. — Bottle grass.
Sporobolus neglectus Nash — Sheathed rush grass.

WEED SEEDS
(40 per cent of vegetable diet)

Amaranthus retroflexus L.—Pigweed.
Ambrosia artemisiifolia L.—Ragweed.
Chenopodium album L.—Lamb's quarters.
Polygonum aviculare L.—Knot weed.
Polygonum convolvulus L.—Bind weed.
Polygononum lapathifolium L.—Smartweed.

MISCELLANEOUS
(10 per cent of vegetable diet)

Acer rubrum—Red maple flower and buds (Gentry, 1876).
Alnus sp.—Alder catkins (Brewster '06).
Andromeda floribunda Pursh.—Panicled andromeda (Thoreau '10).
Aster sp.—Asters (Knight '08).
"Berries" (DeKay 1844).
"Dried berries" (Dawson '93).
Betula sp.—Birch (Judd '01).
Cichorium Intybus L.—Chicory (Brewster '06).
Cultivated grain and millet, 1 per cent (Judd '01).
Cyperaceae—Sedges (Judd '01).
Diervilla — Bush honeysuckle (Horsey '22-'24).
Euphorbia sp.—Spurge (Judd '01).
Helianthus sp.—Sunflower (Judd '01).
Hordeum jubatum L.—Squirrel-tail grass (Stephens '17).
Hypericum prolificum L.—Shrubby St. John's-wort (Allen '24).
Hypericum sp.—St. John's-wort (Horsey '22-'24).
Juniperus sp.—Cedar berries (Warren 1890).
Juniperus virginiana and communis (Gentry, 1876).

Ligustrum vulgare L. — Privet berries (Rogers, corres.).
Lithospermum sp. — Gromwell (Judd '01).
Lonicera periclymenum (Gentry, 1876).
Nicotiana Tabacum L.—Tobacco (Forbush '29).
Oxalis sp.—Wood sorrel (Judd '01).
Philadelphus coronarius L.—Mock orange (Horsey '22-'24).
Portulaca sp.—Purslane (Judd '01).
Prunus pumila L.—Sand cherry (Gates '12).
Rhus Toxicodendron L. — Poison ivy berries (Author).
Rubus sp.—Blackberry (Judd '01).
Rumex Acetosella L.—Sheep sorrel (Judd '01).
Solidago sp.—Goldenrod (Judd '01).
Spiraea tomentosa L.—Hardhack (Thoreau '10).
Stellaria media (L.) Cyrill—Chickweed (Judd '01).
Symphoricarpos racemosus Michx.—Snowberry (Blakiston, 1863).
Taraxacum officinale Weber—Dandelion (Judd '01).
Trifolium sp.—Clover (Doan, 1888).
Tsuga canadensis (L.) Carr.—Hemlock scales (Thoreau '10).
Vaccinium sp.—Blueberry (Judd '01).
Viburnum lentago (Gentry, 1876).
Viola sp.—Violet (Judd '01).
Weigela—(Horsey '22-'24).

TABLE 2. Animal matter used as food by forty-five Tree Sparrows in winter. Data taken chiefly from the files of the U. S. Biological Survey.

Insect	No. and Stage	Total in %
Agrotis sp.	1 adult	5
Allocapnia recta (Hamilton, '33)	Sev. adults	tr.
Aphodius inquinatus	1 adult	5
	4 adults	30
Aphodius sp.	6 adults	80
	1 adult	50
Araneida	1 adult	10
	1 adult	5
	1 adult	11
	1 adult	30
	2 adults	25
	1 adult	50
Blissus leucopterus	1 adult	10
Carabidae	1 adult	5
	1 larva	36
	2 adult	15
	1 adult	10
Casnonia pennsylvanica (Gentry, 1876)	remains	
Chrysomelidae	1 adult	20
Coleoptera	1 adult	10
	2 adults	30
	3 larvae	20
	1 adult	5
Cratonychus cinereus	remains	
Cratonychus pertinax (Gentry, 1876)	remains	
Diptera	1 pupa	5
Formicoidea	adults	10
	adults	15
Formica sanguinea (Gentry, 1876)	remains	
Harpalus pensylvanicus	remains	
Harpalus compar (Gentry, 1876)	remains	
Heteroptera	1 adult	30
Hymenoptera	1 adult	1
	1 adult	5
Ichneumonidae	1 adult	5
Insecta	1 adult	5
	1 adult	1
	1 adult	1
	1 adult	5
Jassidae	1 adult	5
Lumbricus terrestris (Gentry, 1876)	remains	
Musca domestica (Gentry, 1876)	remains	
Lepidoptera	2 pupae	5
	1 pupa	10
	1 larva	40
	indeter.	20
Noctuidae (cutworms)	1 larva	10
	2 larvae	30
	1 larva	30
Orthoptera	eggs	20
	1 adult	4
Pentatomidae	4 adults	45
Phytonomus nigrirostris	1 adult	tr.
Pupa cases	12	60

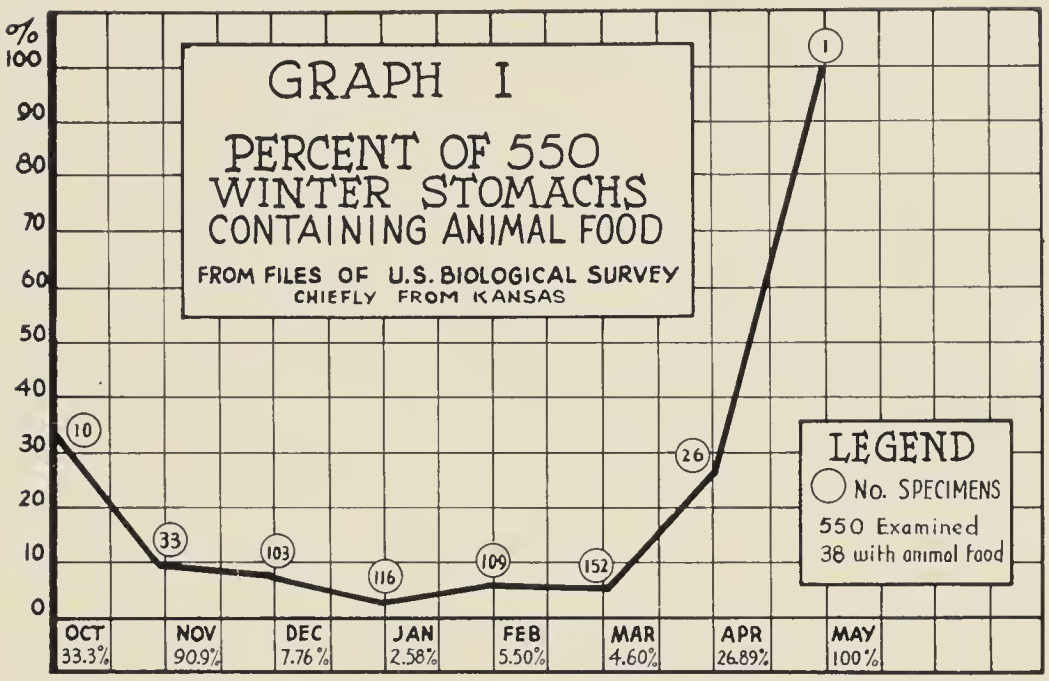

Fig. 8. Graph I, showing the percentage of animal matter in the stomachs of 550 Tree Sparrows taken during the winter season.

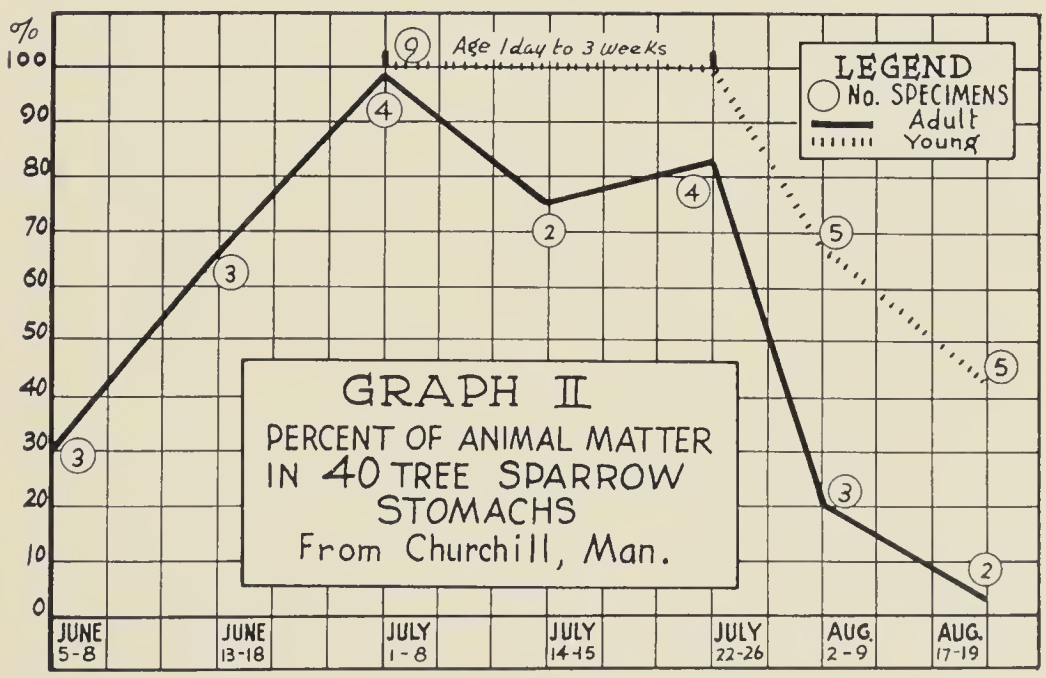

Fig. 9. Graph II, showing the percentage of animal matter in 40 Tree Sparrow stomachs taken at Churchill, Man., during the breeding season.

Insect	No. and Stage	Total in %
Rhynchophora	1 adult	30
	2 adults	40
	1 adult	25
	2 adults	5
	1 adult	10
Scarites subterraneus (Gentry, 1876)	remains	
Schizoneura lonigera (J. A. Allen, 1868)		
Sitones sp.	2 adults	40
Staphylinidae	1 adult	5
Tabanis lineola (Gentry, 1876)	remains	
Tanymecus confertus	1 adult	tr.
Totrix fumiferana (Tothill, '23)		

Bait at Feeding Stations. Almost any fine, cracked grain or crumby material will attract the Tree Sparrows when the snow covers their natural feeding grounds. Commercial chick scratch, consisting of cracked corn and wheat and obtainable at any grain store, was used almost exclusively at the writer's automatic feeding stations at Ithaca, New York. See Figure 10. Whole grains of wheat were found to be rather large, while the sunflower seeds and raw peanuts, so popular with the chickadees and nuthatches, were not touched by the Tree Sparrows. Suet was occasionally nibbled when attached to the top of the feeder. From other banders and the literature came a list of possibilities that range from the substantial to the ridiculous:

Cracked corn
Cracked wheat
Cracked oats
Cracked millet
Cracked hemp
Cracked buckwheat
Cracked nuts
Peanut butter
Sweepings from mills
Hayseed and chaff
Ground pumpkin seed
Bird seed
Weed seeds
Bread crumbs
Doughnuts
Raw pie crust

Time of Feeding. No definite cycles of feeding could be observed, either at the banding station or with captive birds. Early morning and just before dusk usually brought larger numbers to the traps, when the birds were obviously most in need of ready food, but at other times their visits were sporadic. Some banders have also found noon a popular hour. Small groups that occasionally spent the day in the immediate vicinity of the banding station were found to drift over every half hour or so, pick about at the food scattered around the traps, and if not captured would wander away again after five or ten minutes of feeding.

Method of Feeding. Since in winter their diet consists principally of weed seeds Tree Sparrows feed largely on the ground, scratching among the dry grasses or hopping up at the bent-over weeds. They are less inclined to dig than Song Sparrows, and, where food is plentiful, will pass lightly over the more obvious patches. Judd ('01) occa-

FIG. 10. The automatic feeding station maintained by the author at Ithaca, N. Y. See page 70.

FIG. 11. The wire cage constructed by the author for the purpose of observing the feeding of the young Tree Sparrows after the nestling period. See page 78.

sionally found them bending the slender weed stalks to the ground, thereafter holding them with their feet as they pieked out the seeds. Thoreau ('10) watehed them reaeh or hop up to the fine grass from the ground. Frequently they have been observed swaying from a weed top, simultaneously filling their erops and spreading a banquet table on the snow beneath. It has often been averred that they will deliberately shake the weeds with elaws or bills to dislodge the seeds, and Chubb ('29) gives us a vivid pieture of the proeess: "One perehed on a eurved weed eluster, the tip of whieh was loosely held in the light snow, and shook it so vigorously that the end of the weed was freed with a slight jerk, seattering a little shower of seeds whieh were immediately picked up. Another one flew to an evening primrose between three and four feet high. With a number of quiek vibrating motions the dry top was made to shiver vigorously several times. Without even attempting to piek any seeds from the pods he dropped to the snow and pieked up the proeeeds of his labor. It was notieed that whenever this method was used there was no attempt to gather seeds direetly from the plants."

That one bird will perform this serviee for another, as is sometimes intimated, is unlikely. While there is frequently teamwork, it is erediting the bird with too mueh intelligenee to assume that it is eonseious. On the eontrary, it was observed that they rarely eome within six inehes of one another, and maintain a small but definite individual feeding territory. Oeeasionally one eneroaehes upon another, and after a brief show of annoyanee one or the other breaks away.

Sueh food as berries and alder eatkins, upon whieh they frequently nibble, must usually be secured from the bushes on whieh they grow, sometimes as high as forty to fifty feet above the ground, as in the ease of the poison ivy growing up the trunk of the elms near the feeding station at Ithaea, New York.

In the early summer at Churehill, Manitoba, they were seen, usually in pairs, feeding about the grassy edges of little pools, and not infrequently pieking off the fresh buds of the stunted willows and birehes. These were obtained either by perehing on the braneh or by hopping up from the ground, sometimes to a height of several ineh es. Later, when the young had hatehed and the diet had ehanged to ehiefly animal food, the parents were seen gleaning caterpillars and small inseets among the braneh es and fresh leaves of the thiekets immediately surrounding the nest. Oeeasionally one was observed darting into the air for a mosquito or moth, though these flights were short, and if the prey eseaped it was not ardently pursued.

Excreta. Closely associated with food are the excreta. Normally, according to Kendeigh ('34), a bird will defecate every half hour. A captive individual retained overnight by the writer deposited during the night a whitish, almost liquid substance, which Kendeigh states is chiefly waste from the kidneys. During the following morning it was fed only chick feed, and the excrement was yellowish. Later, fine gravel and dirt were placed in the cage, and the droppings thereafter assumed the appearance noted in the field, a pearl gray with white tips. The weight of an excretum sac averaged .5 to .6 grams.

Summer Food

Nature of the Food. The transition from a vegetable to an animal diet begins to be noted in the Tree Sparrow during the spring migration, in late April and May. Upon its arrival at its northern breeding grounds, however, it finds conditions nearer winter than summer, and seeds continue to form the greater part of its diet until past the middle of June, when insects first become active. By August the brief nesting season is over, and the proportion of seeds consumed again approaches the 98 per cent maintained during the winter.

Young birds up to three or four weeks are fed almost 100 per cent animal matter, with a trace of Rosaceae leaves for their greens. When they begin to forage for themselves about the first day of August, seeds and fruit are taken to a limited extent, their proportions gradually increasing. The last stomachs examined, however, on August 19 still showed a considerably larger proportion of animal food than did the adults of the same date. These seasonal fluctuations are depicted on the accompanying graph (Graph II).

A trace of gravel is first found in young birds of three days. At five days and thereafter it may compose from 10 to 15 per cent of the stomach content. In August when they are feeding independently the gravel content is increased to adult proportions, ranging from 15 to 70 per cent, the majority about 35 per cent.

Lists of the plant and animal forms recorded for the Tree Sparrow in summer are given below in Tables 3 and 4. In summarizing the individual contents it was noted that the outstanding vegetable item was the seeds of the genus Carex. These were found throughout the summer in all adults and juvenals that contained any vegetable matter, though they were not found in the nestlings. At least six species of Carex were distinguishable in a single birds. In late July and August seeds of the crowberry (*Empetrum nigrum* L.), cranberry (*Vaccinium Vitis-Idaea* L.), and bulblets of the alpine knotweed (*Polygonum viviparum* L.) became an important part of the menu. Grass

seeds, which form such a large proportion of the winter food, were strikingly scant in the summer diet, being found in only one individual in late August. Besides seeds, plant matter was found in the form of soft bits of wood or chips, fibers, leaf fragments, galls, and unidentifiable debris.

The insects represent a large number of families and genera. among which the following groups are most conspicuous: Arachnida, Coleoptera (especially *Donacia*), Ichneumonidae, Lepidoptera, Nematinae, and Trichoptera. Though in many cases a form is found only in a single individual, it is probable that the same species were eaten by young and old alike, since this was the case wherever there were several records. The adult stage predominated, but eggs, larvae, and pupae were also taken. In observations at the nest the adult birds came repeatedly with mouths overflowing with small green and brown caterpillars, as well as flies, mosquitoes, etc.

TABLE 3. Showing plant matter eaten by thirty-nine Tree Sparrows in summer at Churchill, Manitoba, the identifications being made by L. H. Kelso, of the U. S. Biological Survey.

Plant Food	Stage	Date	Age of Bird
Alnus sp.	Seeds	Early June	Adult
Carex sp.	Seeds	All season	Adults and juv.
Carex incurva	Seeds	End of June	Adult
Empetrum nigrum	Seeds	July-August	9-day young, juv., and adults
Luzula spicata	Seeds	Early June	Adult
Luzula saltuensis	Seeds	August	Juvenal
Poa sp.	Seeds	Late August	Juvenal
Potentilla sp.	Seeds	Early June	Adult
Polygonum viviparum	Bulblets	Late July and Aug.	Adult
Rosaceae	Leaf fragments	July	3- and 6-day young
Rubus arcticus	Seeds	Late August	Adult
Vaccinium Vitis-Idaea	Seeds	All season	Juvenal and adult
Vaccinium Vitis-Idaea	Fruit	August	Juvenal
Vaccinium sp.	Seeds	All season	Juvenal and adult

TABLE 4. Showing the animal matter eaten by Thirty-nine Tree Sparrows in summer at Churchill, Manitoba, the identifications being made by L. H. Kelso, of the U. S. Biological Survey.

Animal Food	Stage	Age of Bird
Amblytelinae	Ad.	Adult, Juvenal
Amphipoda	Ad.	Adult
Anthoca sp.	Ad.	Juvenal
Anthomyiidae	Ad.	Adult, Juvenal
Apanteles sp.	Coc.	Adult
Arachnida	Ad.	Adult, Juvenal, Young
Bethylidae	Ad.	Adult

Animal Food	Stage	Age of Bird
Calimocne sp.	Ad.	Juvenal
Camponotus h. pennsylvanicus	Ad.	Adult
Cantharidae	Ad.	Adult, Young
Cantharus sp.	Ad.	Young
Carabus sp.	Ad.	Young
Chalcididae	Ad.	Adult, Juvenal
Chelonus sp.	Ad.	Adult
Chironomidae	Ad.	Adult, Young
Chironomus sp.	Ad.	Adult, Juvenal
Chrysotus sp.	Ad.	Young
Cicadellidae	Ad.	Adult
Coleoptera	Ad.	Adult, Juvenal, Young
Corixidae	Ad.	Adult
Cremastinae	Ad.	Young
Curculionidae	Ad.	Adult, Juvenal
Dolerus sp.	Ad.	Adult, Juvenal
Dolichopodidae	Ad.	Adult
Dolichopus sp.	Ad.	Juvenal
Donacia sp.	Ad.	Adult, Juvenal, Young
Drymidae	Ad.	Juvenal
Dytiscidae	Ad.	Adult
Elateridae	Ad.	Young
Empididae	Ad.	Adult
Ephemeridae	Ad.	Young
Formica sp.	Ad.	Adult
Formicidae	Ad.	Adult
Geometridae	Ad., Lar.	Juvenal, Young
Habropelte sp.	Ad.	Adult
Helina sp.	Ad.	Adult
Hemitelini	Ad.	Adult
Hydroporus sp.	Ad.	Adult
Hylemyia sp.	Ad.	Young
Hymenoptera	Ad.	Adult, Juvenal, Young
Ichneumonidae	Ad.	Adult, Juvenal, Young
Insecta (indet.)	Ad., Lar., Eggs	Adult, Juvenal, Young
Jassidae	Ad.	Adult
Lasius sp.	Ad.	Young
Lepidoptera (indet.)	Ad., Lar., Eggs	Adult, Young
Leptidae	Ad.	Young
Leptothorax sp.	Ad.	Adult, Juvenal
Limnobiidae	Ad.	Young
Metriocnemus sp.	Ad.	Young
Microlepidoptera	Ad.	Young
Mollusk shells	Debris	Adult, Young
Myrica rubra	Ad.	Adult, Juvenal
Myrica sp.	Ad.	Juvenal
Nematinae	Ad., Lar.	Adult, Juvenal, Young
Noctuidae	Ad., Lar.	Adult, Young
Pemphredon sp.	Ad.	Juvenal
Perlidae	Ad.	Young
Phalangida	Ad.	Adult
Potania sp.	Ad.	Young
Psen sp.	Ad.	Adult
Psocidae	Ad.	Adult, Juvenal, Young
Rhamphomyia sp.	Ad.	Adult
Rhyacophila sp.	Ad.	Juvenal

Animal Food	Stage	Age of Bird
Scatophaga sp.	Ad.	Juvenal
Serphidae	Ad.	Adult, Juvenal, Young
Serphoidea	Ad.	Juvenal
Serphus sp.	Ad.	Juvenal
Simulium sp.	Ad.	Adult, Juvenal
Sphaerium sp.	Shell fragm.	Adult
Spilogona sp.	Ad.	Adult
Spitozona sp.	Ad.	Adult
Tabanus sp.	Ad., Eggs	Adult, Juvenal
Tanypidae	Ad.	Young
Tenthridinidae	Ad.	Adult
Tineidae	Ad.	Juvenal
Trichoptera	Ad.	Adult, Juvenal, Young
Trioza sp.	Ad.	Adult
Vipionidae	Ad.	Adult, Juvenal

Feeding of the Young. The following observations were made at Churchill, Manitoba, in 1933 and 1934. With the hatching of the young birds begin the duties of the male, for from the start he shares the responsibility of feeding almost equally with his mate; and during the last days in the nest he almost doubles her contribution. For a time this does not seriously affect his singing, as the young do not need to be fed more than three or four times an hour. Even when duties have become more pressing he usually flies from the nest to some conspicuous perch and sings a few hasty bars before seeking another caterpillar. But by the end of the nestling period the territories are on the whole rather quiet.

The feeding itself is not generally accompanied by any voice, though if the female has been brooding when the male comes she usually leaves with a low twittering. Sometimes she does not leave when he comes, but simply raises herself on the rim of the nest. On several occasions he was seen to pass food to her, which she fed to the young. Twice she apparently swallowed it herself, though why he should feed her is not clear, as she left the nest frequently. At times the male stood quietly on the rim after feeding the young, once as long as seven minutes while his mate was absent. Sometimes the pair came together to the nest and stood fondly over their family, peering down at them, uttering low cooing notes, and touching one another's bills in a manner that is not explainable as any mere instinct to propagate the species.

In the smaller territories the caterpillars, mosquitoes, etc., which make up the bird's diet, are gleaned from the immediate neighborhood of the nest, though in the more open territory both adults were observed to travel frequently to a ditch which was 450 feet distant. At first the material is partially masticated, and the pulpy mass is jammed

far down the young bird's throat. Several birds may be fed at a single visit. Later great billfulls of more or less entire insects are brought to the nest. But however great the quantity, it seems scarcely enough to satisfy one or two gaping mouths. The enormity of the old birds' task was realized when a male collected in the field was found to hold in its bill forty-one adult insects, four larvae, and fragments of others, all captured, presumably, within three or four minutes.

While the amount of feeding per hour advances conspicuously after the first few days, it maintains thereafter a more or less constant rate of about sixteen feedings per hour. No particular variation was noted at different hours of the day. These facts, with the relative share of the sexes, are indicated in the following table (Table 5) of representative observation periods at different stages of nestling life.

TABLE 5. Showing seasonal and diurnal variation in feeding periods of nestling Tree Sparrows, observations being made at Churchill, Manitoba.

	First Day	Early Morning of 6 days	Noon of 7 days	Evening of 9 days
Feedings per hour:				
Male	3	8	6	9
Female	4	10	10	5
Intervals between feedings.				
Average	8 min.	3 min.	4 min	4.5 min.
Maximum	25	10	8	10
Minimum	1±	1±	1±	1±

Although during June and July there is almost full daylight from 2:00 A. M. until 10:00 P. M. in the North, Tree Sparrows do not begin feeding until 3:15, and cease shortly before 9:00, making a working day of 17.75 hours. With this in mind, it may then be computed that, at an average of sixteen feedings per hour, some 275 feedings are made daily, to be divided among the four or five young. It is interesting to compare with this the parental care given by that closely related species of more temperate latitudes, the Chipping Sparrow (Weed, 1898). Averaging twelve visits per hour, to be divided among only three birds, each individual young of this species seems to be fed as many times per hour as do individual young of the Tree Sparrow. But here the working day begins at 5:00 A. M., and closes at 7:30 P. M., with only 14.50 hours in which to work. Other factors doubtless enter into the question, but it is strongly suggestive that these three extra hours a day make it possible for young Tree Sparrows (at nine and a half days) to leave the nest two days earlier than Chipping

Sparrows (at eleven and a half days). Thus the longer hours of daylight eompensate in a measure for the briefness of the nesting season.

In order to observe feeding habits of young after the nestling period, a wire eage 12x8x12 inehes was plaeed over one nest and the adjaeent shrubbery (Fig. 11). Through the quarter-ineh meshes of this eage the adult birds soon learned to feed the young in, it is believed, a perfeetly normal manner. Fledglings over two weeks old, both at this eage and in the field, seem to have been fed as frequently as during their nest life. On July 26, when they were twenty-two days old, the male made three visits to the enelosure in half an hour, although there was but one bird inside and three at large (the three had eseaped). On this day the young bird was first observed to piek about on the eage floor, and when a bread erust was proffered him from the lunehbox he nibbled at it with interest. While it was not possible to follow this individual further, it is probable that parental eare ended shortly thereafter. During August an oeeasional adult observed in the field eould be seen with a bill full of food, though the young at this age were able to fly freely, and presumably eould forage for themselves.

Economic Importance

Beeause of the vast quantities of obnoxious weed seeds whieh the Tree Sparrows eonsume during the winter sojourn in the States, mueh has been made of the economie value of this speeies. It was estimated by the Department of Agrieulture that the sparrow tribe—of whieh the Tree Sparrow is one of the most abundant speeies—saved the farmer $90,000,000 a year. Judd ('01) deseribed the thoroughness with whieh they elean up a pateh before moving on. On an area eighteen inehes square in a weedy diteh where they had been feeding, he found 1,130 half seeds and only two whole ones, and only half a dozen seeds left in the whole field, whieh, he says, was devoid of weeds the next year.

Sinee Judd's time, however, there has been some doubt of the value of the sparrow tribe. Certainly Judd overestimated the thoroughness of their gleanings, else they eould not return year after year to the same areas, nor would they wander so freely over their little territories, only to eover the same ground another day. And eertainly there is no seareity of weeds in the eountry regardless of the great hordes of these birds. The reproduetive eapaeities of the plants easily outdo the eating eapaeities of the sparrows, and there will probably always be suffieient weeds left to bother the farmer and propagate the

species. Indeed, if there were no sparrows, the overcrowding of the plants themselves would soon establish a balance.

But if not actually beneficial, these birds are at least harmless. They occasionally sample grain, but to no appreciable extent. The charge has been made that they distribute rather than destroy the seeds, but this accusation has been refuted by Judd's study. He found that in the thousands of stomachs containing ragweed, there never was an unbroken seed; the outer ribbed shell of the akene was cracked and not swallowed, but parts of the true seed coat in the shape of angular fragments three to five millimeters long, dirty gray externally and greenish-white internally, were usually found during stomach examination. Uncrushed cotyledons were seldom found, the gizzard being filled with a pasty mass of endosperm with scarcely a dozen whole seeds, which seems to preclude the possibility of subsequent germination. This is also held for pigeon grass, crab grass, pigweed, lamb's quarters, sunflower, the polygonums, and most other seeds, even including the hard drupes of the blackberry. With the harder, smaller seeds the possibility of germination is better, but, Judd points out, the birds take seeds for food, and it seems probable that such use would prevent the evacuation of any but a most insignificant portion of the food taken.

In the summer the Tree Sparrow is of no economic significance whatever, as it nests beyond the reaches of civilization. But whether or not we can evaluate the species in cold dollars and cents, it will always be welcome as a gentle, cheerful little creature of our winter fields and gardens.

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East Lansing, Mich.

A STUDY OF A VIRGINIA RAIL AND SORA RAIL AT THEIR NESTS[1]

BY HENRY MOUSLEY

Working over limited areas of ground year after year certainly has its advantages, since one gets to know where certain birds make their homes, and provided nothing happens to them during the winter and at migration times, one can usually count on finding them again not far from the old haunts year after year, thus providing for a renewal of acquaintance with their home life at points where, from some cause or another it may have been broken off.

This has been so in my case with the Sora Rail (*Porzana carolina*) and the Virginia Rail (*Rallus limicola*), pairs of which have nested for some years in two little cattail marshes (one pair in each), but I was never able to find their nests in the making, and obtain their incubation period. This period in the case of the former is said by Mr. Bent[2] to be fourteen days, while in the case of the latter the exact length has not been recorded, but is known to be not less than fifteen days. In 1935 I discovered the nest of the Virginia Rail after the young had left because of its location in the same marsh with the nest

[1]Read by title at the American Ornithologists' Union at Pittsburgh, Pa., October 21, 1936.

[2]Life History of North American Marsh Birds, Smithsonian Institution, U. S. Nat. Mus. Bull., 135, 1926.

of the Blaek Duek[3], and my desire not to be seen in its vieinity oftener than was absolutely necessary. The nest of the Sora was several hundred yards away in another marsh, and when I found it on June 11 the young had gone, and only one addled egg remained in the nest. The empty nest of the Virginia Rail I found later at the end of June, after the young dueks had hatehed out and left their nest.

This year (1936) I started to seareh early in May in the immediate neighborhood of last year's nests. and was not long in loeating a new nest of the Sora just fifteen feet away from that of last year, and one of the Virginia Rail thirty feet from last year's site. The former eontained its first egg on May 14. and its full eomplement of eleven on May 24, an egg being laid eaeh day. In the ease of the Virginia Rail the first egg was deposited on May 18. and the tenth, and last, on May 27. The young of the Sora appeared on June 7, and all were gone the following day, thus giving an ineubation period of fourteen days from the laying of the last egg. In the ease of the Virginia Rail the first young appeared on June 13, and all were gone two days later, the ineubation period thus being seventeen days from the laying of the last egg to the appearance of the first young. During the hatching period, I never onee saw the male or young in the vieinity of the nest, and it is my belief the latter were led away by the male as soon as they hatehed out, as has been stated by Mr. Bowdish[4]. This little rail reminds me very mueh of the European Water Rail (*Rallus aquaticus*) not only in its general make-up, but also in its habits and behavior. In 1931. a paper of mine was published in the Canadian Field-Naturalist[5], in whieh I deseribed my troubles photographing a Virginia Rail. Briefly, it took four hours before the bird aeeepted the camera, but when she did so. I had no diffieulty in obtaining pietures every ten minutes. Naturally, I was more than anxious to see how the present bird would aet under similar eonditions. So on June 3 I made a start by slightly opening up the nest, setting up the eamera, and retiring to my "hide-out" some twenty feet from the nest. Two hours went by. and still the bird would not faee the eamera. and this was the ease with the Sora the day following. I gave up the game in both cases. resolving to try again in a few days when the ineubating eyele would be more at its height.

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[3]Birth of a Black Duck Family, Auk, Vol. LIII, No. 4, 1936, pp. 377-380, 2 pls.

[4]Notes on the Virginia Rail. The Ornithologist and Botanist, Vol. I, 1891, pp. 73, 74.

[5]Notes on the Home Life of the Virginia Rail. Can. Field Nat., Vol. XLV, 1931, No. 3, pp. 65-66.

Accordingly, I made another attempt five days later, June 8, too late for the Sora unfortunately, but with somewhat better luck at the Virginia's nest, the bird coming on her nest in three-quarters of an hour after the camera had been set up. Upon obtaining two pictures, one showing her appearing through the runway (which was at the back of the nest), the other of her sitting on the eggs, and drawing up the grasses in front to form a screen, I decided to move up the camera and open the nest a little more (the light not being very good). From here I obtained two more pictures, one showing her turning the eggs, the other depicting her about to step up out of the shallow water into the nest. Two days later, or the 10th, the weather cleared and conditions seemed ideal, so I decided to fully open up the nest and try and get some really good pictures. Because the incubating period being nearly at its zenith, when the bird would be very reluctant to leave her eggs for any length of time, she accepted the nearness of the camera in about one-quarter of an hour after it had been set up, coming somewhat nervously at first to arrange the eggs in two tiers. This took several visits, as she kept coming on and going off the nest before the eggs were apparently arranged to her liking. One photograph taken at this time shows her eyeing the eggs with evident satisfaction, before settling on them.

To make a long story short, I took no especial pains to secrete myself (in fact, I sat in front of a thick bush I was using as a blind, instead of behind it) the bird paying no attention to me whatever, after having once accepted the camera. All I had to do after re-setting the shutter each time, was to walk back to the "hide", and almost before I could sit down the bird was on the nest again. Never, perhaps, shall I have a better opportunity of observing the movements at such close quarters of so shy a bird as the Virginia Rail, as she was in full view every time I re-set the shutter, never moving very far from the nest. After a time the male joined her, this being the only occasion on which I had seen both birds together. During the whole of these proceedings, the female (sometimes joined by her mate) kept up a continuous series of pig-like grunts, some resembling those made by little pigs, others again more gruff like those made by an old sow. But the note that impressed me most, and which was more often given than any other, was horribly sharp, a squeak that set one's teeth on edge. This is the note, I imagine, which has been referred to by the late Dr. Charles W. Townsend[6] as suggestive at times to the squeak

[6]Supplement, Birds of Essex County, Mass., 1920, p. 72.

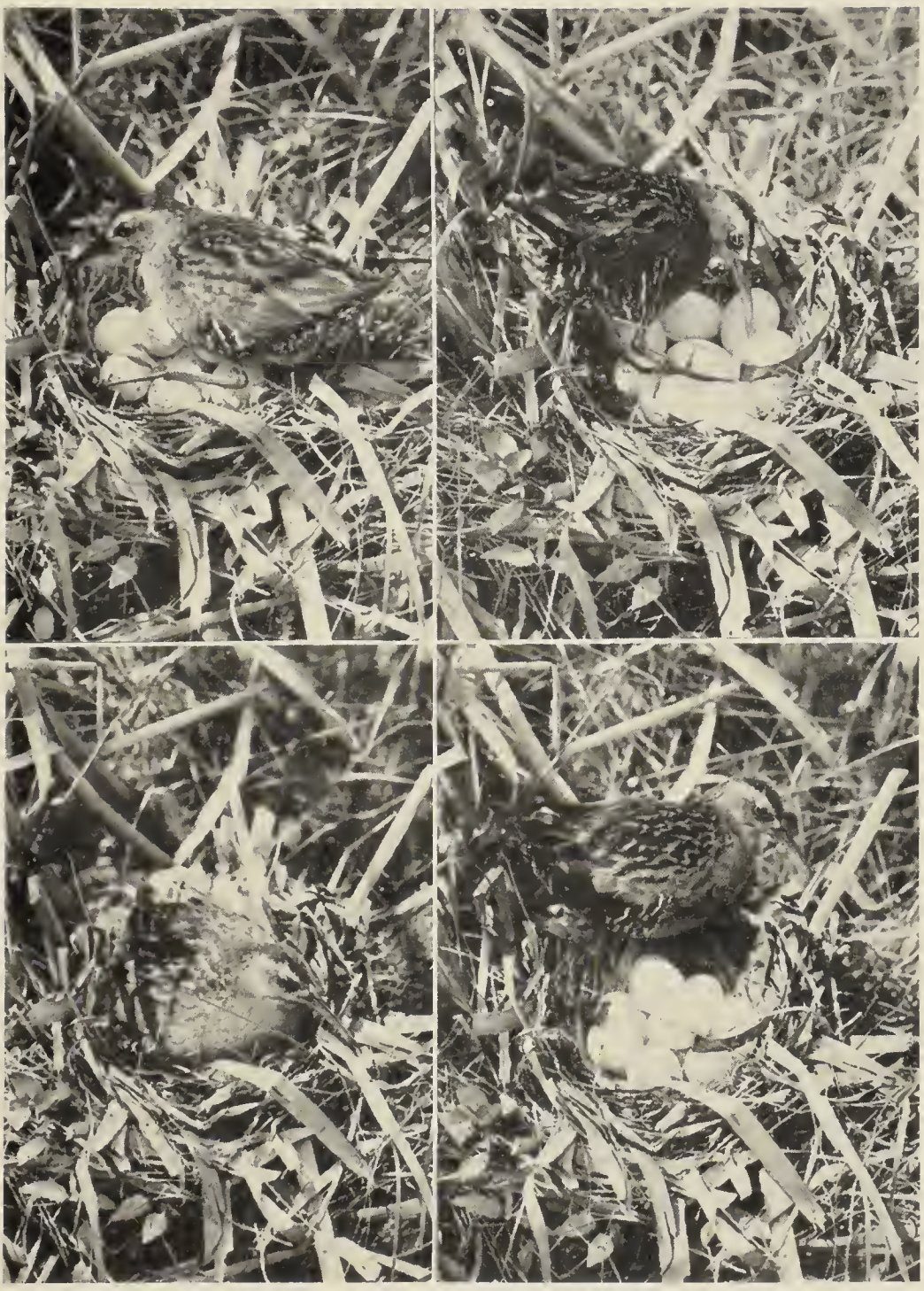

FIG. 12. The Virginia Rail in various attitudes on the nest. Upper left, stepping on the eggs; upper right, turning the eggs; lower left, quietly brooding; lower right, inspecting. Photographs by the author .

made by the grass-blade stretched between the thumbs. I can not say I remember having heard it before, at all events not so many times repeated.

The nest, as was the case last year, was composed entirely of dry cattail leaves and grasses, well concealed in a bunch of growing cattails, the top of the nest being 6.5 inches above the water, whilst the bottom rested on the mud 3.5 inches above the shallow water. The dimensions were as follows: Outside diameter, 6.75 inches; inside diameter, 4.25 inches; outside depth, 3 inches; inside depth, 1.5 inches. The cattail leaves forming the foundation consisted of 750 pieces ranging from 2 to 12 inches in length, and from one-fourth to one-half an inch in width, whilst the fine grasses forming the lining consisted of 1,350 pieces also ranging in length from 2 to 12 inches. No empty egg shells were found in, or near, the nest.

In the case of the Sora, half an egg shell and the one addled egg only were found in the nest; some of the empty shells were at the end of the runway, whilst the remainder could not be found. Given sufficient time between the hatching out of the young, I think the parents remove the empty shells as the young leave them. The nest of the Sora (as is usual) was in a much wetter place. It was supported amongst growing cattails, the top being 11 inches above the water, the bottom 6 inches, whilst the water was over 12 inches deep. It was composed entirely of dry cattail leaves, coarse in the foundation, finer as a lining. The dimensions were: Outside diameter, 7.50 inches; inside diameter, 4.25 inches; outside depth, 5 inches; inside, 2.50 inches.

In conclusion, the Sora appears to be much shyer at the nest than the Virginia Rail, and I imagine the obtaining of pictures of it on the nest is likely to be a somewhat tedious undertaking, judging from my experiences this season.

Montreal, Canada.

LUDWIG KUMLIEN

BY MRS. H. J. TAYLOR

Ludwig Kumlien, oldest son of Thure Kumlien, was born in a log cabin on the Kumlien homestead near Busseyville, now Sumner, Jefferson County, Wisconsin, on March 15, 1853. His full name was Aaron Ludwig Kumlien but he so disliked his first name that he never used it after he was grown. He died, after many months of suffering from cancer of the throat, at his home in Milton, Wisconsin, December 4, 1902. The funeral was held at the Seventh-Day Baptist Church. He was buried in Milton Cemetery.

The children of Thure Kumlein and Christina Wallberg were a distinct asset to the communities in which they located. Ludwig, after finishing the common school course, attended Albion Academy, Wisconsin, where his father, Thure Kumlien, was professor of Zoology and Botany. He became one of Thure Kumlien's outstanding students in botany and ornithology. On completing the academy course in 1873 he attended the University of Wisconsin from 1873-1877 as a special student in the scientific course. He held no degree from the University of Wisconsin but in 1892 he received from Milton College the honorary degree of Master of Science.

A letter from his brother, T. V. Kumlien, in October, 1936, says that Ludwig was a naturalist from childhood. He was always making friends with birds and other animals. He raised a pair of Mourning Doves, feeding them as he had seen the parent birds feed them, and they became household pets. A pair of goldfinches were also tamed. By damming up a nearby spring he caught and tamed a blue heron. It followed at his heels ever eager for the frogs, minnows, and small fish he secured for its food. Ludwig's collection of birds' nests and eggs was also begun in his childhood years.

He was painstaking and accurate in all he did and inherited his father's love for art. His widow (May, 1936) writes: "Ludwig was definitely inclined to be an artist or sculptor and he had the necessary qualifications in an eminent degree. I have two books of drawings made between the ages of fifteen and twenty-five years. The subjects were insects, mammals, and birds. Most of the mammals are done in water color. His work in taxidermy shows his artistic feeling. His phenomenal eye-sight allowed nothing to escape his observation and drawing was as natural to him as writing."

A few weeks after leaving the University of Wisconsin Kumlien went as a naturalist on the Howgate Polar Expedition, August 2, 1877.

to October 30, 1878. For this expedition he made the Report of Explorations in Greenland. (Annual Report of the Board of Regents of the Smithsonian Institution, 1878, pp. 452-4).

During this expedition of fifteen months in the arctic he made interesting and important collections in several fields of natural history. Kumlien (Bulletin of the United States National Museum, No. 15, published under the Direction of the Smithsonian Institution, Washington; Government Printing Office; 1879, p. 5) writes: "The schooner fitted out in New London [Connecticut] . . . sailed on the morning of August 3, 1877, . . . and on the 6th of October the Florence dropped anchor in the little harbor of Annanactook. . . . Arrangements were at once begun by Mr. Sherman [Meteorologist] and myself to erect a shelter that would serve for an observatory and general working place. . . . As soon as the snow became compact enough, we engaged the Eskimo to build a snow-house for us, in which our tent served as a lining." In his Report of Explorations in Greenland he says (pp. 452-4): "In this illy-lighted and poorly warmed structure Mr. Sherman and myself spent our time till July [nine months]. . . . While dissecting one of the animals [Eskimo dog] I had the misfortune to cut a finger slightly, and the virus (?) together with a frost-bite made me a cripple for two months, and came very near costing me the loss of my arm; this occurring in the busiest season, I lost many specimens. Eskimo women were instructed to skin and clean birds and mammals, which they soon learned to do very nicely, invariably removing the fat with their teeth. . . . No birds except *Corvus corax* [Raven], *Falco candicans* [White Gyrfalcon], and two species of *Lagopus* [Ptarmigan] remain during the winter. The first birds to return are *Larus glaucus* [Glaucous Gull], often long before there is any open water; they cruise up the ice-covered fjords and feed on the young of *Phoca foetida* [Harbor Seal]. As soon as the snow begins to melt *Plectrophanes nivalis* [Snow Bunting] greets one with a very pretty song. Eiders, *Somateria molissima*, nested by thousands on the rocky islets around our winter harbor, and the eggs were a very welcome addition to our rations. . . . Only forty-four species of birds were met with in Cumberland Sound, and at least four were stragglers. Interesting notes were procured on rare or little known Arctic water-birds. . . . We left much too early to secure a fair representation of the flora of the district poor as it is. The same species were collected on the Greenland coast . . . much more luxuriant. The algae . . . were abundant both in species and numbers. Some interesting notes on the habits, legends, etc., of the Eskimo were secured with drawings; also a good number

of Eskimo drawings. . . . Annanaetook (our winter harbor) was a most remarkably barren plaee. . . . Did not get out of Cumberland Gulf till the 19th of July. . . . Reaehed Godhavn Harbor on the last day of July . . ."

The men were disappointed that the expedition steamer did not meet them at Godhavn. They were greatly disappointed that no word had eome from home during twelve months of their absenee.

Ludwig Kumlien, 1853-1902

Kumlien found in Governor Feneker a man familiar with the birds of North Ameriea as well as of Europe. He had aequired a good knowledge of Aretie ornithology during his eleven years' residenee in Greenland. Kumlien (United States National Museum, Bulletin 15, p. 72) says: "The birds do not eongregate in large numbers on the islands in Cumberland to breed, the way they do on the Greenland eoast. There is an exeeption with *Somateria molissima* [Northern Eider]. Some speeies that breed by myriads two hundred miles to the southward, and are equally numerous on the eoast of Greenland

to 73 N. lat., are found only as occasional stragglers in the Cumberland waters. Some idea of the barreness of the islands around Annanactook may be arrived at from the fact that from October to July *one hare* and *two ptarmigans* were brought in, and there were twelve Eskimos that hunted the greater part of the time, and I was out on every occasion when I thought it at all likely that such game could be procured."

On the valuable ethnological articles and birds secured by Ludwig Kumlien while on the Howgate Expedition to Arctic America. Spencer F. Baird, Secretary of the Smithsonian Institution, (Report of Explorations in Greenland, Smithsonian Report 1878, pp. 44, 47, 51) says: "... The collections of Mr. Kumlien made by him during several months' residence at Cumberland Gulf, in Arctic America, and on the opposite coast of Greenland, ... include great numbers of stone implements found in Esquimaux graves ... also many articles of dress and adornment, implements of war, and of the chase, etc. ... A series of the seals of Arctic America, both of skins and skeletons, brought back by Mr. Kumlien, supplies a very important gap in the collections of the National Museum. ... In the collection of fishes gathered in Cumberzland Gulf by Mr. L. Kumlien, while connected with the Howgate Expedition, were several kinds new to the fauna of northwestern North America."

The list of birds obtained by Kumlien on the Howgate Expedition numbers eighty-four. He also brought back a gull which in 1883 was recognized by William Brewster as a new species, and which he named, *Larus kumlieni*. Bent, in his Life Histories of Gulls and Terns, makes this comment: "When Kumlien ... found this species breeding in Cumberland Sound in 1878 he supposed that it was identical with the glaucous-winged gull of the Pacific coast and so reported it." Kumlien referred to the return of the Expedition in 1878 as follows: "On the morning of October 30 the Florence lay along the same dock she had left fifteen months before, every man brought back alive and well."

The Janesville [Wisconsin] Gazette, October 21, 1899, says: "He [Ludwig Kumlien] has made natural history collections for a number of museums in this country and Europe, as well as for private individuals, and for the past four years has done mounting for various museums, including our state normal schools and a number of leading high schools.

"His collection of natural history specimens is very large, embracing between 5,000 and 6,000 bird and mammal skins, all North American, and an egg collection of over 500 species of North American birds, and what is more notable, there is not a doubtful egg in the entire collection. The skin collection comprises sixty-six species of the warblers of the United States, nearly all the hawks, owls, ducks, geese, woodpeekers, waders and finches, most every species of Wisconsin birds, embracing 365 species, of which number the professor [Kumlien] had added more than thirty to the list himself. His birds are mounted in groups, representing male and female, nest and eggs, often also winter plumage and young, and with enough of the natural surroundings to give the idea of the bird's habits."

The services of Ludwig Kumlien were sought and valued for his scholarship and accuracy in many fields of natural science. In 1891 he accepted the professorship of physics and natural history in Milton College, Wisconsin, and continued to hold this chair until his death in 1902. His learning, his seasoned knowledge and the capacity to use it made him a rare and valued teacher. His wide horizon and vision gave interest; his seriousness inspired work. The impress of his life on Milton College is indelible.

Wisconsin as a state is indebted to Ludwig Kumlien, as well as to his father Thure Kumlien, for pioneer work in botany and ornithology. Ludwig's most important contribution to Wisconsin's early ornithology is The Birds of Wisconsin by L. Kumlien and N. Hollister (Bulletin of the Wisconsin Natural History Society, Vol. 3, New Series, Milwaukee, 1903). When this bulletin was published, March, 1903, Kumlien had been dead several months and Hollister had been in Alaska nearly a year. Therefore there could be no last additions and corrections.

The preface to this bulletin states: "... Our foremost thought ... has been to perfect the list.... Starting in 1899, with a list of 365 species and sub-species ... now we recognize but 357 in all, that we believe are really entitled to a place.... We have made no attempt at descriptions of birds, nor have we gone to any length in discussing their habits. Our whole aim and object has simply been to bring our knowledge of Wisconsin ornithology, as regards occurrence and abundance, up to date, and to present a carefully compiled list of all those species and sub-species which have positively been known to occur

within the limits of the state at any time. . . . We have included . . . only those species and sub-species which we ourselves are thoroughly satisfied have, at some time, occurred in the state. . . . The records, notes, and observations herein given are based principally upon our own collections and personal work in the field, covering a large part of the time for periods of thirty-five and fifteen years, respectively. . . . Added to this, and perhaps of even greater value, has been the use of the extended, accurate and perfectly authentic notes of the late Thure Kumlien, covering a period of constant residence in the state of nearly forty-five years, from 1844* to 1888, making, with the time spent by us in similar work, a total period of sixty years of constant observation. . . . Besides the personal acquaintance of the late Dr. P. R. Hoy and Capt. B. F. Goss, we have had the benefit of many letters from these gentlemen to Thure and L. Kumlien for many years."

Ludwig Kumlien was an associate member of the American Ornithologists' Union, contributing now and then to its publication. He also contributed short articles to Forest and Stream, Nidologist, and the Osprey. His name is linked with Wisconsin as pioneer ornithologist but Ludwig Kumlien, through his research work as naturalist on the Howgate Expedition, his outstanding work as assistant on the United States Fish Commission, and his contributions to various fields of natural history, is a national figure.

In 1892 he married Annabel Carr. It was a rare companionship through ten brief years. Three little children born to them were too young to know their father when Ludwig Kumlien, scarcely in the prime of life, died in 1902. His life was expressed in many fields and he belongs not only to Wisconsin but to the world.

Berkeley, California.

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*Thure Kumlien arrived in Milwaukee in 1843, and his study of bird life continued from that date. The accuracy of this date is established by three facts, two of which are found in Kumlien's own writings. Kumlien wrote a letter to President Twombley, of the University of Wisconsin, in which he stated that he came to this country in 1843. Again in a paper published in the Transactions of the Wisconsin Academy of Sciences (1875) Kumlein referred to his arrival in this country in 1843. In his "Life of Thure Kumlien", P. V. Lawson gives the date of Kumlien's marriage as September 5, 1843, at Milwaukee. This date has been verified by Kumlien's son, T. V. Kumlien; by his granddaughter, Mrs. Angie Kumlien Main; and by authorities of the Milwaukee Public Museum. All of these facts are presented in full in the Wilson Bulletin for June, 1936, XLVIII, pp. 86-93.

1936 PHEASANT NESTING STUDY

BY ALDO LEOPOLD

A preliminary study of pheasant nests in hayfields was made in 1936 on the University Farms near Madison, Wisconsin, by the author, on the Riley Game Area in Dane County by Ellwood B. Moore, and on the Elkhorn and Whitewater Game Areas in Rock County by Douglas E. Wade.

Twenty-three parcels of freshly cut hay-stubble, totaling 141 acres, were "cruised" by a strip survey. The width of the strips varied from ten to forty feet, depending on obstructions to visibility. The object was to find all hayfield nests. No thorough cruise of fence-rows or other nesting cover was attempted.

Of the twenty-three parcels, fourteen were alfalfa. The remainder were mostly red clover or clover mixtures. All were first-crop mowings, and fell between the dates June 19 and July 4. Drought postponed the second crops until after the nesting season. hence the second haying was not studied.

Forty-two nests were found, all pheasants except one Hungarian Partridge nest at Elkhorn. There are no Hungarians at Riley or the University Farms. A few quail are present on each of the areas, but no nests were found.

The average hayfield nesting density was found to be 0.3 nests per acre, or 3.4 acres per nest, but this average has little meaning because of the startling disparity as between the various areas. This disparity is reserved for later discussion.

Nest and Hen Mortality. Of the forty-two nests found:

17	had hatched before cutting	41 per cent
1	had been destroyed by a predator	2 per cent
19	were destroyed by cutting	45 per cent
5	destroyed by cutting, together with hen	12 per cent
42		100

The total mowing mortality was twenty-four out of forty-two hay field nests. or 57 per cent.

Parts of chicks mangled by the mower were found near four nests. The five mower-killed hens found had invariably lost their legs, and often wings and heads also. The proportion of mower-killed hens may be greater than the observed 12 per cent. Farmers repeatedly told of legless hens flying away, and even eluding (by a second

flush) an attempt to put them out of their misery. Unless the mower cuts feathers as well as legs it is easy to overlook evidence of hen-mortality.

A total of ten mower-killed young rabbits, seventeen *Microtus*, one Redwing Blackbird, and one tame turkey were found, together with hundreds of torn-up *Microtus* nests and some rabbit nests. All in all, the trail of the mowing Juggernaut is a gruesome one.

Two dead cock pheasants, seemingly pre-dating the mowing, were found.

I could see no tendency for nests to occur on edges, as reported by English (2) in Michigan and Hamerstrom (1) in Iowa. In at least three 10-acre patches of alfalfa, one of which was extra dense and heavy, numerous nests occurred in the very center. However these fields averaged from one to two nests per acre, so perhaps the crowding forced the birds to accept non-peripheral locations.

Desertion of Cutover Nests. Of the nineteen pheasant nests destroyed by cutting without known loss of the hen, all were deserted, regardless of the stage of incubation. This is mentioned because instances of return of hens to mowed-over nests are recorded by Hamerstrom (p. 187).

However a Marsh Hawk nest cut over on June 19 was reoccupied by the incubating bird immediately after the mowers had left the alfalfa field in which it was situated. A half-moon of cut hay was left to shield it from crows. Despite many visits by curious observers, all five eggs hatched nine days later, and the young were (except for one taken as a pet by the owner) successfully raised.

A Hungarian nest of twenty-two eggs, situated in a very narrow fencerow of quack grass, was pipping on June 19 just at the time of mowing. The edge of the mower-knife passed within a foot of the nest. The hatched chicks were successfully led away by the anxious parents, but four unhatched eggs were deserted.

Reading Evidence; Points of Technique. Crows seemed to get most of the eggs exposed by mowing within a few days, especially if the eggs had been scattered by the rake. Some nests uncovered by the mower but not scattered by the rake were never found by crows. Eggs opened by crows could be detected at a greater distance than unbroken eggs.

In one such case, an oat stubble nest of four eggs found eight days after mowing, it was suspected that the hen had resumed incubation because one egg, broken as a test, emitted no odor and con-

tained a chick ready to hatch. On returning ten days later, another egg, when broken, showed still no odor, and little or no decomposition. Apparently, then, deserted nearly-hatched pheasant eggs are very slow to decay, or else these particular eggs had been actually "cooked" and thus preserved by the sun.

Re-growth of stubble begins to hide evidence of nests within a few days after mowing, so that cruising strips must grow progressively narrower with stubble-age. Cruising becomes impossible after a week unless drought has abnormally retarded re-growth.

It was sometimes puzzling to distinguish the weathered shells of eggs opened early in 1936 from 1935 egg shells.

Hatched egg shells could be easily distinguished from predator work by the neatly-halved shells and membranes, and by the absence of yolk stains. Advanced incubation in predator-opened shells could often be detected by blood stains.

Mower-killed hens which flew away could usually be detected by finding the severed feet, and by finding feathers clipped by the mower. Blood stains were not found, though they must have been present.

It was seldom found impossible to count the clutch in mowed-over nests except in nests too deeply depressed to be scattered by the rake. Where eggs or hatched shells were reached by a rotary rake, they were scattered so widely that in a field containing many nests one often felt uncertain which eggs belonged to which nest. Furthermore I have no doubt that many shells and some whole eggs actually reach the haymow.

Fields with hay which has been mowed and windrowed but not loaded can be cruised by deducting a percentage for the windrow-covered area.

Farmers' estimates of hayfield nests were found unreliable and usually too low. The farmer sees the nests from which incubating hens are flushed, but he is less likely to see those from which the hen is absent, or those hatched previous to mowing. Clutches of eggs uncovered but not scattered are seldom seen by the farmer. In one case a perfectly reliable farmer, who had just mowed over sixteen nests on eight acres of alfalfa, told me the field contained only three nests (in each of which he had killed a hen), plus several broods of chicks which he had assisted to escape unhurt. He had apparently failed to see the thirteen other nests (six pre-hatched, one previously destroyed by predators, and six going nests) which he had uncovered. The heat,

hurry, and worry of getting hay in before the next rain is not conducive to good observation of incidentals like game.

Population Density and Hayfield Nests; Flushing-bars. The original object of the study was to find out whether enough nests are destroyed by mowers to warrant the use of flushing bars.

The information obtained, however, proved to be pertinent to a much more important question: Why do pheasants nest in hayfields anyhow?

In Table I the five areas studied are arranged in descending order of population density. The hayfield nest density (last column) is seen to follow the same order. The non-hay nesting cover was substantially similar on each of the five areas. We have, then, a series

TABLE I

AREA			SPRING CENSUS			PHEASANT DENSITY	
Name	Acres	Hay-Cruised Acres	Pheasants	Quail	Hungarians	Acres per bird	Acres of hay per nest
University Bay Farm	500	30	300?	25?	0	1.7	0.8
Whitewater	240	12	65	0	5	3.7	No nests found
Riley	1700	81	150?	40?	0	11.0	27.0
Elkhorn	780	18	57	31	52	14.0	22.0
University Hill Farm	200	11	6	8	0	14.0	No nests found

of comparable samples in which hayfield nesting is proportional to nesting population. On the thinly populated samples there are virtually no hayfield nests: on the thickly populated samples there are many hayfield nests. On the first sample (University Bay Farm) the nests averaged more than one per acre.

This strongly suggests the hypothesis that pheasants nest in hay because they have to; that heavy hayfield nesting occurs only where the other (and preferred) cover does not suffice to accommodate more than a part of the population.

Substantially the same conclusion was drawn by Hawkins (3) from a nesting study of Hungarian Partridge at Faville Grove. This hypothesis, if ultimately substantiated by more ample data, answers the flushing-bar question. On thickly populated areas flushing-bars would save many nests, but are not needed because there are already enough pheasants. On thinly populated areas there are not enough hayfield nests to justify the bother of using bars. In either case more fencerows would appear to be a sounder way to save nests than more flushing-bars.

Flushing-bars would seem to have a place on areas where there is a good stand of pheasants but more are desired, where more fencerows are impossible, and where damage to crops does not occur or may be ignored.

It may here be remarked that on the University Bay Farm, which the table shows to have the heaviest population and the heaviest hayfield nests, pheasants inflicted severe damage on corn in both 1935 and 1936. There was no damage on the other areas.

Movements. The University Bay Farm and the University Hill Farm, which contrast so strongly in both population and hayfield nests, are separated only by a highway. The former is partly lowland, the latter all upland. Both are fed in winter and both are nominally refuge. The University Bay Area is so hedged in by lake, woods, golf links, and residential property that any spread of birds must be in the direction of the Hill farm. Why do the pheasants from the crowded University Bay not spread to the nearly empty coverts of the Hill farm, at least for nesting? Wight's (unpublished) findings in Michigan indicate a spring dispersion of up to three miles. The direction of this movement is toward uplands.

I am unable to answer this question, except to suggest that the Hill Farm is heavily poached, whereas University Bay is not. For this or some other reason the University Bay birds prefer to nest on their winter range, despite its crowded condition.

None of the conclusions herein set forth can be considered as more than tentative until the work is repeated through a series of years, and until the nesting density in fencerows and other covers is determined for both thinly and thickly populated samples.

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OBSERVATIONS AT A BARN SWALLOW'S NEST

BY HAROLD B. WOOD

A Barn Swallow (*Hirundo erythrogaster*) was noticed one afternoon flying around the cabin in which I was living on the Allegheny plateau at an elevation of 2300 feet. Joined by its mate the next morning, the pair gave an unusual opportunity for observation. Their summarized activities follow: The male arrived May 31, 1936, and its mate June 1; that same day they selected their place for nest building and began building the following day; nest building took six days, followed by a day of rest; two eggs were laid June 10 and 11; they rested the next day; incubation was exactly seventeen days for each young bird; the young flew from the nest when the older was nineteen days old, or thirty-five days from the beginning of nest building. There was no attempt at a second brood. All four birds left together on their southern migration on August 13, after a seasonal residence of seventy-four days. The adult male was banded C46504, the adult female C46505, the older young, presumably a female, C46502, and the younger, presumably a male, C46503. The investigation was made at Cherry Springs, Potter County, Pennsylvania.

Sitting at my window I first noticed the first bird late in the afternoon. Early the next morning he was joined by a mate, and both kept flying around the cabin, even up to my open window, as though in search of an entrance or place to nest. I at once nailed a board above the window, fastening it to the rafter. That afternoon it was evident that the birds had selected the shelf, as they went to it frequently. By 8:00 A. M. the following morning they began to build. From then on, many notes of their activities were made. No acts of mating were observed. It was soon seen that the male bird had the right outer tail feather about an inch shorter than the left, aiding in his identification while rapidly approaching the nest. In all my actions I had to be especially careful not to disturb the birds too much for fear they might abandon their undertaking. When reaching into the nest at first I did so immediately after they flew, but when handling the young I wanted them to watch that no harm would be done.

Nest building was done by both parents, beginning at 8:00 A. M. June 2 and completing the nest in six days. The birds would collect the mud by pushing the bill into it three or four times, then after carefully selecting the exact spot for each mouthful, would expel it as though by pushing with the tongue. There was no act of disgorgement as would be shown by extending the neck or by neck muscular movements. This was watched with binoculars at a distance of twenty

feet. The mud would be carefully pushed into place with the bill, and as the nest assumed its cup shape the bird would turn around as though giving the interior the correct shape and size. At no time would the feet be used to carry, to place, or to shape the mud. A mouthful of dried grasses or rootlets would alternate with several of mud. No green vegetation was used. The first pellets of mud were placed where the outer rim of the nest would be, and soon much mud was applied to the vertical rafter as though the side anchorage was necessary. Later I weighed thirty distinct pellets of dried mud at 120½ grains, and determined from the dry sifted earth that the birds took 1359 trips to collect the mud, or approximately one hundred trips per day per bird, and traveled to the only two mudholes which were the source of the supply, a total distance of 137 miles. At a flying speed of twenty miles per hour (once carefully checked by my automobile) this gave about six hours of work to collect the mud. The nest was found to contain, besides nearly seven and one-half ounces of dried earth, 1635 rootlets over one-half inch in length, 139 white pine needles, 450 pieces of dried grass, 10 chicken feathers, 4 pieces of wood, 2 human hairs and a piece of leaf and cotton, and a tablespoonful of minute pieces of rootlets and grass.

The first egg was laid in the morning of June 10, the second the following morning before 7:20 o'clock. I felt into the nest frequently each day. The birds stayed away from the nest all day after each egg was laid, as far as I was able to determine by frequently looking for them. The third day was a very noisy one, with several tractors and men going past the nest frequently. They apparently frightened the birds from the nest and prevented egg-laying and perhaps destroyed the urge or ability to lay. The birds were not seen at the nest that day. Incubation began the next morning.

Incubation was performed by both parents, changing place every few minutes. After the birds had been incubating for a few days I placed a mirror in such position that I could distinctly see from inside my room what was going on at the nest but could not see the eggs. The effect of the mirror on the adults was striking and will be described presently. After the third day I noted that the birds would change places on the nest at intervals of between four and fifteen minutes. I recorded that the female spent each night on the eggs, quieting down at about 7:50 P. M. while the male rested on a perch alongside the nest shelf and would leave between 7:50 and 8:10 P. M. to spend the night in the woods, as I could see. On the eleventh day of incubation my notes show the parents were changing places at the nest at

intervals of six to thirty-six minutes. The morning when the first-born was to be hatched the birds changed at 10:10, 10:20, 10:28, 10:42, 10:51. Then the male, now on the nest, became very restless and flew off at 10:56 and back at 10:59 A. M. The female then flew to look into the nest at 11:00½ and took her dutiful position at 11:06. Soon after noon that day I discovered a young bird had been hatched. Doubtless this occurred when the male was so restless; he seemed very fussy at 2:20, which may have been when the final act of getting rid of the shell occurred. At 7:20 the second morning I found two egg-shells directly beneath the nest; one contained dark blood, the other fresh blood not yet coagulated. The second young bird was then felt.

The parents retired regularly, the mother going to the nest about 7:45 each evening. After I placed a trap under the shelf for catching the parents to band, when the older nestling was ten days old, the mother stopped spending the night on the nest, but was on the nest up to about 8:00 P. M.

The young Barn Swallows were hatched June 27 and 28, being exactly seventeen days after each egg was laid. They were banded when the older was ten days old. They both left the nest when the older was nineteen days old. The young were just three centimeters long when hatched. Daily measurements were made, but no weights: complete notes of their developments, feather growths, and other activities were kept. When hatched they had tufts of black down, frontal, occipital, scapular, and mid-spinal. This down persisted and one bird still had a few wisps on the head when he flew from the nest. The eyes began to open on the sixth day, when the dorsal pin feathers began to develop. The young birds could make a slight noise when three days old.

Feeding was done by both parents. The method of early feeding was not observed. On the tenth day I distinctly saw a fly's wing protruding from the bill of the adult indicating that the young were then being fed raw food. When the young were fourteen days old they were removed to an artificially made nest in the windowsill, so I could watch from a distance of less than a foot. Attempts were made before this to transfer them but they were too young to make enough noise to attract the parents down from the upper shelf. Many observations were then made of their feeding. Usually flies were their diet, occasionally a moth and frequently a hairless green caterpillar, identified by Dr. Carl Heinrich, of the Bureau of Entomology, as the *Heterocampa guttivitta*, Wlk., an abundant species in the woods. Practically all the food was collected over a half acre of plowed field immediately adjacent. Many of the feeding trips were timed and closely watched,

and it was definitely determined that the nestlings were given raw, sometimes live insects, and not any bolus of predigested food, not even saliva-soaked. The times of returning with a newly caught fly were as short as ten seconds. It was easy to distinguish which parent was feeding at any time. The male was more highly colored, had a short right outer tail feather and a right leg band; the female was banded on the left. My notes show that on the fourth day of the older nestling the time for changing of the adults at the nest varied from ten seconds to three and one-half minutes, averaging one and one-third minutes; on the tenth day the feeding times varied between 15 and 120 seconds, averaging 53.

I placed green caterpillars on the rim of the nest and no attention was given them by the young birds. After freshly killed flies were placed on the windowsill shelf the young birds paid no attention, but the father advanced and ate four himself, then fed one to a nestling, four more for himself and one for the children, repeating. The young being banded on different legs it was easy to keep account of when each was fed. It was definitely determined that the parents did not select the young to feed in order or rotation. The parents were not selective. The food was always given to the young bird which was ready, which had its bill open first or which leaned forward, or in some cases the one which called with a little note. One bird frequently received every feeding and when satisfied would turn around in the nest and face the window, giving the other bird a chance. When it became satisfied it would settle down, and the parents fly off to the telephone wire. When the young were ready to be fed they would call out "*asch, asch, asch*" to the flying parents, and then feeding began again.

Sanitation of the nest is carefully observed by Barn Swallows. The nest is kept clean by the actions of the nestlings. When the mother was near, the nestling would give a little call, then turn around in the nest and raise the hind quarters above the rim of the nest and expel the white, pyriform, fecal pellet. The female adult would grasp by her bill the pellet before it was half expelled, but the male always waited until it was dropped on the outside of the nest. This was first noticed when the young birds were only a week old. The pellets were carried away and dropped at measured distances between twenty-five and fifty feet.

When the older nestling was nineteen days old I was sitting by the open window with the bird in my hand when it suddenly flew away, going out the window to a tree just 548 feet away. On the previous two days it had stood upon the rim of the nest and flapped

its wings, but made no attempt to fly. The mother seeing the bird fly away followed, and I found them together. An attempt to retrieve the young bird frightened it away, but a half hour later it was found on the same branch it had last seen its mother. The four birds kept together until they left on their southern migration, August 13.

Emotionally, the male Barn Swallow is more aggressive and defensive, more inquisitive and suspicious than the female. The female was the more cautious and wary. When the young were moved to the windowshelf the female seemed resigned, but the male searched for the cause of their absence from the old nest. When the mirror was fastened up by the first nest the female disregarded it; her thoughts were to help the young. But the male looked into the mirror and attacked the supposed intruder, then looked around in back to see what became of it. A dummy nest placed on the other end of the shelf when the first nest was half built disturbed the male greatly, but not the female. When the young were moved to the window sill the male sat upon the old perch and listened: as soon as the young awoke and chirped the male flew directly to them, not having discovered them before. He began feeding at once, but the female did not go to the nest for two and one-half hours, and not to feed for another half hour. Noises did not disturb the birds as much as motion. A severe thunderstorm never bothered them, neither did blasting or slamming doors. But if I scratched upon the window they would leave the nest, believing I was going to reach into the nest, as they had seen me do repeatedly. When a person walked near enough to be seen by a bird on the nest the bird would leave. The respiratory rate of 120 per minute was not affected by heavy claps of thunder. The pulse rate was not counted. When I handled the young out doors the adults would make sudden darts, swerving past my head, the male always nearer, calling "*asch, asch, asch*". An extra male frequently came around, seemingly looking at the young in the nest, but never attempting incubating or feeding. Only once did he seem to bother the father. The parent birds would make the first morning calls, at 4:50 A. M. when the young were five days old; later recorded calling times were 4:40 and 4:44 A. M. When the older nestling was five days old I noted that the young awoke at 4:45 A. M., the next day at 4:40 and for six subsequent days they awoke exactly at 4:35 A. M. and began to call for breakfast.

These observations definitely determine a number of interesting facts about one pair of Barn Swallows, which differ from other recorded statements.

Harrisburg, Pa.

NOTES ON THE BREEDING OF THE GROUND DOVE IN FLORIDA

BY DONALD J. NICHOLSON

During the spring of 1930 I had a wonderful opportunity to study the nesting habits of several pairs of Ground Doves (*Columbigallina passerina passerina*) on the U. S. Laboratory Experiment Grounds, at Orlando, Florida, while doing special work on the eradication of the Mediterranean Fruit Fly.* Some very interesting facts were brought to light on the domestic habits of this beautiful little dove, which I felt should be passed on to others.

I do not pretend to give a complete life history of the species, but simply am giving my observations as I found them on this small plot of about three acres, which was planted in the main to citrus trees, though many other species of plants, introduced and native, are growing on the grounds. The station is located in the heart of the city, and much traffic passes hourly.

There were five pairs of these doves nesting on the grounds at the same time, and all in trees or shrubs. Ordinarily these doves nest equally either in trees or on the ground. They do not seem partial to either. On only one of the nests were observations made in detail from the beginning of nest-building and continued until the young left the nest. I was hampered by the lack of time, and give only fragmental data on other nests observed.

During the early part of February I first noticed six to eight Ground Doves feeding together on the ground in front of my car, as I drove up to the grounds at 8:00 A. M. They all fed within a few yards silently and peaceably. This was noticed upon a number of occasions, until the latter part of February when they began to pair off and began the plaintive wooing calls which were kept up all day long. In wooing on the ground, the male chases the female by rapidly walking after her with lowered head uttering low short notes sounding like *wuut, wuut,* or *woot, woot, woot,* flitting his wings ever so slightly as he goes. When he comes too near she rises and flies a few yards and he does likewise, repeating the actions described. The actual mating I have witnessed but once, over thirty years ago, and I do not recall the details, but remember it was consumated on the branch of a hawthorne tree, (*Craetegus*). Just before nesting a pair will often be seen sitting side by side, with bodies touching, facing the same direction, on the limb of a tree, on fences, or on line wires.

*Under the Bureau of Entomology and Plant Quarantine, of the United States Department of Agriculture.

The male is very devoted and assists fully as much as the female in nest-building, and especially in incubating and caring for the young. The male carries material to the nest and helps place it, as does the female, and both are found close to the nest before the eggs are deposited. After the eggs have been laid, only one bird is seen about the nest except during the changing of places on the nest. The male rarely gives his mating *coos* when incubation begins, but about the time the young are ready to leave the nest he begins to call, and it is not long before another nest is started or the old nest re-used. Sometimes the same nest is used four times consecutively in a single season. This habit of using the nest over and over again during the season was not known to me until this year.

Although the birds are ordinarily peaceable, rival males bristle with anger when in pursuit of the same choice for a mate. Recently I saw two smitten males fighting for their choice. One would run toward the other with upraised wings uttering angry sounding sharp *wut, wut, wut, wut* notes, but this seemed to be the extent of their vengeance. A Florida Blue Jay alighted upon the ground not far from a dove that I had flushed from the nest. The dove with both wings raised high above its back ran rapidly toward the jay, putting it to flight. Usually nesting doves are very timid and leave the nest when you are near, but one courageous male defended his domicile with astonishing bravery. I placed my hand in the nest and touched him, and immediately was struck a stiff blow on the hand by its upraised wings descending forcibly. Again and again this was repeated. I could grasp the bird and raise it clear of the eggs or young and replace it. Still it clung to the nest. This was, of course, very unusual, and it was the only experience of the kind encountered.

Pair No. 1. Ground Dove nest in orange tree eight feet above the ground, built in the old nest of the previous year. Found February 24, 1930, with female sitting on the nest at 11:00 A. M., but no eggs in the nest. February 25, at 3:30 P. M., female sitting on one egg. February 26, at 3:50 P. M., female sitting on two eggs. Bird was gentle and permitted me to stroke her back, which frightened her off. March 4, female sitting low to escape observation. March 6, female sitting at 11:00 P. M. and as the bird watched me, I reached up and stroked her tail feathers twice. She then flew to the ground ten feet away, fluttering about feigning lameness as she had done numerous times before. March 7, noted that both male and female took turns brooding; eggs still unhatched. March 8, eggs unhatched. March 9, nest not visited. March 10, parent brooding two tiny young. The

nest was watched for several hours from a distance and, as I did not see the parents making trips to nest, I had decided that the young were not fed so young. Mareh 11, sometime between 9:00 A. M. and 9:45 P. M., while watching bird on nest, it began making jerky motions with the head and crop, and upon ereeping up close I discovered for the first time that young doves were fed by regurgitation. The little one would wriggle from under the parent, coming just in front of it as the parent would raise its body slightly. The nestling would quiver and raise its head weakly and the parent (male) lower its head, and the young thrust its head firmly and deeply into the mouth of the parent. While in this position the male worked its head and crop violently while the regurgitation went on. The feeding progressed for two or three minutes, with various pauses, possibly to allow the young to swallow. Immediately upon disengaging, the young would settle down in front of parent to rest. Within four or five minutes this operation was repeated. The young were fed nine times within three-quarters of an hour, and remember they were only two days old. When satisfied the young would crawl back under the parent without assistance. I was able to stand within four feet in plain sight and wateh. Forty-five minutes elapsed before he fed them again and this time only once. During some of these rest periods the parent touches the bill of the young, apparently giving it something. Although I was within a blind (later on during the observations) within three and one-half feet of the nest I could hear no audible sound by the parents, but when very young the nestlings give weak cheeps when hungry. Neither parent left the nest over ten minutes from the time the first egg was laid up to the present time. March 13, 1:20 P. M. Young with eyes open (they are closed the first day); even dull, cloudy skies seemed to affeet their eyes and they would close them. Quills of primaries of both young about an inch long. March 14. 9:00 A. M. Female brooding. At 9:15 A. M. both parents in nest; female sitting and male standing on nest beside her. 11:30 A. M., male brooding. Today small short pin-feathers showing on tail, and two parallel ridges on back showing short quills. None on the head or other parts of bodies. Wing coverts about equal to the length of primaries. At 2:35 P. M. female brooding. At 3:05 male alighted on nest beside her and both flew at cliek of eamera. Soon male sat on nest. Young not fed between 3:05 and 5:00 P. M. when I left, and they lay quiet. March 15, male brooding at 9:00 A. M., remaining on nest until 10:15 A. M. when female alighted on nest. After a few seeonds he left and she settled down and at once began pulling up and

re-arranging the sides of nest. The male had been for the past half hour pulling at nest and trying to strengthen it. It had rained hard and the weight of the young had caused the nest to sag to a dangerous angle. Five minutes after male left the nest he returned and alighting on her back, with grass in his mandibles, reached over her head and placed it in front of her; she arranged it. He made five trips and acted the same. About six minutes after she arrived she began feeding one young but ceased when the camera clicked. At 11:15 young were examined and now showed sheaths on head, throat, thighs and two lines on the abdomen. None of the quills on wings had yet burst. Horny white tip on mandibles still intact. This presumably. is what aids the young in puncturing the shells. permitting them to escape. This plate is not shed on the twelfth day when they leave the nest. As it is not present in the adults, I can conceive of no other function it could perform.

As I handled the young they uttered low almost inaudible "cheeps". Male was on the nest at 1:15 P. M. and fed young and again at 2:25 P. M. Female exchanged places at 2:35 P. M. At 3:40 P. M. young crawled in front of female and she fed both at once. They had been quiet up to this time. (I looked at two other nests on the lot at 4:55 P. M. and all three were brooded by females).

March 16, 11:47 A. M., young quite active when handled in nest, facing in opposite directions. No feathers yet showing. March 17, female on nest with two young in front of her at 8:45 A. M. and had evidently been feeding. I went into blind at 9:00 A. M. and she fed them at 9:10. At 9:30 A. M. male came and sat in nearby tree and female left immediately. Male flew to nest at once and began feeding two young at same time. Both pleaded with weak cheeps and outstretched necks, until male opened his bill and both forced their bills as far down his throat as possible. He now pumped more vigorously and violently than on the first three days of feeding. Upon completion the young settled under him. At 10:30 A. M. male not been relieved. During this time the young came out from under male and stretched their wings and legs a number of times. also picked and pulled at the quills on their wings as if they hurt or itched. They did not appear hungry and did not beg for food. but soon after stretching crawled back under parent. One of the young during this time. stretched, turned tail to rim of nest and expelled excreta. Not once did the

parents carry away fecal matter from the nest, nor was it otherwise disposed of. This was allowed to remain in a ring upon the edge of the nest. As the nests are so frail it is possibly allowed to remain as a cement to strengthen it.

At 11:00 A. M. I examined the young and found the sheaths of the primaries, on one young only, had burst and were now showing feathers for the first time, which was the eighth day. There were fourteen feathers (only ten primaries) on one wing showing one-sixteenth to one-eighth inch. On the other wing of this nestling there were only twelve primaries that had broken through the sheaths, and were not quite so long as upon the other wing. No other quills on any other parts of the bird yet showed feathers. Male brooding at 12:20 P. M. I was gone from then until 1:30 P. M. About 2:15 P. M. it began to rain and I watched from a blind for fifteen minutes while it lasted. Female sat low upon the nest with head drawn in and eyes half closed. The water was shed easily from her feathers and she did not become soaked. One of the young with one side exposed to the elements, did not seek shelter. Male did not appear while it rained. At 3:45 P. M. male on nest and both young facing same direction. At 4:40 P. M. female brooding. Now found that the second nestling was showing numerous feathers on the primaries of both wings, however, they were not as long as those of the first bird. There were not any feathers showing on this young at 11:00 A. M. The nestling first showing feathers, now had much longer ones than it had at 11:00 A. M. The crops were very full and felt as if filled with small seeds, feeling rough to the touch.

March 18, at 9:00 A. M. female brooding. Young quite restless and stretched frequently, by exercising one wing then the other. Also the legs were stretched at same time. Pleaded for food but were not fed. About 9:15 A. M. female left the nest for the first time, since young were hatched, before the male arrived. About twelve minutes later male arrived and within half a minute began feeding both young at same time. I snapped picture and the young "froze" as if warned by parent, and remained thus for some minutes. After fifteen minutes the male fed only one young this time. The other seemed satisfied and lay quiet. This time it released the young three or four times, beginning over again. At 10:00 P. M. the female alighted on top of my blind just four inches above my head. She walked back and forth

uttering low *wuut, wuut,* notes. Male left nest when these notes were uttered, and female flew directly to nest. As she did so both young flapped their wings rapidly, then she fed both at same time in the usual manner. At no time while in the nest were the young fed in any manner but by regurgitation. Young continually stretching and breaking tips of their quills with their beaks, by pulling and running them through closed bills. Male returned at 11:22 A. M. and pecked female lightly on the back three or four times before she would leave. Male fed immediately one young, and before it finished both were fed together. At 11:45 A. M. I examined the young and found feathers now showing for first time, on tail, but very short, also quite long on thighs, scapulars, and back. Feathers on these parts were not showing the previous day. The secondaries and primaries now quite long. The young now had a habit of snapping their mandibles when handled, but this was not noted when they were unmolested in nest. Parents today for first time "talked" softly to the young.

Saw repeatedly the manner in which the quills were broken. The young would peel off large scales at a time and were now continually pulling at sheaths. Neither parent aided in this work.

From time the first egg was laid, the approach to the nest was essentially the same—the returning bird would always alight near the nest, making one to three short flights from branch to branch before alighting upon the nest. March 19, at 9:00 A. M. the female was brooding and at 1:20 I flushed her while trying to touch her and she did not return. Young left unbrooded for three-quarters of an hour when the male arrived. He gave his mating calls for the first time since the eggs were laid, near the nest before flying to it. Probably her absence disturbed him. When upon the nest he gave low almost inaudible *coos,* as if talking to the young. They cheeped in return. He began feeding one and before it finished the other began to plead and reach for his bill while the feeding young tried to fight it off by widely spreading its wing. However, the male finally fed both simultaneously. The young were more restless than usual today, and moved about considerably.

Desiring a better light, I parted the branches above the nest and the sun shone down intensely upon the young. The young seemed to suffer much from the heat and their throats palpitated rapidly, as if panting. When the male returned, he viewed the unfamiliar sun-covered nest with suspicion. He uttered rapid and numerous *wut, wut wut* notes before alighting on the nest. Very soon the heat proved too much for the male and he also began to "pant" which was evidenced

by palpitations of the throat and mandibles widely distended. He wisely and with much solicitation, stood in a position which best shielded the young from the scorching rays of the sun. This was the only time suffering from heat was noted, and I soon placed the branches in former position. Within a few minutes the panting of the young ceased and when the male returned he evidenced no suffering. This incident explained to me why Ground Doves select shady nesting sites.

Today very short feathers were now appearing on the head, throat, and sides of the neck. The eyes were brown—quite unlike those of the adults. There were now sixteen feathers on the primaries showing the reddish-brown color as in the adults. These were the only feathers exhibiting such color. The general color of the feathers was now something similar to that of the adults, but paler, and each feather edged at tip, with grayish-white. Purplish-black spots showed prominently on secondaries and scapulars. Bill horn-color and the white horny knob still present. I may say this had not disappeared when the young finally left the nest.

At 10:50 A. M. after handling one of the young it flew from the nest several yards, alighting upon the ground, where it ran several feet. It was replaced in the nest and remained there. At 11:40 A. M. the female was brooding. When trying to touch her she flew to the ground below, feigning lameness by fluttering her wings and crawling along the ground, uttering peculiar notes with a nasal twang difficult to describe. She uttered these notes only after the young were hatched. These are notes of anger.

March 20, at 9:00 A. M. the young in the nest but parents absent. Female on nest at 10:30 A. M. Male on nest at 11:30 A. M. Male on nest at 12:05 P. M. About 3:30 P. M. upon visiting the nest I saw a Florida Blue Jay just two feet above the nest inspecting it. The dove was in a fighting attitude with highly upraised wings. Frightened by me the jay flew. The male gave his mating calls quite frequently today. More so than at any time since incubation began.

March 21, at 9:00 A. M. the male sitting on nest with the two young which were practically fully feathered sitting on edge of nest in front of parent. During the past two days the parents did not pretend to cover the young, and were often absent for long periods, contrary to the earlier life of the nestlings. At 12:10 P. M. male sitting beside young permitted me to watch it only two feet away and as I put my hand within four inches of him, he flushed and fluttered on the ground beneath. Both young upon being touched now launched from the nest

and flew fully thirty feet. I caught and replaced one in the nest and it remained quiet, but could not find the other nestling. When visiting the nest at 2:30 P. M. I was surprised to find that the other young had returned to the nest. Both were now there, sitting beside the male. Young were now nicely feathered but rather bare in spots on belly and thighs.

At 3:45 P. M. I found a parent and the two young in the nest, but becoming alarmed they all flew away. Returning once more at 5:10 P. M. I found the nest empty and could see nothing of the happy family. I visited it the next morning and the following day but nothing more was seen of them, so I took it for granted that twelve days must be the time required for young doves to remain in the nest, before venturing into the world.

The Re-use of This Nest. On April 12, 1930, I went by this nest and examining it, thought that I detected a few new pieces of fresh grass. Two hours later my suspicions were fully confirmed as I now found the old structure completely renovated. Much grass had been added and it appeared as if ready for eggs. April 14, at 9:00 A. M. I found the female sitting upon one egg. At 1:30 P. M. she still sat upon the single egg. April 15, at 7:45 A. M. female still sitting upon one egg, but at 10:50 A. M. she sat upon two eggs. On April 16, I stood in the blind as female sat upon the nest. I set my Graflex at one-twenty-fifth of a second, and the picture shows how rapid and responsive these birds are to disturbances. Before the shutter closed she had been able to raise her wings. She had been sitting quietly upon the nest. The 18th of April revealed a bird tragedy. I found body feathers of a dove scattered on the ground and in the nest. One broken egg remained in the nest and the other smashed upon the ground below; mute testimony of a desperate struggle. Whether the marauder was a cat or an owl, I cannot say.

Off and on all that day the male kept up his calls in the vicinity of the nest, waiting in vain for an answer that would never come. I have watched this nest since and up to August 5, it has not been used.

Pair No. 2. A Ground Dove nest ready for eggs found eight feet up in a small orange tree about the center of the tree in a dense shade, on south side of the Laboratory, February 28, 1930. Female sitting upon the nest at 8:24 A. M. and flushing found the nest empty. She was back upon the nest at 8:40 A. M., remaining until 12:00 A. M. when

again flushed. No eggs yet. Nest visited about 3:30 P. M. and still no egg. Female upon the nest at 5:15 P. M. but not disturbed.

March 1, at 9:00 A. M. I discovered the first egg. Bird on nest at 5:00 P. M. sitting on the single egg. This was evidently laid early in the morning. Did not visit nest Sunday, March 2; on March 3, at 8:20 A. M. found female sitting upon two eggs. Today the eggs were left uncovered for several hours, which is quite unusual. They are rarely left uncovered even when there is only one fresh egg. On March 10, about 11:00 A. M. I was surprised to find the male standing upon the back of the brooding female. They both flew. He was probably just going to exchange places with her when I approached.

March 12, at 3:05 P. M. I examined the eggs and found no signs of hatching. March 13, 9:25 A. M. female sitting. Found one of the eggs with very small break in center. The other not yet pipped. At 5:15 P. M. both eggs now pipped. March 14, at 8:25 A. M. neither egg yet hatched. At 11:30 A. M. still unhatched. At 2:30 P. M. one young apparently just emerged and was wet. No eggshell in nest. Parent brooding and flushed. Back upon nest within four minutes. At 3:04 P. M. the second egg had hatched and two young in nest. No signs of eggshells in nest or on the ground. Parent seen to expel fecal matter over side of the nest. That of the young is allowed to remain upon rim of nest in a circle.

March 15, at 11:00 A. M. eyes of neither young yet open. Very faint sign of primaries (quills) showing. Male brooding. At 4:10 P. M. eyes still closed. No noticeable development of quills since 11:00 A. M.

March 16, at 10:45 A. M. female brooding. Eyes of young barely open. Primaries still very faint. No quills showing on any other parts of their bodies. March 17, at 12:00 P. M. the primary quills now showing fully one-sixteenth of an inch. Quills on secondaries now barely perceptible. Male brooding. March 18, at 1:15 P. M. male brooding. The secondaries and primaries now had grown to about one-half inch. Secondaries only a trifle shorter than primaries. Patches of quills now showing on scapulars. Two ridges along the backs showing a few tiny quills. None elsewhere on bodies. Fledglings uttered weak almost inaudible cheeps.

On March 25, I found only one young left in the nest. The other nestling must have been taken by either a Blue Jay, Catbird, Brown

Thrasher, or Shrike. A cat would have taken both. I did not observe this nest further until they used it again.

The Re-use of This Nest. On May 13, 1930, upon visiting this nest, I found the female sitting upon one fresh egg, and the next day there were two eggs. I have strong reasons for believing that the majority of the doves in this plot repeatedly nested in their old nests. Later on in this article I offer conclusive proof that at least one of these pairs nested twice during the season in the same nest. There is no reason to think that any other pair but the owners of these nests would re-use them. Therefore I am presuming this to be the case. On May 27, at 1:00 P. M. one of the two eggs found pipped. May 28, at 9:30 A. M. now one young and one pipped egg. Male brooding. At this time the egg was slightly broken on one side one-fourth way down from end. At 11:30 A. M. male brooding. Egg now nearly encircled with perforations near one end, forming almost a complete ring. I believe these broken places are made by forcing the horny tip of the mandible through the weakened shell. When male was frightened from nest at 11:30 it did not return until 12:15 P. M. as I sat near watching the nest expectantly. At 11:45 A. M. the egg popped open and the head of the young shown. For several minutes the clinging shell could be seen moving about, now up, now down, caused by the actions of the struggling young. I went inside and watched from a window twenty feet away. The male returned at 12:15 P. M. and did not settle down on nest. It immediately picked up a section of the shell, giving it several hitches to insure a firm hold, and flew to the westward. The round trip consumed about thirty seconds. Again this was repeated but this time it flew over the Laboratory to the northward. The time was the same. He now appeared very shy, standing alert and erect upon the nest for several minutes. After turning around on the nest several times he settled down to brood. He did not offer to feed the young at that time. I then went to lunch. Observing the nest between 1:30 P. M. and 2:00 P. M. the male fed the young or a young (I could not be sure) a little at a time at frequent intervals. The young would crawl out in front of him and when satisfied crawl back. The violent motions of neck and head were not indulged in at this tender age, and his actions were quite mild compared to later feedings when the young were older. Lice or mites seemed to be bothering the brooding bird and he would peck frequently at some-

thing on the edges of the nest. This was noted in other dove nests. Whether the youngest bird was being fed, I was unable to determine. This gave me an idea. I removed the oldest nestling and watched from a tree nearby. Five minutes later the male returned to the nest and apparently detected no loss and settled down to brood. It fed this young twice between 2:45 P. M. and 2:55 P. M. In all probability it had been fed prior to this, but I was now positive that the young are fed at least within the first three hours of their lives.

Up to August 5, this nest was not used again. However, a nest with two perfectly fresh eggs, in an old Brown Thrasher nest, thirty-five feet south of this old site, found on August 5, may or may not have belonged to this pair.

The following notes on nests on this plot will give some idea of the frequency with which these doves re-use their nests, and the time elapsing between each brood. As I have given fairly complete details on two pairs, I will only give brief data on the others.

Pair No. 3. On February 28, 1930, on the east side of the Laboratory, a pair of Ground Doves were building a nest about two and one-half feet above the ground in a cinnamon tree, shaded by a tung oil tree well back among the shadows. March 1, at 9:00 A. M. female on nest but no eggs. At 10:05 A. M. female flushed off nest but no eggs. Male within a few yards of the nest on the ground, several times prior to this time. March 3, at 8:20 A. M. bird sitting upon one egg. At 1:00 P. M. female on nest with the one egg. Late during the afternoon I visited the nest and found the egg gone. Some roving bird had robbed the nest but I could never catch the marauder. Bird not about. This is the reason that these doves can not leave the nest for long. A Catbird and Brown Thrasher frequently were seen in the tree and either may have been the guilty one.

On April 7 this same nest held two fresh eggs. There were none in the nest on the 5th. On April 19, at 8:45 A. M. both eggs found to be pipped; at 11:30 A. M. neither hatched. Visiting the nest at 1:45 P. M. found both eggs hatched and no sign of eggshells. On April 21, I found one young missing. The remaining one was safely reared. To August 5th, this site was not used again.

Pair No. 4. On March 29, 1930, a Ground Dove was seen building a nest on the inside of a 1929 Brown Thrasher's nest, in an orange tree seven feet above the ground. This tree was near the entrance gate of

the insectory, and within three feet of the pathway, where many passed daily. One of the men who watched the building of this nest related the following: "One bird remained in the nest while the other brought material to it which was arranged by the stationary bird. This was repeated many times." I have no reason to doubt his word, as he has raised pigeons and was interested in watching this pair of doves. On March 31, the female sat upon two fresh eggs. April 12, by 9:20 A. M. I found one young and one pipped egg in the nest. At 2:30 P. M. there were two young.

This was a remarkably courageous pair of birds and from their behavior I concluded the same pair used the same nest for a second brood.

I could reach up and touch the birds (parents) as they sat brooding, numerous times, when they sat upon eggs or brooded young. They would utter rasping nasal notes angrily, and raise their wings vertically, high above their backs, and strike a swift downward blow upon the hand. He or she would back to one side of the nest, refusing to leave it. I frequently lifted the bird, either male or female, off the nest and replaced it, without driving it away. No other pair of doves on the lot would stand for this, although I did touch several other nesting pairs. On the re-use of this nest later, these actions were duplicated. In view of this I feel safe in presuming that the re-use of all nests on this lot were by the original owners. The young left the nest on the 24th or 25th of April.

On June 2, this same nest held two young that hatched this date. As the eggs hatch in twelve or thirteen days, the first egg must have been deposited May 18 or 19, which was about three weeks after the first brood left the nest. There were no more eggs laid in this nest up to August 5.

Pair No. 5. On February 26, 1930, a dove nest found fifteen feet above the ground on a lattice-work of small branches of a tangerine tree, well shaded. February 27, the nest held two eggs. On March 11, at 5:05 P. M. female sitting on one pipped and one sound egg. On March 12, at 8:45 A. M. found that only one egg remained. This pipped. At 3:10 P. M. I climbed the tree and lightly touched the bird on the tail and she flew to the ground. There was now a yellowish young in the nest, which flourished and left the nest in due time. March 13, at 1:25 P. M. the eyes of the young closed, and tiny quills (primaries) barely in evidence. March 14, at 9:10 A. M. parent brooding; young still unable to open their eyes. Quills on wings now about one-sixteenth of an inch upon the second day. No other quills yet showing.

Color of bill dark horn-color; extreme tip whitish, and just back of tip on upper mandible is a little horny knob pure white and behind this the bill is encircled by a black narrow band. At 3:05 P. M. male brooding and female also at nest. Both young now barely able to open their eyes. Very short quills on wing coverts now obvious. March 15, today the quills showing on tail for first time. Male brooding and placed my hand within three inches of him before he flushed.

This nest was re-used and on April 2, I found a dove sitting upon the nest, which was empty. April 7, there were two fresh eggs and bird sitting. A Brown Thrasher's nest with three incubated eggs in same tree nine feet from the dove's nest. On April 12, the dove was still sitting upon the two eggs. I did not follow it up.

On May 12, this nest was again used, and the dove was sitting on two fresh eggs, which constituted the third set since February. I did not observe this further.

This nest was used a fourth time. On June 11, I found that fresh pieces of grass had been used to repair it, and on June 13, she was sitting on two fresh eggs. I did not look into this nest until June 24, and found the nest empty and deserted. The Brown Thrasher was again using her old nest in this tree, making her second brood.

Pair No. 6. On May 27, 1930, I found a Ground Dove nest built upon an old Cardinal nest in a tangerine tree fourteen feet above the ground. It held two young eight or nine days old.

She laid in this nest again and on June 10, there was one egg and on June 11, a second egg was laid. On June 24, one egg hatched and the other was found to be infertile.

On August 5, I flushed a dove off this nest which held one lone well incubated egg.

Pair No. 7. On March 17, 1930, I found a Ground Dove building a nest nine feet up in a calamondin tree. March 18, bird on nest arranging it and quite a bit more had been added. March 19, bird worked on nest today. March 20, at 9:10 A. M. bird sitting on nest, no eggs. At 12:15 P. M. was absent. At 5:15 P. M. bird sitting, but did not disturb her. March 21, at 8:40 A. M. female sitting upon one egg. This was either deposited late in the afternoon of the 20th; or prior to eight o'clock on the 21st. At 12:05 P. M. I visited the nest and found it deserted and egg gone. The work of egg-eating birds again. I do not believe that the loss of eggs and young would have been so great, had I left the birds undisturbed. This is the reason that the nest is rarely left unattended.

Pairs No. 9 and 10. On August 5, 1930, I found two more nests on the grounds. One nest was four feet up in a sour-orange tree, built inside a Cardinal nest of the year. Male sitting upon two eggs incubated about two days. The other nest was built in a delapidated Brown Thrasher nest of the year, three feet up in a lemon tree. There were two quite fresh eggs.

To complete my observations on the habits of these doves, I should add that two nests were built to completion that were abandoned. The cause I was unable to determine.

To give some idea of the popularity of this three-acre tract, and something of the environment in which these peaceful little doves lived I give a list of the birds nesting here on April 17, 1930. There were five occupied Ground Dove nests, two Mockingbird nests, one of the Florida Cardinal, two of the Brown Thrasher, one of the Loggerhead Shrike, and two of the Florida Blue Jay, a total of thirteen nesting pairs.

There were nineteen occupied Ground Dove nests up to August 13, 1930, since the commencement of the nesting on February 25. Of these, seven nests met with total or partial misfortune; one adult was killed (?) and the two eggs broken; another nest lost one young ten days old, another lost one young two days old; two lost one egg each, and another lost both eggs. I do not believe this is any criterion, however, as the birds were frequently disturbed by myself and others innocently. Where they are left to themselves the loss is not so great. Of the many nests that I have found in the field I do not recall a nest having less than two young. On several occasions three pairs of doves would be nesting within a radius of thirty-five feet. I once found seven or eight pairs of Ground Doves nesting in a scattered colony on the ground 150 feet back from the shores of Lake Munroe. One of these pairs had built a nest in a rust-eaten tin can which sheltered it. More often the nests are isolated, either on the ground or low in trees. Two nests containing three eggs each were found by my brother, Wray H. Nicholson. I have one of these sets in my collection.

In conclusion I might say that I expect these same pairs will be nesting again in September and into the early part of October. Thus it will be seen that they are quite prolific and nidification is carried on nine months during the year, at least.

Orlando, Florida.

EDITORIAL

This Year's Meeting of the Wilson Ornithological Club will be held on December 27 and 28, at Indianapolis, Indiana, in conjunction with the meetings of the American Association for the Advancement of Science. Details of the meeting will be carried in the Secretary's letter in the fall. Indianapolis is centrally located for our membership, and should draw a good attendance. It is not too soon to plan your part in the program. The Local Committee consists of Mr. Samuel E. Perkins III, Chairman, and Mrs. Percival Brooks Coffin, of Richmond. Mr. Grant Henderson, of Greensburg, Mr. Frank Johnson, of Fort Wayne, Mr. Ralph M. Kreiber, of Bedford, and Mr. Harold A. Zimmerman, of Muncie.

Mr. Richard H. Pough, of the National Association of Audubon Societies. (1775 Broadway, New York), desires to obtain the assistance of any one who may be in a position to band hawks or owls. Bands of the proper size will be furnished by Mr. Pough. Write to him for further information.

In the Wilson Bulletin for September, 1932, (p. 179), editorial comment was made on the remaining unpublished volumes of Ridgway's "Birds of North and Middle America". This called forth a letter from Dr. Alexander Wetmore which was published in the Wilson Bulletin for December, 1932 (p. 248). The last volume of the Ridgway series (No. VIII) was published in 1919, eighteen years ago. So far as we have heard the United States National Museum has never disavowed its intention of completing this series.

GENERAL NOTES

Conducted by O. A. Stevens

The Mockingbird in East-Central South Dakota.—On June 3, 1936, the writer saw an adult Mockingbird (*Mimus polyglottos* subsp.) just a few miles south of the town of Forestburg, Sanborn County, South Dakota. The bird had been sitting on a telephone wire and as the car came near, it flew across the road just a few feet from the car. Reports for this species are recorded from the Black Hills area of South Dakota, but records for the eastern part of the state are virtually unknown.—Wm. Youngworth, *Sioux City, Iowa.*

A Record of the Lapland Longspur in Stillwater, Oklahoma.—On February 1, 1937, a flock of approximately fifty Lapland Longspurs was observed on the campus of the Oklahoma A. & M. College at Stillwater. Three specimens were taken from this flock and identified as *Calcarius lapponicus lapponicus*. This identification was subsequently verified by Dr. Alexander Wetmore, of the United States National Museum.

The flock was observed on the campus throughout the first and second days of February, but was not to be found on following days. The birds were found to be very gentle; on several occasions observers were able to approach as near as fifteen feet of the flock without disturbing their feeding activities.

Previous published records of the Lapland Longspur in Oklahoma are those of Cooke (1884) in Bryan County and Bunker (1903) in Cleveland County. Dr. T. C. Carter informs me that he found this species rather common in Woods County in 1907-1908 as a winter visitor, but has not seen them since.—Gerald M. Steelman, *Stillwater, Oklahoma.*

Nesting of the Pine Siskin in South Dakota and Kansas.—The note of Mr. William Youngworth in the Wilson Bulletin for December, 1936 (XLVIII, p. 310), regarding the nesting of the Pine Siskin (*Spinus pinus*) at Yankton, South Dakota, recalls a similar instance ten years before. This nest was found by Rev. R. C. Shearer, then pastor of the local Methodist Church, on April 26, 1926. The writer with Mr. Shearer visited the nest that day, but did not examine the nest, not wishing to disturb the bird which was on it. Eleven days later, May 6, there were two young birds, recently hatched, in the nest. On the 17th, the young birds were still there but with flight feathers well developed. Two days later, May 19, when the nest was next visited, it was empty.

Another instance of the nesting of this species, not before published, comes to mind. The writer found a nest of the siskin at Wichita, Kansas, on April 15, 1915. There were two eggs in the nest, the incubation well advanced. But one of these hatched, that one on April 19. The other egg disappeared from the nest a day or so later. Thirteen days later, May 2, the young bird was observed when it finally left the nest and took its first flight.

The length of time spent in these nests by the young birds corresponds closely. As stated before, the young bird stayed in the Wichita nest for thirteen days. It was not possible to watch the Yankton nest so closely, and the exact time was not learned. It is known, however, that the young birds remained in the latter nest eleven days and were gone on the thirteenth day. It is also of interest to note that in 1915 when the siskins nested in Wichita, Kansas, nests of the species were also found at Lincoln, Nebraska (Swenk, Myron H., Wilson Bulletin, XLI, p. 82).—Austin P. Larrabee, *Yankton College, Yankton, S. D.*

Cinnamon Teal in Iowa.—The Fourth Edition of the A. O. U. Check-List of North American Birds (1931) gives the eastern limit of the breeding range of the Cinnamon Teal (*Querquedula cyanoptera*) as western Manitoba, eastern Wyoming, and southwestern Kansas. Casual in Alberta, Wisconsin, Ohio, New York. South Carolina, Florida, and Louisiana.

At the time of the publication of "A Revised List of the Birds of Iowa", by Philip A. DuMont, no Iowa specimen of the Cinnamon Teal was generally known to exist. DuMont included it in his Iowa list on the basis of records from eight counties. The first being in Pottawattamie County in 1894 and the last being in Boone County in 1932.

In the Wilson Bulletin of September, 1935 (Vol. XLVII, No. 3, pp. 205-208) Philip A. DuMont reports the discovery of a specimen in the Stemple collection at Macedonia, Iowa, taken by M. A. Stemple in Pottawattamie County in the late '90s.

On the afternoon of April 18, 1937, Dr. T. C. Stephens and the writer visited a sparsely timbered area in the "bottoms" between New Lake and the Missouri River, Woodbury County, Iowa, to examine a nest of the Great Horned Owl (*Bubo virginianus*) which contained a fledgling. We had made many previous trips to this locality and as usual went over to the lake to check up on the water fowl before going home. We were rewarded by seeing an American Golden-eye (*Glaucionetta clangula americana*), which is an uncommon migrant in the Missouri River valley. We were about ready to leave when we decided to examine more closely three ducks which were seen to swim in close to shore beyond a wooded promontory. We got quite close. They were a Cinnamon Teal and two Blue-winged Teals (*Querquedula discors*). The light was good and there was no question of identification. We collected the Cinnamon Teal, which proved to be a male in full breeding plumage. It is now in the study collection of the Department of Biology at Morningside College.

In many years of duck hunting in the Missouri River valley and recent years of bird study, the writer had seen but one other Cinnamon Teal alive. I have a record of a Cinnamon Teal in a flock of twelve Blue-winged Teals on the little lake at St. James in Watonwan County, Minnesota, October 22, 1935.—Bruce F. Stiles, *Sioux City, Iowa.*

Terrestrial Feeding Kingbirds.—On June 3, 4, and 5, 1935, the Waubay Lakes region in northeastern South Dakota was swept by high winds from the north and the temperature during the night dropped to near the freezing point. Heavy frost was visible on two mornings and it was such weather that caught the last migrating wave of kingbirds and orioles. It was a common sight to find hundreds of Common Kingbirds, Arkansas Kingbirds, and Baltimore Orioles in the lee of every small patch of trees or brush. The dust-filled air was not only extremely cold, but apparently was void of insect life. Thus the birds resorted to ground feeding, and here they hopped around picking up numbed insects. Usually the birds just hopped in a rather awkward manner from one catch to the next. However, occasionally the kingbirds would flutter and hop while picking up an insect. There were many thousands of kingbirds in the lake region, with the Common Kingbirds outnumbering the Arkansas Kingbirds about two to one. —Wm. Youngworth, *Sioux City, Iowa.*

The 1936 Fall Migration at the Washington Monument.—The following may be added to the records of bird migration at the Washington Monument in Washington, D. C. (Wilson Bulletin, Vol. XLVIII, 1936, p. 222). A total of 277 birds of thirty species were picked up at the Washington Monument in 1936, compared with 246 individuals of thirty-three species in 1935. No results have yet been obtained in eliminating the beacon lights during the height of the migration season. In fact, the lights were turned on the Monument fifteen minutes longer each night in 1936 than in 1935, thus considerably increasing the chances for bird mortality.

In 1936 the nights of September 17 and 18 were the "big nights" of the season. Well over one-half of the mortality occurred on these two nights alone, with 101 birds picked up on the 17th and ninety-five on the 18th. Both nights were very stormy, and at the same time a hurricane was raging through the South Coastal States (which may not have had anything to do with the bird migration at the Washington Monument, however).

Two new observers, William Wimsatt and James Fox, two enthusiastic young men who attended the Audubon Nature Camp in Maine, were on hand nearly every night, and they, as well as Miss Knappen and Allen McIntosh, kindly aided me in securing complete data on migration at the Monument.

Two Connecticut Warblers were so fat that when they landed at the base of the monument they burst open and left large splotches of grease that did not wash off nor wear away for many weeks. Whip-poor-wills were present at the Monument until October 23, on which date a bird of this species in a careless swoop struck a bench with enough force to cause it to cry out in pain and surprise, and to stop and rest awhile on the bench.

October 18 was a sparrow night. Sparrows alighted on the benches and roadway in numbers, exhausted, perhaps, but none struck the Monument. With a flashlight in one hand and a pair of field glasses in the other I was able to identify one bird as a White-throated Sparrow, but the remaining birds were too restless for such identification. October 23 was a similar sparrow night, but on that night a Grasshopper Sparrow was picked up dead a few minutes before the beacons were extinguished at midnight.

The following is the list of birds which struck the Washington Monument in the Fall of 1936: Chimney Swift, 1; Northern Flicker, 4; Eastern Wood Pewee, 2; Long-billed Marsh Wren, 4; Short-billed Marsh Wren, 5; Catbird, 1; Eastern Golden-crowned Kinglet, 1; Eastern Ruby-crowned Kinglet, 2; White-eyed Vireo, 13; Yellow-throated Vireo, 1; Red-eyed Vireo, 56; Black and White Warbler, 2; Parula Warbler (subsp.), 4; Magnolia Warbler, 29; Cape May Warbler, 4; Black-throated Blue Warbler, 4; Black-throated Green Warbler, 13; Blackburnian Warbler, 1; Bay-breasted Warbler, 1; Black-poll Warbler, 3; Northern Prairie Warbler, 1; Yellow Palm Warbler, 1; Ovenbird, 14; Connecticut Warbler, 8; Yellow-throat (Maryland and Northern), 78; Yellow-breasted Chat, 6; American Redstart, 7; Indigo Bunting, 2; Eastern Grasshopper Sparrow, 1; Eastern Henslow's Sparrow, 1; unidentified (5 disposed of by guards and 2 partly eaten by cats), 7.

This list brings the total mortality at the Monument for the years 1935 and 1936 to 523 individuals of thirty-nine species. It is interesting to note that in 1935 the dates of migration extended from August 28 to October 24, while in

1936 they extended from August 17 to October 23. In 1935 the Red-eyed Vireos headed the list with 110 individuals. Magnolia Warblers and Maryland Yellow-throats tied for second place with thirty-one each. In 1936 the Yellow-throats were first with seventy-eight individuals, Red-eyed Vireos second with fifty-six, and Magnolia Warblers third with twenty-nine.

Of all the birds the Red-eyed Vireo's period of migration has been the longest. In 1935, Red-eyes were picked up on eighteen different nights from August 28 to October 6. In 1936 they were picked up on seventeen different nights from August 22 to Octobr 21. As in 1935 several bats struck the Monument with enough force to stun or kill them.—Robert Overing, *Landover, Md.*

Bird Records for Oregon.—The following are new or unusual records which seem worthy of record. For those marked with an asterisk, the specimens were identified by Dr. H. C. Oberholser, of the U. S. Biological Survey. The specimens are preserved in the author's private collection.

American Egret (*Casmerodius albus egretta*). A male at Scio, August 23, 1934.

*Surf Scoter (*Melanitta perspicillata*). Marion Lake, Linn County, at 5400 feet in the Cascade Mountains, 150 miles from the ocean, October 10, 1927. The birds were present during June, July, and August. I hope to secure a nesting record this year.

*Harlan's Hawk (*Buteo buteo harlani*). A female at Scio, November 10, 1928. The first record for Oregon.

*Black Gyrfalcon (*Falco rusticolus obsoletus*). A male at Scio, in May, 1925; a female at St. Helen's Tide Flats in 1927.

Yellow Rail (*Coturnicops noveboracensis*). A female at Scio, February 1, 1900. The first record for Oregon.

Black Swift (*Nephoecetes niger borealis*). A male at Scio, September 9, 1927. The second record for Oregon.

*Harris's Sparrow (*Zonotrichia querula*). A male at Scio, February 17, 1936. I think this is the third record for Oregon.

White-throated Sparrow (*Zonotrichia albicollis*). One bird was at my feeding station for two weeks in February, 1937.—Dr. A. G. Prill, *Scio, Oregon.*

The Woodcock in North Dakota.—The Woodcock (*Philohela minor*) is one of the most sought for of the game birds in the New England, Central, and Middle Western States, north into Canada, Ontario, and southeastern Manitoba. It is fairly common in the eastern half of Minnesota, becomes rare in the western half, and is very seldom found in North Dakota.

When I was preparing for my first trip to North Dakota in the spring of 1890 I made a check list of birds that I might find, using such lists of birds as were available, including the Woodcock as a possibility. It proved to be a very rare possibility, as it was some forty-six years before I was thrilled by flushing one, in a bushy growth at the south end of Snyder Lake, located in central Towner County, fifteen miles north of Cando.

On October 2, 1936, while at the lake for an outing, I was wandering around watching some migratory sparrows. I was startled by the sight of a bird rising in front of me not over six feet away, straight up about eight feet then leveling off over the top of bushes for about ten or twelve rods, when it dropped like a plummet to the ground. I was thrilled by the sight of the first Woodcock I had

seen alive in North Dakota. Having been very familiar with them in my early years in southwestern Connecticut, there could be no question as to the identity and it did give me a thrill, such as only a student of bird life can experience. I hunted through the bushes, which were thick in places, almost impenetrable, but failed to flush it again.

Migrating by night as the Woodcock does, it may be more common than such data as we have would indicate. Such cover as it would usually seek is not often threshed out by our North Dakota hunters. We have, so far as I can find, only four records of their being taken in North Dakota.

Henry V. Williams of Grafton shot one in the fall of 1934, east of Grafton along the river and now has it in his collection of mounted birds.

The note of my own as above recorded was at Snyder Lake, October 2, 1936.

Dr. Coues records in his "Birds of the Northwest", the statement of an army officer who shot one near old Fort Rice in the Missouri River Valley. Dr. N. A. Wood, Ann Arbor, Michigan, gives it a place in his "Preliminary Survey of the Bird Life of North Dakota" from a statement of a hunter who said he had shot three near Saint John, North Dakota, in October, 1920.

Contributory data: Roberts ("Birds of Minnesota"), says it is common in the Mississippi Valley, rare along western boundary, casual in eastern Montana. Taverner ("Birds of Western Canada"), says it is occasional in southern Manitoba. Seton-Thompson ("Birds of Manitoba"), reports it along the boundary line of southeastern Manitoba. Youngworth (Wilson Bulletin, XLVII, p. 218), records that a few were shot at Fort Sisseton, South Dakota, in 1877-78, but have not been seen there recently.—E. T. Judd, *Cando, N. D.*

Banding of Snow Buntings in North Dakota.—These northern birds are frequent visitors to the United States during the winter, but their restless disposition gives us little opportunity for close contact. For the year ending June 30, 1936, only 383 of them were banded in North America. In the winter of 1933-1934, C. E. Boardman and Glenn Berner at Jamestown, North Dakota, banded 1285 and reported a few observations on their behavior (*Bird Banding*, V, 1934, pp. 129-131). During January and February, 1937, I was able to band 235 of them and found, as did Boardman and Berner, that they came only when the ground was well covered with snow and the weather cold.

There was a small spot in front of our granary where the snow always blew off the ground. We fed turkeys and sheep there daily and the buntings formed the habit of coming to feed also. With a drop trap 24x36 inches, I took from three to nine at a time. They were probably the most nervous and restless of any species which I have handled. During real stormy days they seemed to relax from their nervousness and would fight to get under the trap.

In milder weather it was hard to get many near the trap and they would fly at the least noise. Usually they would disappear for about four hours during the middle of the day. Trapping was best in the early morning and late afternoon. The birds would appear in small flocks of twelve to fifty, and rarely did any of the banded ones re-appear. It was hard to get them out of the trap as they would continually try to fly upward. In the hand they would flutter and try to escape. They were quite pugnacious, picking savagely at fingers though not inflicting injury. As soon as warmer weather made bare areas in the fields the birds deserted us.—Edgar Preston, *Tower City, N. D.*

Summer Food Habits of the Short-eared Owl in Northwestern Iowa.—While winter data on the food habits of the Short-eared Owl (*Asio flammeus*) have been rather easily procurable in those parts of Wisconsin and Iowa where I have carried on field studies in recent years, it has not proved so convenient to obtain summer data on this species.

The data from the examination of the comparatively few summer stomachs and pellets that have come to hand are of considerable interest, however. Summer diet does not show quite the monotony of mouse representation that winter diet commonly does; and, moreover, it provides a better index to the upper size limits of prey which the owls are able to handle.

The specimen material from northwestern Iowa consisted of thirty-four pellets and one stomach from two localities, for which the data may be briefly summarized. The determinations of food items were made by Mrs. Frances Flint Hamerstrom. Items representing contaminations have not been listed.

June and July, 1933—Pasture in the vicinity of the University of Iowa Biological Station, Lake Okoboji, Iowa.

Of 25 pellets, 1 contained jumping mouse (*Zapus*); 1, house mouse (*Mus*); 22, meadow mouse (*Microtus*) (39 individuals); 2, deer mouse (*Peromyscus*) (4 individuals); 2, undetermined mice; 1, young Franklin's ground squirrel (*Citellus franklini*); 3, striped ground squirrel (*C. tridecemlineatus*, including 1 young); 2, short-tailed shrew (*Blarina*); 1, shrew (*Sorex*) (2 individuals).

June, July, and August, 1934—Marshy ground, near Mud Lake and Barringer's Slough, Ruthven, Iowa.

Of 9 pellets and 1 stomach, 1 contained young cottontail (*Sylvilagus floridanus*); 1, jumping mouse (2 individuals); 1, Norway rat (*Rattus norvegicus*); 5, meadow mouse (6 individuals); 3, deer mouse; 2, Fringillidae; 1, Red-winged Blackbird (*Agelaius phoeniceus*); 1, young (about three and one-half weeks) Ring-necked Pheasant (*Phasianus colchicus torquatus*).

The question has previously been raised by Errington (*Condor*, Vol. XXXIV, pp. 176-186, 1932) as to how strictly the related Long-eared Owl (*A. wilsonianus*) takes its prey in order of availability and may well apply to the Short-eared Owl, also. The lack of insect prey in the diets of pasture-living Short-cared Owls suggests that, if availability is the chief factor influencing food habits, it may at times be operative within narrower limits for these owls than for most other midwest owls studied. On the other hand, higher vertebrates ranging in size up to adult ground squirrels and adult meadowlarks (Errington, op. cit.) seemed to be preyed upon more in accordance with what might be judged their comparative availability in habitats occupied.—Paul L. Errington, *Iowa State College, Ames, Iowa.*

ORNITHOLOGICAL LITERATURE

Adventures in Bird Protection. By Thomas Gilbert Pearson. D. Appleton-Century Co., New York. 1937. Pp. i-xiv+1-459. Price, $3.50.

Dr. Pearson's presentation of this autobiography is a very happy and instructive contribution to the cause of conservation. The entire book is virtually a history of bird protection in this country. While no movement is treated in detail, nearly every one is mentioned with dates and general implications. The author will be granted the privilege of recording the history of events as he has seen them and interpreted them. Naturally his slant may not always be the same as that of people who held different views on the particular problem discussed. All history is written in that way, and with the same limitations.

We see about three general features in this book, namely, the factual account of Dr. Pearson's life, the factual account of bird protection history, and the interplay of these two series of events upon each other, which the reader must more or less interpret for himself. It is germane to bring in Pearson's early boyhood life in Florida, disclosing his innate love for nature; and his college life in North Carolina, with no deviation from the original bent. Each succeeding stage of the story seems to reveal the unfolding with precision of what might seem to be a predestined career. And of his career during these early years the author himself says that he passed through the stages of "an egg-collector, a bird-collector, a college professor of biology, a summer school teacher of bird study, an amateur nature photographer, and a student of hunting methods in many fields."

From the pages we glean that there have been stages in bird protection history when ornithological powers have been faint-hearted. For example, in 1898, when Senator George F. Hoar introduced in the United States Senate a bill to prohibit the importation and sale of feathers for millinery uses, the A. O. U. Committee on Bird Protection refused to lend its support to the bill (p. 260).

Again, Dr. Pearson gives some account of the preliminary negotiations for the bird protection treaty with Great Britain and Canada, wherein he describes the great opposition to the prohibition of spring shooting of ducks. Fear of this opposition led the Chief of the U. S. Biological Survey and the Directors of the National Association of Audubon Societies to assent to the elimination of the spring shooting clause (by setting the closing date forward from February 1 to March 10). Later it was learned that the public opposition to the spring shooting clause was local and not so formidable as had been supposed, but the treaty had then been returned to Canada and could not be recalled (pp. 283-287).

Dr. Pearson's discussion of bag-limit legislation is interesting and illuminating, but does not clarify the opposition of the Biological Survey and the Audubon Association to the Haugen bag-limit reduction bill (H. R. 5287) in 1930, one year before the bag-limit on ducks was reduced from twenty-five to fifteen.

Nevertheless, in spite of all such controversial entanglements over questions which made agreement difficult, the history of the Audubon movement is one of progress and achievement. The record must be read for an appreciation of this fact. Aside from Dr. Pearson's services in promoting desirable legislation for the protection of game and non-game animals, it seems to us that his greatest accomplishment has been in the erection of ample financial resources for the permanent uses of the Association. It is also generally conceded that the organization of the International Committee on Bird Protection has been a splendid step in general conservation, and that its results are likely to be more far-reaching than can now be realized.—T. C. S.

Audubon, an Intimate Life of the American Woodsman. By Stanley Clisby Arthur. Harmanson, Publisher. New Orleans, 1937. Pp. 1-517. 66 illustrations. Price, $5.00.

Those who have kept track of the literature must have wondered at the number of biographies of Audubon which have appeared in very recent years. It can scarcely be because of his scientific attainments, for this world of people is not so greatly interested in scientific progress nor in the lives of those who make it. It must be that the personal side of Audubon's life makes an unusual appeal. His life story does present mystery, romance, adventure, conflict, devotion to purpose, failure, success, and other extremes of various sorts. Peattie's biography of Audubon we would characterize as impressionistic, and highly skillful and entertaining from that angle. Arthur's biography is strictly factual and informative, in that respect resembling Professor Herrick's work. It differs from earlier biographies in being less flattering and adulatory. In appraisal the author is fair and respectful, but not obsequious. He does not hesitate to show the weakness as well as the strength of his subject. And the reader is usually satisfied to learn that his hero is human after all. One thing is made clear, that Audubon would have been helpless in literary production without the aid of his editors. And there is evidence that the editors were not always careful in transmitting the facts without distortion. The question of Audubon's birth origin is discussed at considerable length. In spite of the discovery by Professor Herrick of certain data to show Audubon's birth in Santo Domingo in 1785, and the acceptance of such conclusion by the Encyclopaedia Britanniea, the idea is now suggested that Audubon may have been in fact the second son of Louis XVI of France and Marie Antoinette—the lost Dauphin. Nothing but circumstantial evidence is offered for this claim, of course. The author's part in this book has been well done, and the same may be said for the printer: but the binder has done a woeful job, probably from picayunish economy. The book is well supplied with illustrations, including a very good collection of Audubon portraits.—T. C. S.

Check-List of Birds of the World. Volume III. By James Lee Peters. Harvard University Press, Cambridge, Mass. 1937. Pp. i-xiii+1-311. Price, $3.50.

The public is by this time familiar with the plan of this work, which is being issued at intervals of two or three years. This third volume treats of two orders, Columbiformes and Psittaciformes; the former including the sand grouse, dodos, fruit pigeons, doves, etc., and the latter including the parrots. The publisher's announcement states that the volume "covers 142 genera and approximately 1675 forms", a very large number of which are subspecies. While these two large groups of birds hold less interest, perhaps, for the average North American bird student, they are important, and the forms are far more numerous than ordinary ornithologists probably realize. As each volume is added the series becomes more impressive.—T. C. S.

Life Histories of North American Birds of Prey. Order Falconiformes (Part 1). By Arthur Cleveland Bent. U. S. Nat. Mus. Bull. 167. Washington, 1937. Pp. i-viii+1-409. Pls. 101. Price, 70 cents.

This tenth number in the series treats of the condors, vultures, kites, darters, buzzards, eagles, harriers, and ospreys; the falcons are not included in this number. The plan of the volume is essentially the same as its predecessors. The accounts of several species have been written by others than Mr. Bent.—T. C. S.

Studies on the Muscles of the Pelvic Appendage in Birds. By George Elford Hudson. Amer. Midl. Nat. (Notre Dame, Ind.) Vol. 18, No. 1, Jan., 1937, pp. 1-108.

This anatomical study stands out prominently, because so little work has been done in this field during the past quarter of a century. But, in addition, the work is notable for its extensiveness and thoroughness. Only the musculature of the pelvic appendages is studied. These muscles are described and figured in detail. Altogether, the leg muscles of thirty-five species, distributed in sixteen orders, have been examined. Numerous additional species are mentioned in the text. However, all figures are made from the crow, of which forty specimens were examined. Careful comparisons are made with the works of Shufeldt, Gadow, and others. It is a matter of some interest that Hudson preserved his material in a mixture of one part of forty percent formaldehyde with eight parts of water—a stronger mixture than is ordinarily used. Specimens were thoroughly injected with this preservative, and immersed in it for keeping.—T. C. S.

Ten Years' Returns from Banded Bank Swallows. By Dayton Stoner. Circ. 18, N. Y. State Museum. January, 1937.

Dr. Stoner banded a total of 4,925 Bank Swallows from 1923 to 1935, inclusive, of which 3,044 were young, and 1,881 were adult. From these, 99 returns were secured, 31 young and 68 adults. Seventy-five per cent of the adult returns were recovered in the native colony, while only 19.3 per cent of the young were recovered in the native colony. The author also found that out of ten cases no pairs remained mated during a second season. He also finds that relatively few Bank Swallows attain the age of four years.—T. C. S.

A Key for the Identification of the Nests and Eggs of Our Common Birds. By Howard Jones, M. D. Published by the Author (Circleville, Ohio). 1927. Pp. 1-44

We overlooked this brochure at the time of its publication, and do not know the price, but it can probably be obtained from the author. At the time of writing the author stated that only two keys for the identification of the nests and eggs of American birds were in print, one being by H. D. Minot in 1877, the other being by Dr. Howard Jones in 1886. The present key is one for the eggs, although the nests are described in each case, and would help to clinch the identification of the eggs. One hundred and twenty-six species are treated in the key. Dr. Howard Jones is one of our nestors in ornithology, having now passed his eighty-first birthday; and he began collecting birds' eggs when he was six years old. In his earlier days he wrote the text for "The Illustrations of the Nests and Eggs of the Birds of Ohio".—T. C. S.

Birds of the Southwest. By Charles Edward Howard Aiken. Colorado College Publ., Gen. Series, No. 212, pp. 1-73. 1937.

In this report we find a list of birds composed mainly of those seen by Mr. Aiken on a wagon trip from Colorado southwestward into New Mexico and Arizona in the year 1876. The report also contains a good deal of narrative material relating to Aiken's long trip, and to shorter ones. A map is included to show the route of the longer trip.—T. C. S.

Food Habits of Marsh Hawks in the Glaciated Prairie Region of North-Central States. By Paul L. Errington and W. J. Breckenridge. Reprinted from Amer. Midl. Natl., Vol. 17, 1936, pp. 831-848.

Food Habits of Mid-west Foxes. By Paul L. Errington. Reprinted from Journ. Mammalogy, Vol. 16, 1935, pp. 192-200.

The latter paper is based on the examination of stomach contents and fecal samples from both red and gray foxes. Remains were found of numerous kinds of wild birds, for example: Blue Jay, Bob-white, Crow, Meadowlark, Red-winged Blackbird, Robin, Catbird, House Wren, Horned Lark, Long-eared Owl, Horned Owl, Mourning Dove, Bittern, Canada Goose, Pintail, Blue-winged Teal, among many other things, of course. One of the author's conclusions is that "With respect to winter bob-white, fox pressure appears rather confined to that proportion of the population which the environment does not easily accommodate."—T. C. S.

The Composition and Dynamics of a Beech-Maple Climax Community. By Arthur B. Williams. Sci. Publ. Cleveland Mus. Nat. Hist.

An excellent ecological study of a tract of land sixteen miles northwest of Cleveland, Ohio. On pages 57-70 the bird life of the area is discussed. A total of eighty-three species are given in the lists. Twenty-nine breeding species are named for the season of 1934.—T. C. S.

The *Nebraska Bird Review* for January, 1937 (V, No. 1) gives a list of wild fruits used by birds in central Nebraska. This paper, by Glenn Viehmeyer, is based upon actual observations on the feeding activities of the birds, or analysis of their droppings. In addition there are nine pages of general notes and eight pages of migration notes.

The *Florida Naturalist* for July, 1936 (IX, No. 4) contains an interesting report of a conflict between a black snake and a Great Horned Owl. The snake appeared to have the best of the fight, and, to give the owl a better chance, both were collected and preserved. The April number (1937, X, No. 3) is mainly a record of the Annual Meeting of the Society and reports of officers. A short note reports an attack of a civet cat on a Clapper Rail.

In *Iowa Bird Life* for December, 1936 (VI, No. 4), Mr. Fred J. Pierce gives a summary of the observations made in Iowa in 1843 by John J. Audubon. There is also a synopsis of bird records previously published in the mimeographed letters of the I. O. U. The issue for March, 1937 (VII, No. 1), carries an article by Messrs. Friley and Hendrickson on the nesting of the Eared Grebe in Clay County, Iowa. Mr. and Mrs. M. I. Jones write on banding experiences. A number of short notes indicate that another invasion of Iowa by Magpies took place in the early winter of 1936-1937.

The *Migrant* for March (1937, VIII, No. 1) contains a short paper on the Raven, by Bruce P. Tyler; a catalogue of Tennessee's Wildwood Parks (with map), by A. F. Ganier; and miscellaneous short notes.

The *Bird Calendar* of the Cleveland Bird Club (32d year, No. 3, 1936) contains various breeding and census lists, while the closing number for the year (No. 4) follows a similar plan of contents.

In the *Raven* for September-October (VII, Nos. 9-10, 1936) Dr. Murray presents a fourth paper in his series of "Some Virginia Ornithologists", this one being on William Palmer. The fifth instalment is a sketch of Col. Wirt Robinson, and is found in the November-December number. The January number (VIII, No. 1. 1937) presents a list of birds observed in the vicinity of Blacksburg. The February-March number (VIII, Nos. 2 and 3) reports a number of interesting local records, and has also a radio talk by Mr. Ralph M. Brown.

The *Night Heron* is a mimeographed periodical published in St. Louis for the promotion of local ornithological interest. The Spring (1936) number contains a list of the birds found at Creve Coeur Lake. We also acknowledge the Winter number for 1936-37.

The *Audubon Annual Bulletin* for 1937 is presented as Number 27, by the Illinois Audubon Society. In it Mrs. M. M. Nice writes of some of her opportunities for bird banding. Mr. B. T. Gault gives some reminiscences of early experiences in the Chicago area. Mr. W. I. Lyon reports the first recorded nesting of the Common Tern in Illinois. Other notes and miscellaneous information are also included.

The *Annual Bulletin* for 1936 of the Toledo Naturalists' Association comes this time with a novel cover design in color. It is issued early in the year and gives a tentative program of work for each month of 1937. The remaining forty mimeographed pages present local contributions. Price. 50 cents.

Mr. Irl Rogers in the *News from the Bird Banders* for December (1936, XI, No. 4) gives directions, with diagrams, for constructing a new type of bird trap which has been very successful. In the February issue (1937, XII, No. 1) Mr. Rogers reports that in one day he trapped and banded 118 Gambel's Sparrows. We have long admired the format and mimeograph work on this periodical. The pages are of letter size (8.5x11 inches), with perforations and rounded corners, indicating that the sheets are die-cut. The paper has an absorbent quality which gives good printing effects, and the printing is done on both sides of the sheet. Recently we found in our 10-cent stores a very substantial binder which exactly fitted these holes. One canvas-covered binder sold for twenty-five cents, and another paper-covered one sold for twenty cents. Even some for ten cents were available. Now we find it possible to preserve the issues in the correct order and accessible. Any little contrivance of this sort which will encourage members to preserve their mimeographed periodicals should be of interest to societies which issue them. The May number (XII, No. 2) contains a statistical report for the year 1936, which shows that a total of 37,951 birds of 221 species were banded.

The *Inland Bird Banding News* for September (1936, VIII, No. 3) contains a report of Mr. W. I. Lyon's thirteenth annual bird banding expedition, and numerous shorter notes. The December number (VIII, No. 4) carries the minutes of the Fifteenth Annual Meeting, and an article on the molting of the Savannah Sparrow. In the March number (1937, IX, No. 1) we find a paper by Prof. O. A. Stevens on the progress of banding work in North Dakota, as well as reports on the returns of various species in Michigan.

MEMBERSHIP ROLL

MEMBERSHIP ROLL OF THE WILSON ORNITHOLOGICAL CLUB†

Officers, 1937

President—Josselyn Van Tyne, Museum of Zoology, Ann Arbor, Michigan.
First Vice-President—Margaret M. Nice, 5708 Kenwood Ave., Chicago, Illinois.
Second Vice-President—Lawrence E. Hicks, Ohio State University, Columbus, Ohio.
Secretary—Olin Sewall Pettingill, Jr., Carleton College, Northfield, Minnesota.
Treasurer—S. E. Perkins, III, 709 Inland Bldg., Indianapolis, Indiana.
Editor of the Wilson Bulletin—T. C. Stephens, Morningside College, Sioux City, Iowa.

Honorary Members

Ballard, Harlan Hoge, 247 South, Pittsfield, Massachusetts.....1893
Burns, Franklin Lorenzo, Berwyn, Pennsylvania.....Founder
Jones, Dr. Lynds, 352 W. College St., Oberlin, Ohio.....Founder
Sherman, Miss Althea Rosina, National via McGregor, Iowa.....1902
Strong, Dr. Reuben Myron, 5840 Stoney Island Ave., Chicago, Illinois.....Founder

Life Members

Bretsch, Clarence, 690 Broadway, Gary, Indiana.....1925
Ellis, Ralph, Jr., Jericho, Long Island, New York.....1926
Hicks, Dr. Lawrence Emerson, Coöperative Wildlife Research Station, Ohio State University, Columbus, Ohio.....1925
Jones, Dr. Lynds, 352 W. College St., Oberlin, Ohio.....Founder
Lyons, William Isaac, 124 Washington St., Waukegan, Illinois.....1921
McIlhenny, Edward Avery, Avery Island, Louisiana.....1910
Rogers, Charles Henry, Museum of Zoology, Princeton, New Jersey.....1903
Sherman, Miss Althea Rosina, National via McGregor, Iowa.....1902
Taylor, Dr. Arthur C., Washburn, Wisconsin.....1929
Taylor, Mrs. H. J., 900 Santa Barbara Rd., Berkeley, California.....1916
Tucker, Mrs. Carll, Penwood, Mount Kisco, New York.....1928
*Whitney, Thomas Hayes.....1916

Sustaining Members

Bailey, Harold H., 820 Alhambra Cir., Coral Gables, Florida.....1908
Baldwin, Dr. Samuel Prentiss, 11025 E. Blvd., Cleveland, Ohio.....1916
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Bent, Arthur Cleveland, 140 High St., Taunton, Massachusetts.....1893
Bishop, Dr. Louis Bennett, 450 Bradford St., Pasadena, California.....1903
Brand, Albert Rich, 9 E. Ave., Ithaca, New York.....1931
Bruen, Frank, Apt. A-4, 22 High St., Bristol, Connecticut.....1902
Burke, Dr. Edgar, Medical Center, Jersey City, New Jersey.....1933
Cahn, Dr. Alvin Robert, Forestry Bldg., Norris, Tennessee.....1914
Carroll, James Judson, Box 356, Houston, Texas.....1926
Chambers, Willie Lee, 2068 Escarpa Drive, Eagle Rock, Los Angeels ,Calif.....1909
Christopher, Mrs. Joseph, Fairhope, Alabama.....1937
Coursen, C. Blair, 761 East 69th Place, Chicago, Illinois.....1927
Fargo, William Gilbert, 506 Union St., Jackson, Michigan.....1923
Ganier, Albert Franklin, 2507 Ashwood Ave., Nashville, Tennessee.....1915
Goetz, Christian John, 3503 Middleton Ave., Cincinnati, Ohio.....1930
Hann, Dr. Harry Wilbur, Zoology Department, University of Michigan, Ann Arbor, Michigan.....1930

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*Deceased.

†This membership roll is complete to May 1, 1937. The Secretary would appreciate immediate notification of any omission of names and change in address, or any errors in the spelling of names, the use of titles, and the exact years of election to membership. The Secretary would also appreciate having the *full* names of all members. Each member, therefore, whose name is not complete is asked to send to the Secretary a card upon which is written the name in full.

Harriot, S. C., 200 W. 58th St., New York, New York....1934
Harris, Dr. A. Trevenning, 738-40 Gary State Bank Bldg., Gary, Indiana....1936
Havemeyer, Henry Osborne, Mahwah, New Jersey....1930
Helmuth, Dr. William Tod, 667 Madison Ave., New York, New York....1934
Howell, Arthur Holmes, 2919 S. Dakota Ave., Washington, D. C....1921
*Kennard, Frederic Hedge, Dudley Rd., Newton Centre, Massachusetts....1919
Magee, Michael J., 603 South St., Sault Ste. Marie, Michigan....1919
Marmon, Mrs. Elizabeth C., 970 N. Delaware St., Indianapolis, Indiana....1933
Mitchell, Dr. Walton Inngerich, 1644 Visalia Ave., Berkeley, California....1893
Nelson, Miss Theodora, % Zoology Department, University of Michigan, Ann Arbor, Michigan....1928
Philipp, Frederick Bernard, West Rd. and Hobart Gap Rd., Short Hills, N. J....1933
Philipp, Philip Barnard, 220 Broadway, St. Paul Bldg., New York, N. Y....1914
Roads, Miss Katie Myra, 463 Vine St., Hillsboro, Ohio....1914
Roberts, Dr. Thomas Sadler, Museum of Natural History, University of Minnesota, Minneapolis, Minnesota....1914
Shearer, Dr. Amon Robert, Mont Belvieu, Chambers Co., Texas....1893
Stephens, Dr. Thomas Calderwood, Morningside College, Sioux City, Iowa....1911
Stoddard, Dr. Herbert Lee, Route 5, Sherwood Plantation, Thomasville, Ga....1916
Sutton, Dr. George Miksch, Bethany, West Virginia....1920
Thorne, Mrs. W. V. S., 810 Fifth Ave., New York, New York....1930
Thordarson, C. H., 470 Beacon St., Chicago, Illinois....1936
Todd, Walter Edmund Clyde, Carnegie Museum, Pittsburgh, Pennsylvania....1911
Uhrig, Mrs. A. B., 425 E. Water St., Oconomowoc, Wisconsin....1926
Wheeler, Leslie, Lake Forest, Illinois....1934
Young, Colonel John Paul, 205 Devon Rd., Ithaca, New York....1913

Active Members

Adams, Benjamin, 25 Garden St., Wethersfield, Connecticut....1936
Agostini, Charles Thomas, Carnegie Museum, Pittsburgh, Pennsylvania....1931
Aldrich, John Warren, Cleveland Museum of Natural History, Cleveland, O....1930
Allen, Dr. Arthur Augustus, Fernow Hall, Cornell University, Ithaca, N. Y....1914
Allen, Durward Leon, Kellogg Bird Sanctuary, Augusta, Michigan....1933
Bailey, Alfred Marshall, Colorado Museum of Natural History, Denver Colo....1928
Bartel, Karl Emil Edgar, 2528 W. Collins St., Blue Island, Illinois....1934
Bartlett, Wesley H., Parsons College, Fairfield, Iowa....1936
Bartsch, Dr. Paul, U. S. National Museum, Washington, D. C....1894
Bennett, Mary A., 623 E. Carroll St., Macomb, Illinois....1933
Bennett, Walter Waldo, Arnolds Park, Iowa....1925
Blain, Dr. Alexander Willis, 2201 Jefferson Ave., E., Detroit, Michigan....1902
Blake, Mrs. Charles Henry, Massachusetts Institute of Technology, Cambridge, Massachusetts....1935
Blincoe, Benedict Joseph, Route 13, Dayton, Ohio....1920
Brant, Irving W., % St. Louis Star, St. Louis, Missouri....1932
Breckenridge, Walter John, Museum of Natural History, University of Minnesota, Minneapolis, Minnesota....1929
Brockner, Winston W., 175 Dutton Ave., Buffalo, New York....1933
Brodkorb, Dr. William Pierce, Museum of Zoology, Ann Arbor, Michigan....1936
Brooks, Major Allan Cyril, Okanagan Landing, British Columbia, Canada....1930
Brooks, Earle A., 166 Plymouth Rd., Newton Highlands, Massachusetts....1933
Broun, Maurice, % Miss Bessie Penniman, Orleans, Cape Cod, Massachusetts....1935
Bruun, Charles Anaultus, 1510 Central Ave., Hot Springs, Arkansas....1921
Bryens, Oscar McKinley, McMillan, Luce Co., Michigan....1924
Buchanan, Charles J., Marott Hotel, Indianapolis, Indiana....1933
Buckelew, Herbert, 611 E. 2nd St., Milford, Delaware....1936
Burdick, Dr. Harold C., Box 164, Milton, Wisconsin....1929
Burleigh, Thomas Dearborn, 400 Union Bldg., 837 Gravier St., New Orleans, Louisiana....1922
Burtch, Verdi, Branchport, New York....1924
Butler, Dr. Amos William, 52 Downey Ave., Indianapolis, Indiana....1911

Cahalane, Victor H., Wildlife Division, National Park Service, Washington, D. C. 1933
Carleton, Dr. Blondel H., Box 151, Collegeboro, Georgia 1936
Carpenter, F. S., 2402 Longest Ave., Louisville, Kentucky 1934
Carpenter, J. Richard, Lincoln College, Oxford University, England 1934
Chapman, Dr. Frank Michler, American Museum of Natural History, New York, New York 1910
Chase, Henry B., Jr., Southern Biological Supply Co., New Orleans, La 1932
Chase, H. D., University of Tulsa, Tulsa, Oklahoma 1935
Christy, Bayard Henderson, 403 Frederick Ave., Sewickley, Pennsylvania 1922
Clay, Miss Marcia B., Bristolville, Ohio 1924
Coffey, Ben Barry, Jr., 1434 Bank of Commerce Bldg., Memphis, Tennessee 1928
Coffin, Mrs. Percival Brooks, 624 S. West A St., Richmond, Indiana 1936
Colburn, Albert E., 716 S. Flower St., Los Angeles, California 1928
Cole, Dr. Leon J., Genetics Bldg., University of Wisconsin, Madison, Wise 1921
Cottom, Clarenee, Biological Survey, Department of Agriculture, Washington, D. C. 1929
Cox, William T., U. S. Resettlement Administration, 6th Floor, Court House, Milwaukee, Wisconsin 1936
Cypert, Eugene, Camden, Arkansas 1936
Danforth, Prof. Stuart T., Box 541, Mayaguez, Porto Rico 1924
Davis, C. N., Soil Conservation Service, Bethany, Missouri 1936
Dawson, Sallie, 807 N. 4th St., Terre Haute, Indiana 1933
Deaderick, Dr. William H., 36 Circle Drive ,Hot Springs, Arkansas 1936
DeLury, Dr. Ralph Emerson, Dominion Observatory, Ottawa, Ontario, Canada 1920
Dickinson, F. R., 1518 Astor St., Chicago, Illinois 1931
Dodge, Thomas Henry, Box 169, Gallup, New Mexico 1933
Dodge, Victor K., 137 Bell Court W., Lexington, Kentueky 1935
Douglass, Donald W., Department of Biology, Texas Technologieal College, Lubbock, Texas 1929
DuMont, Philip Atkinson, Sand Lake Waterfowl Refuge, Columbia, S. D. 1928
Duncan, Donald P., 5841 Niekerson Ave., Norwood Pk., Chicago, Illinois 1936
Eifrig, Prof. Charles William Gustave, 1029 Monroe Ave., River Forest, Ill. 1907
Ekblaw, Dr. George Elbert, 506 W. Main St., Urbana, Illinois 1911
Ekblaw, Prof. Walter Elmer, Clark University, Worcester, Massachusetts 1910
Emilio, Shepard Gilbert, 7 Winter St., Salem, Massachusetts 1929
English, Dr. P. F., Department of Forestry, Conneetieut State College, Storrs, Connecticut 1934
Ernst, Miss Lillie R., 6058 Kingsbury Ave., St .Louis, Missouri 1935
Errington, Dr. Paul Lester, Iowa State College, Ames, Iowa 1932
Fleming, James Henry, 267 Rusholme Rd., Toronto 4, Ontario, Canada 1906
Floyd, Judge Joseph Larke, 1009-11 Geo. D. Harter Bank Bldg., Canton, O. 1903
Frazier, John M., Station A., Box 156, Hattiesburg, Mississippi 1930
Freer, Prof. Ruskin Skidmore, Lynchburg College, Lynchburg, Virginia 1930
Friedmann, Dr. Herbert, U. S. National Museum, Washington, D. C. 1932
Gabrielson, Dr. Ira Noel, Biological Survey, Department of Agriculture, Washington, D. C. 1913
Gallagher, William, 201 Smith Ave., Kirkwood, Missouri 1936
Gault, Benjamin True, 563 Main St., Glen Ellyn, DuPage Co., Illinois 1895
Golterman, Miss Elizabeth, Educational Museum, St. Louis, Missouri 1935
Grater, Russell K., National Park Service, 515 U. S. Customs Bldg., Denver, Colorado 1936
Gregory, Stephen S., Jr., Box N, Winnetka, Illinois 1922
Grinnell, Dr. Joseph, Museum of Vertebrate Zoology, University of California, Berkeley, California 1914
Guest, Mrs. Marjorie Lee, Athens State Hospital, Athens, Ohio 1924
Hand, Ralph L., 428 11th St., St. Maries, Idaho 1933
Handlan, James Tee, Jr., 91 Lynwood Ave., Wheeling, West Virginia 1934
Handlan, John Welty, Oglebay Park, Wheeling, West Virginia 1932

Hendrickson, Prof. George O., Department of Zoology, Iowa State College, Ames, Iowa 1933
Herrick, Dr. Francis Hobart, 2863 Noble Rd., Cleveland Hts., Ohio 1917
Heston, Dr. W. E., Department of Biology, McMurry College, Abilene, Texas 1936
Hetler, Dr. Donald M., Department of Bacteriology, Washington University Medical School, St. Louis, Missouri 1935
Himmel, Dr. Walter J., Department of Botany, University of Nebraska, Lincoln, Nebraska 1915
Hines, Frank J., President, Western State College, Kalamazoo, Michigan 1935
Hinnen, Dr. G. A., 1343 Delta Ave., Cincinnati, Ohio 1934
Hinshaw, Thomas D., 1908 Scottwood Ave., Ann Arbor, Michigan 1926
Holt, Ernest Golsan, 2121 New York Ave., Washington, D. C. 1926
Jackson, C. F., University of New Hampshire, Durham, New Hampshire 1936
Jenner, William, 806 W. Davis St., Fayette, Missouri 1933
Johnson, Archibald, Stewart, Nevada 1934
Jones, Sterling P., 690 Bonita Ave., Webster Groves, Missouri 1935
Jung, Clarence Schram, 4612 N. Oakland Ave., Milwaukee, Wisconsin 1921
Kalmbach, Edwin Richard, 527 Custom House, Denver, Colorado 1926
Kelso, Leon, Food Habits Research, Biological Survey, Washington, D. C. 1930
Kendeigh, Dr. Samuel Charles, Experimental Zoological Laboratory, Wright and Healey Sts., University of Illinois, Champaign, Illinois 1923
Laird, Miss Lonnie, 3664 Washington St., St. Louis, Missouri 1935
Lambert, Bert, Brevoit Lake, Allenville, Michigan 1936
Larrabee, Prof. Austin Park, Yankton College, Yankton, South Dakota 1921
Laskey, Mrs. Frederick Charles, Graybar Lane, Nashville, Tennessee 1928
Lee, Robert E., Soil Conservation Service, Shenandoah, Iowa 1936
Leopold, Prof. Aldo, New Soils Bldg., University of Wisconsin, Madison, Wisconsin 1928
Lewy, Dr. Alfred, 2051 E. 72nd Pl., Windsor Park, Chicago, Illinois 1915
Loftus, Miss Anne, 5932 McPherson St., St. Louis, Missouri 1935
Lopp, O. Vernon, 1502 Raymond Ave., St. Paul, Minnesota 1936
MacCracken, Dr. Walter H., Detroit College of Medicine and Surgery, 1516 St. Antoine St., Detroit, Michigan 1933
Mailliard, Joseph, 1815 Vallijo St., San Francisco, California 1930
Marsh, V. L., Box 8, Missoula, Montana 1934
Mayfield, Prof. George Radford, Vanderbilt University, Nashville, Tennessee 1917
McAtee, Waldo Lee, Biological Survey, Washington, D. C. 1911
McCabe, Thomas Tonkin, Museum of Vertebrate Zoology, University of California, Berkeley, California 1928
McConnell, H. B., Cadiz, Ohio 1935
McCreary, Otto, Agricultural Hall, University of Wyoming, Laramie, Wyo. 1930
McKnight, Edwin T., 201 I St. N. W., Miami, Oklahoma 1936
McMath, Robert R., Route 4, Pontiac, Michigan 1934
Mershon, William Butts, Saginaw, Michigan 1910
Metcalf, Prof. F. P., Lingnan University, Canton, China 1919
Metcalf, Prof. Zeno Payne, State College, West Raleigh, North Carolina 1900
Minich, Edward C., 1047 Fairview Ave., Youngstown, Ohio 1923
Mitchell, Mrs. Osborne Sinden, 69 Oriole Rd., Toronto, Canada 1933
Morse, Harry G., Huron, Ohio 1914
Morse, Miss Margarette Elthea, 11432 Mayfield Rd., Cleveland, Ohio 1921
Moseley, Prof. Edwin Lincoln, State College, Bowling Green, Ohio 1925
Mushbach, George E., Box 603, Brigham, Utah 1936
Neff, Johnson Andrew, 270 Federal Bldg., Sacramento, California 1920
Nice, Dr. Leonard B., Chicago Medical School, 710 S. Lincoln St., Chicago, Illinois 1932
Nice, Mrs. Margaret Morse, 5708 Kenwood Ave., Chicago, Illinois 1921
Nichols, Charles Ketcham, 212 Hamilton Rd., Ridgewood, New Jersey 1933
Northcutt, Charles Everett, 514 Worley St., Columbia, Missouri 1930
Oberholser, Dr. Harry Church, 2805 18th St. N. W., Washington, D. C. 1894
Oehlenschlaeger, Miss Elizabeth, 926 E. Kilbourn Ave., Milwaukee, Wisc. 1936

Olsen, Humphrey Adoniram, Caney Creek Junior College, Pippapass, Knott Co., Kentucky 1932
Osgood, Dr. Wilfred Hudson, Field Museum of Natural History, Chicago, Illinois 1910
Over, Prof. William Henry, University Museum, Vermillion, South Dakota 1930
Palmer, Dr. Theodore Sherman, 1939 Biltmore St. N. W., Washington, D. C. 1914
Palmgren, Dr. Pontus, Museum Zoologicum Universitatis, Helsenki, Soumi, Helsingfors, Finland 1935
Parker, Herbert, South Lancaster, Massachusetts 1928
Pemberton, John Roy, 3031 N. Lake Ave., Altadena, California 1922
Perkins, Samuel Elliott, III, 709 Inland Bldg., Indianapolis, Indiana 1923
Peterson, Roger Tory, National Association of Audubon Societies, 1775 Broadway, New York, New York 1935
Pettingill, Dr. Olin Sewall, Jr., Department of Zoology, Carleton College, Northfield, Minnesota 1930
Phelps, Frank Mills, 312 5th St., Elyria, Ohio 1912
Phillips, Allen Robert, Museum of Northern Arizona, Flagstaff, Arizona 1934
Pickwell, Dr. Gayle Benjamin, Department of Natural Science, San José Teachers' College, San José, California 1923
Platford, Sidney D., 4900 6th Ave., Los Angeles, California 1936
Preble, Edward Alexander, 3027 Newark St., N. W., Washington, D. C. 1929
Presnall, Mrs. Clifford C., Springdale, Utah 1930
Prill, Dr. Albert G., Main St., Scio, Oregon 1933
Quillian, Prof. Marvin C., Wesleyan College, Macon, Georgia 1927
Randall, Mrs. W. S., 4424 Belclaire Ave., Dallas, Texas 1925
Rea, Gene, 2378 Neil Ave., Columbus, Ohio 1936
Riley, Joseph Harvey, U. S. National Museum, Washington, D. C. 1914
Rogers, Mrs. Walter E., 911 E. North St., Appleton, Wisconsin 1931
Rosene, Walter Melvin, Ogden, Iowa 1923
Rust, Henry Judson, Box 683, Coeur d'Alene, Idaho 1921
Satterthwait, Dr. A. F., 806 W. Ohio St., Urbana, Illinois 1935
Satterthwait, Elizabeth Allen, 806 W. Ohio St., Urbana, Illinois 1925
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Schorger, Dr. Arlie William, 168 N. Prospect Ave., Madison, Wisconsin 1927
Shaffer, Chester M., Dorcas, West Virginia 1934
Shaver, Dr. Jesse Milton, Peabody Teachers' College, Nashville, Tennessee 1922
Shelford, Prof. Victor Ernest, Vivarium Bldg., Wrigley and Healey Sts., Champaign, Illinois 1931
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Smith, Prof. Frank M., 79 Fayette St., Hillsdale, Michigan 1910
Smith, Frank R., 9 Sibley Ave., Hyattsville, Maryland 1930
Smith, Harry M., 2007 Calumet Ave., Whiting, Indiana 1936
Smith, Luther Ely, Southwestern Bell Telephone Co., St. Louis, Missouri 1936
Smith, Roy Harmon, 183 N. Prospect St., Kent, Ohio 1936
Spiker, Charles Jolley, Branchport, New York 1916
Stebbins, Miss Fannie Adell, 31 Ely Ave., West Springfield, Massachusetts 1935
Stillwell, Jerry E., 7460 San Benito Way, Route 4, Dallas, Texas 1935
Stoner, Dr. Dayton, New York State Museum, Albany, New York 1912
Stuart, Anne, 1905 D St., Lincoln, Nebraska 1924
Suthard, James G., Route 1, Madisonville, Kentucky 1936
Sutton, Mrs. J. G., 122 S. W. 7th St., Richmond, Indiana 1930
Taylor, Dr. Aravilla M., Lake Erie College, Painesville, Ohio 1936
Thomas, Edward Sinclair, 1116 Madison Ave., Columbus, Ohio 1921
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Tonkin, George, Biological Survey, 209-211 Federal Bldg., Moline Illinois 1935
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Van Tyne, Dr. Josselyn, Museum of Zoology, Ann Arbor, Michigan 1922

Visscher, Dr. Paul, Biological Laboratory, Western Reserve University, Cleveland, Ohio 1924
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Warren, Edward Royal, 1511 Wood Ave., Colorado Springs, Colorado 1911
Weber, Orlando F., Jr., Mt. Kisco, New York 1936
Webster, Mrs. Laurence J., Holderness, New Hampshire 1936
Webster, Walter A., Sycamore Town Farm, Route 1, Quaker City, Ohio 1935
Wetherill, Milton, Kayenta, Arizona 1935
Wetmore, Dr. Alexander, U. S. National Museum, Washington, D. C. 1903
Weydemeyer, Winton, Fortine, Montana 1930
White, Francis Beach, St. Paul's School, Concord, New Hampshire 1926
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Wilson, Prof. Gordon, 1434 Chestnut St., Bowling Green, Kentucky 1925
Wineman, Andrew, 150 Michigan Ave., Detroit, Michigan 1934
Wing, Leonard William, College of Agriculture, University of Wisconsin, Madison, Wisconsin 1924
Wood, Dr. Casey A., Wood Library of Ornithology, McGill University, Montreal, Canada 1924
Worley, John G., 237 Charleston St., Cadiz, Ohio 1936
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Allert, Oscar Paul, Route 1, McGregor, Iowa 1923
Amadon, Dean, Route 4, Franklinville, New York 1935
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Bacon, Brasher C., Madisonville, Kentucky 1934
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Bailey, Mrs. Mary L., 511 23nd St., Sioux City, Iowa 1918
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Ballard, J. O., 5388 Waterman Ave., St Louis, Missouri 1935
Bamberg, John, Tennessee Valley Authority, Joe Wheeler Dam, Alabama 1936
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Barnett, Dorothy I., Lucas, Ohio 1933
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Birkeland, Henry, Route 2, Nevada, Iowa 1934
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Blanchard, Dr. Frank Nelson, Department of Zoology, University of Michigan, Ann Arbor, Michigan 1928
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Blincoe, Mrs. Benjamin J., Route 13, Dayton, Ohio 1926
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Book, Dr. Rodney Dent, Corning, Ohio 1933
Bordner, Mrs. Robert I., Hudson, Iowa 1930
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Boulton, Rudyerd, Field Museum, Chicago, Illinois 1922
Bowdish, Beecher Scoville, Demarest, New Jersey 1924
Bowman, Lawrence L., Orchard Hills, Route 7, North Canton, Ohio 1935
Brady, Dr. John A., St. Augustine College, Lakewood, Ohio 1925
Braly, John, De Poe Bay, Oregon 1927
Brasher, Rex, Chickadee Valley, Kent, Connecticut 1926
Braund, F. W., 1022 Central Ave., Cleveland, Ohio 1935
Breece, Russell, Delaware, Ohio 1933
Breslau, Leo Arthur, % Laurel Printing Co., 480 Canal St., New York, N. Y. 1933
Brokaw, Howard Pyle, 614 Mt. Prospect Ave., Newark, New Jersey 1935
Brookins, Albert M., Hastings Museum, Hastings, Nebraska 1935
Brooks, Alonzo Beecher, Oglebay Park, Wheeling, West Virginia 1931
Brooks, Maurice, Department of Zoology, West Virginia University, Morgantown, West Virginia 1926
Broomhall, Willard Harlan, Stockport, Ohio 1926
Brown, John Willcox, White Oaks, Montchanin, Delaware 1932
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Brown, Mrs. William, Edgewater Park, Celina, Ohio 1936
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Bush, Lee, Cambria, Illinois 1935
Buss, Irven O., W. Broadway, Redwood Falls, Minnesota 1936
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Carter, John Darlington, Lansdowne, Pennsylvania 1930
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Clayton, Miss Luella B., Feasterville, Pennsylvania 1930
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Cole, Dr. W. Storrs, Ohio State University, Columbus, Ohio 1937
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Compton, Lawrence Verlyn, Soil Conservation Service, Box 1314, Albuquerque, New Mexico 1923
Compton, Leila Anna, 846 E. Bowman St., Wooster, Ohio 1930
Conant, Roger, Philadelphia Zoological Society, Philadelphia, Pennsylvania 1930
Conklin, Charles, Canal Winchester, Ohio 1933
Converse, Charles D., Amlin, Ohio 1935
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Counce, Dr. Cynthia C., Lynnhurst Sanatarium, Oakville, Tennessee 1937
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Craig, Gerald S., Teachers College, Columbia University, New York, N. Y. 1932
Crane, Francis V., South St., Needham, Massachusetts 1932
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Crook, Compton N., Jr., Matthew Whaley School, Williamsburg, Virginia 1929
Crow, Louis W., Ridgeview Hotel, Evanston, Illinois 1936
Cunningham, James W., 4425 Main St., Kansas City, Missouri 1935
Curl, A. Laurence, Quincy, Ohio 1932
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Dambach, Charles A., Burton, Ohio 1934

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Davidson, W. M., Route 1, Silver Spring, Maryland....1933
Davis, Edward M., Winter Park, Florida....1936
Davis, George, State Teachers' College. Murfreesboro, Tennessee....1936
Davis, Mrs. L. Irby, Box 669, Harlingen, Texas....1933
Davis, Russell Sage, Clayton, Illinois....1932
Dawley, Jean Wilson, 13962 Clifton Blvd., Lakewood, Ohio....1931
Dawley, Jessie Sprague, 1002 Garfield St., Madison, Wisconsin....1935
Denton, Prof. J., Department of Zoology, University of Georgia, Athens, Ga....1935
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Dille, Frederick Monroe, Sonoita, Arizona....1912
Dingle, Edward von Seibold, Huger, South Carolina....1921
Dixon, J. B., Route 1, Box 688, Escondido, California....1936
Dockham, Verne, Mio, Michigan....1936
Dodge, Ernest S., Peabody Museum, Salem, Massachusetts....1936
Dole, J. Wilbur, 51 E. Stone St., Fairfield, Iowa....1930
Domm, Dr. Lincoln V., Whitman Laboratory for Experimental Zoology, University of Chicago, Chicago, Illinois....1936
DuBois, Alexander Dawes, Christmas Lake Rd., Route 2, Excelsior, Minn....1935
Dyer, Mrs. Minnie M., Byington, Tennessee....1930
Easton, Robert S., 904 Moss Ave., Peoria, Illinois....1936
Eastwood, Sidney Kingman, 301 S. Winebiddle Ave., Pittsburgh, Pennsylvania....1928
Edge, Mrs. Charles Noel, 136 E. 67th St., New York, New York....1931
Edson, John Milton, 90 Marietta Rd., Bellingham, Washington....1928
Eheim, Joseph Mathious, 236 S. Adams St., Hutchinson, Minnesota....1926
Eike, James, Box 4, Woodbridge, Virginia....1933
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Empey, Miller, Freeland, Michigan....1931
Engleby, Thomas Lester, 1002 Patterson Ave., Roanoke, Virginia....1934
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Erwin, W. G., Henderson State Teachers' College, Arkadelphia, Arkansas....1936
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Evans, T. R., 607 Moore St., Huntington ,Pennsylvania....1937
Evins, Samuel N., 38 E. 14th St., Atlanta, Georgia....1921
Fabert, Harry John, 413 Linwood Ave., Columbus, Ohio....1932
Fautin, Reed W., R. F. D. No. 2, Box 307, Provo, Utah....1937
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Felker, John Oberle, Route 1, Box 403, Clayton, Missouri....1934
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Ferguson, M. S., 301 Natural History Bldg., Urbana, Illinois....1936
Finster, Ethel Beulah, Asheville Normal School, Asheville, North Carolina....1930
Fisher, Harry E., Route 5, Wapakoneta, Ohio....1936
Fisher, Warren, Carlisle, Kentucky....1935
Fitzpatrick, Prof. Fred L., Teachers' College, Columbia University, New York, New York....1924
Fleetwood, Raymond J., Soil Conservation Service, Paducah, Kentucky....1934
Flentge, Louis G., Box 68, Wheeling, Illinois....1936
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Force, Edith R., 3021 E. 8th St., Tulsa, Oklahoma....1931
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Forsthoefel, Paul, 303 E. Fulton St., Celina, Ohio....1932
Fossler, Mary Louise, 550 N. Los Robles Ave., Pasadena, California....1936
Foster, George, 15 W. Circle Drive, Norris, Tennessee....1935
Fowle, John Trenchard, Route 2, Vernon, British Columbia, Canada....1936
Franks, Roscoe Whitlock, State Civil Service Commission, Columbus, Ohio....1932

Frazer, Dr. T. Atchinson, Marion, Kentucky....1934
Friauf, James J., 930 Dewey Ave., Ann Arbor, Michigan....1936
Frishman, Kenneth, 1114 9th Ave. S., Fargo, North Dakota....1936
Frost, Marvin, Asheville School, Asheville, North Carolina....1937
Frothingham, Mrs. Randolph, 56 Sargent Crossway, Brookline, Massachusetts..1932
Fryklund, P. O., Roseau, Minnesota....1926
Furniss, Owen Cecil, 2203 First Ave., West Prince Albert, Saskatchewan, Can...1934
Gall, John F., 1450 Warren Ave., Chicago, Illinois....1936
Gander, Frank F., Natural History Museum, Balboa Park, San Diego, Calif....1928
Ghigi, Alessandro, R. Universita, Bologna, Italy....1931
Gifford, Dr. Harold, 4907 Davenport, Omaha, Nebraska....1936
Gigstead, Gill, Havana, Illinois....1936
Gilbert, Winifred, 524 W. 24th St., Cedar Falls, Iowa....1936
Giles, Norman Henry, Jr., 959 Drewery St., N. E., Atlanta, Georgia....1930
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Gillett, Francis C., Minot, North Dakota....1935
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Gray, Allan L., Orleans, Nebraska....1932
Greene, Earle Rosenbury, New Holland, North Carolina....1930
Gresham, Burt, Winnipeg Free Press, Winnipeg, Manitoba, Canada....1934
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Gross, Dr. Alfred Otto, Bowdoin College, Brunswick, Maine....1927
Guion, George Seth, 1701 American Bank Bldg., New Orleans, Louisiana....1935
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Hagar, Mrs. Jack, Rockport, Texas....1930
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Haller, Carl W., Route 1, Short Creek, Virginia....1934
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Hanawalt, Prof. Fred A., Zoology Department, Otterbein College, Westerville, Ohio....1932
Handlan, Mrs. John Welty, Oglebay Park, Wheeling, West Virginia....1934
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Harkin, Hon. James Bernard, Commissioner, Department of Interior, Ottawa, Ontario, Canada....1924
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James, Mrs. Alvin Orlando, Chatham, Virginia....1931

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Jenks, Randolph, Rancho Esperero, University Station, Tucson, Arizona....1934
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Johnson, D. Elmer, 266 Lava, Hot Springs, Idaho....1934
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Lundquist, Arthur, Peabody Hospital, Webster, South Dakota....1930
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MacLulich, Dr. Duncan Alexander, Mountain Sanitarium, Hamilton, Ontario, Canada....1933
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Mendenhall, Eugene W., 97 Brighton Rd., Columbus, Ohio....1932
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Peterson, Mervin H., Payson, Utah....1936
Peterson, Nels Theodore, 80 Oaklawn Ave., Battle Creek, Michigan....1931
Pickens, A. L., Paducah Junior College Library, Paducah, Kentucky....1927
Pierce, Fred John, Winthrop, Iowa....1920
Pierce, John T., Anita, Iowa....1930
Pierce, Wright McEwen, Box 343, Claremont, California....1926
Pirnie, Dr. Miles David, W. K. Kellogg Bird Sanctuary, Michigan State College, Augusta, Michigan....1928
Poenitz, Hans, Frankfurter Strasse 2 III, Leipzig, Germany....1930
Poland, Lloyd, 526 W. Burke St., Martinsburg, West Virginia....1934
Pond, John, 1776 N. Parkway, Memphis, Tennessee....1937
Poole, Frazer Glendon, Federalsburg, Maryland....1936
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Pratt, Delbert Randall, McKinley High School, Canton, Ohio....1932
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CONTENTS

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LIFE HISTORY OF THE OVEN-BIRD IN SOUTHERN MICHIGAN*

BY HARRY W. HANN

Table of Contents

*Contribution from the Department of Zoology, University of Michigan.

Introduction

The Oven-bird (*Seiurus aurocapillus*) has attracted more than ordinary attention since first known to science. Its taxonomic position, peculiar nest, "teacher" song, flight song, secretive habits, and heavy parasitism by the Cowbird (*Molothrus ater*), have combined to give it special and sometimes baffling interest.

When the Oven-bird was described by Linnaeus in 1766 (Ridgway '02), it was placed in the genus Motacilla (*M. aurocapilla*) with

the Old World wagtails. In 1790 it was transferred to the genus Turdus (*T. aurocapillus*) by Latham, and was known as the Golden-crowned Thrush. In 1827 it was placed in the genus Seiurus by Swainson, but continued to be called the Golden-crowned Thrush until the publication of the first A. O. U. Check-List in 1886. The name "Oven-bird" was mentioned by Nuttall (1832), and a little later by Audubon (1834), who said, "The nest is so like an oven, that the children in many places call this species the Oven-bird".

Wilson (1831) described the nest, common song, and secretive habits of the Oven-bird, and mentioned the parasitism by the Cowbird. Nuttall briefly described the flight song, which seems to have escaped the attention of Wilson and Audubon. John Burroughs, in Wake Robin (1871), likened the common song to "teacher, teacher, . . .", a comparison which is known almost as well as the bird itself. Ornithologists of the following years acquired considerable new data on the species, chiefly by casual observations in the woods.

In late years Mousley ('26) watched a nest from the beginning of incubation until the young left, and Mrs. Nice ('31b) watched two nests of young birds, one until the young left, and the other until the brood was taken by a predator at the age of four days. Both of these observers gained considerable information on the habits of the species.

On July 25, 1932, while studying birds in a forest near Coldwater Lake, Michigan, the writer found an Oven-bird's nest containing four young birds, which proved so interesting that he resolved to make a study of the species when the opportunity was afforded. During the same year a nest was found in a large forest five miles southwest of Ann Arbor. In the spring of 1933 the forest near Ann Arbor was visited a number of times and the study was begun. Five nests were found, two of which contained eggs, and one of these was watched from a blind from hatching time until the young left the nest.

In the spring of 1934, the study was started in earnest. Visits to the forest were begun late in April, and from the time the first Oven-bird was seen on May 2, visits were made daily, or twice daily, with the exception of two days, until August 31. Less frequent visits were made during the first two weeks in September, terminating after the last birds had disappeared. The work was continued during the spring and summer of 1935, daily observations being made from April 25 to September 3, and less frequent visits continuing until October 13. In 1936, a check was made of the returning birds and some time given to nest study, trips being made more or less regularly from the latter part of April until the middle of June.

The number and distribution of hours spent in the forest during the study are shown in the table below. During most of May, June, and July in 1934 and 1935, two trips to the woods were made each day. The first usually lasted from early morning until noon, and the second, two or three hours in the evening, ending at dusk. There was enough irregularity in this program so that the afternoon was not neglected. Relatively less time was given to the work in May than in June and July, during these two seasons, on account of teaching duties, which terminated about June 1.

Table showing the number and distribution of hours spent in the forest during the study.

	April	May	June	July	Aug.	Sept.	Oct.	Total hours
1933	....	2	56	8	....	....	....	66
1934	2	137	250	168	35	4	....	596
1935	16	153	246	209	36	20	4	684
1936	5	67	25	.....	....	....	....	97
Total hours	23	359	577	385	71	24	4	1443

During the season of 1934, twenty-five nests were found, nineteen of which contained eggs or young of the Oven-bird, and in 1935, thirty-one nests were found, eighteen of which contained eggs or young. In 1936, eighteen nests were found, thirteen of which contained eggs or young, but for the most part these were not included in the calculations. The number of nesting pairs each season was about twelve. During the study eleven nests were followed from before the first egg was laid until the young left the nest.

One of the large factors in the work from the standpoint of time and labor was searching for nests. Different methods were used in the search as the season progressed. First a careful watch was kept for the females at work building, or flying up from the ground when approached. Later a search was made, especially along the edges of roads or other open spaces, where most of the nests were located. If the above methods failed until after the incubation season began, the area in question was thrashed over with a stick or switch in hopes of flushing the female from the nest. When a nest was deserted, adjacent parts of the territory were searched for a subsequent nest. The singing of the male is an important clue, but only a general one, and the chirping of the parents may be helpful if it occurs.

Adult birds were banded with metal and colored bands from the Biological Survey soon after the young hatched. A drop-trap of the "pull-string" type was set over or near the nest for catching them. The young were banded with metal bands when from three to five days old. Special effort was made to follow parents and young after they

left the nest, and much of the work during the latter part of the season was of this nature. Eight-power binoculars were carried at all times as an aid to vision.

Two green denim tents 1.8 meters square and 1.4 meters high were used as blinds, and were placed from one to six meters from the nests. These were set up dozens of times, for periods ranging from a few minutes up to twenty days, and observations were made from them as early as the egg-laying period.

Weights of young birds were taken with a pair of triple-beam Cenco scales, reading to one-hundredth of a gram. Two permanent platforms were set up in different parts of the woods, on which the scales were set, and young birds were brought to these centers for weighing. Young birds were distinguished by colored threads until they were large enough to band.

Where weighing was being done, wire netting was placed around the nests when the young were about ready to leave, so that the final weight could be obtained. In two cases a trap was placed over the nest and the parents allowed to go in and out to feed the young. These enclosures were found to be a hazard to the young birds, however, and should be used with great care.

Temperatures were taken by means of a thermocouple and potentiometer-indicator of Leeds and Northrup manufacture, accurate to about two-tenths of a degree Fahrenheit. An itograph, made by the writer, and patterned largely after the one made by Kendeigh and Baldwin ('30) was used at two nests in 1934, one in 1935, and one in 1936 (Plate XI, D and E).

Persistent watch was kept throughout the study for data on the flight song. During more than ninety evenings the author remained in the woods until after singing ceased, and in a majority of cases was stationed at favorable places, listening for songs and watching for the spiral flight, which he never saw.

The area studied was from fourteen to sixteen hectares (thirty-five to forty acres) in extent, being a little larger in 1935 than in 1934. This was about half of the available territory for study, but it was thought better to restrict the work to an area that could be covered thoroughly. The woods was exceptionally free from molestation by people, the only damage done being the crushing of a nest by a truck. The absence of intruders was due in no small degree to the mosquitoes which infested the woods. As a protection against these pests the writer wore thick clothing, leather gloves and a covering over the back of the head and neck, even in hottest weather. Mosquito dope

was used on the face with some success, and a brush of twigs was used a great deal when it did not interfere with the work.

I wish to express my appreciation of the helpful criticisms and suggestions received from Mrs. Margaret M. Nice and Dr. L. E. Hicks, of Columbus, Ohio, who read the manuscript, and of aid received from different members of the biological teaching staff of the University of Michigan, particularly Professor E. C. O'Roke, of the School of Forestry and Conservation, and Professor F. G. Gustafson of the Department of Botany.

Territorial and Sexual Relations

Arrival of Males. The first male Oven-birds arrived from nine to fourteen days before the first females. The arrival of the males was spread over a longer period of time, however, and the average time between the arrival of all males and females was about seven days (Fig. 4). In 1934, the first male was seen on May 2. On May 4 and 5 there were several more, and by May 6, all appeared to be in their places. They took up territory and defended it as soon as they arrived, and later checking showed that the choice of territory was permanent except for minor changes.

In 1935 the first male was seen on April 28, and two more on the 29th. The last two were banded birds, which went immediately to their old territory, and it is probable that the first was an old resident, since the male in that territory in 1934 was not banded. Cold, wet weather followed the arrival of the first males. During this time no new birds came, and little was seen of those already present. On May 8, fair weather came, and with it most of the remaining males, including two that were banded, one old one, and one yearling.

In 1936, three males, two of which were banded, were seen on April 29, and two unbanded birds were seen first on April 30. Other males, banded and unbanded, were seen for the first time from May 3 to 5, and one male which hatched in the woods two years before was seen first on May 7.

My records for former years gives additional data on the time of arrival. In 1930 a male was recorded at the University Forestry Farm four miles west of Ann Arbor on May 2, and on the following day one was found in the Arboretum at the east edge of the city. Both of these birds were migrating, as they do not nest in either place. On May 10, 1931, and May 4, 1932, males were found in suitable nesting ground in the Ann Arbor region, and doubtless were established in their territory.

Arrival of Females. In watching for the first females, one is faced with the problem of distinguishing females from non-singing males that may be trying to acquire or extend territory. The first females of 1934 which were identified with certainty were seen on May 14, when five were found already mated. As early as May 11, however, I saw a bird which I strongly suspected was a female. In 1935, the first female was found mated on May 12, and others were seen on the 13th and 14th. In 1936, four mated females were seen on May 8, and a bird seen on May 7 probably was a female. Practically all of the remainder were present and mated by May 11. Most of the matings occurred about the same time, indicating that the females arrived almost simultaneously.

For the relation of migration and nesting to temperature, see Figure 4.

Territory. The size of territories in the area studied ranged from 0.2 to 1.8 hectares (0.5 to 4.5 acres) in extent, and the average population was about one pair of birds to each 1.2 hectares (three acres) (Figs. 1 and 2). Variation in size of territory depends apparently upon the desirability of the area, the number of birds to be accommodated, and the pugnacity of the males. The first males to arrive wander about some, but as others come they narrow their ranges.

From the time the males come there is much contention, chasing, and fighting until the females arrive, and sometimes afterwards. Fighting is never very serious, and no injury was ever noted as a result. After the females arrive, two pairs of birds may enter into a dispute over territory, but this is less common. Females in this case are probably no more than interested observers.

When the nesting site is chosen, the territory usually undergoes some change, due to the shifting of the center of interest from the male's favorite singing place to the region of the nest. There is little change after this unless later nests are built. Subsequent nests are usually built well within the territory, but in one instance one was built at the border within a few meters of an earlier nest which belonged to a neighboring pair. There was no friction here, however, since the nests were not occupied at the same time.

When boundaries are once established, they are usually recognized by the birds concerned. One male under observation wandered into neighboring territory to get away from me, but hastened back immediately when he heard the female there objecting. The mating call of a female, or an object of curiosity such as a young bird, is apt to cause a male to cross a boundary line, but he is usually chased

back immediately. As far as I have observed, nesting material and food are gathered in home territory.

Banding and Returns. In 1933, one pair of adults and three young birds were banded. The male (No. 10) returned the following year, and occupied a territory adjacent to the old, and perhaps overlapping it some (Fig. 1). It is probable that he was crowded over by a stronger male. This was the only male observed which moved his territory appreciably upon returning the following year.

In 1934, ten additional males and eleven females were banded, making twenty-two adults in all. This number consisted of ten pairs, plus one male whose mate I could not catch, and one female which was a second mate. The young were banded also, and about forty of these lived to leave the nest.

In the spring of 1935, three males and seven females returned, also a yearling male which was banded in the nest (Fig. 2). The male banded in 1933 was not among those that returned. The adult males of 1934 were banded with a metal band on each leg, and colored bands in addition. Fearing that the weight of the extra band might have caused the death of some of the males, I placed only one metal band on each male during the following season.

The three old males that returned (Nos. 5, 9, and 10A) went immediately to their former territories. The final size and shape of the territories for the season were different from those of the previous year, however, due to surrounding males, and to the location of the nest, or nests, within. It may be significant also that the size of the territory of each male was a little larger, suggesting greater activity and pugnacity on the part of the older males.

Of the seven females that returned, three occupied their former territory, and four, adjacent territory. A strong attachment to the old location was shown by the three females (Nos. 6, 12, and 15), which built their nests 3.9, 6.6, and 24.5 meters respectively from their nests of the previous year (Fig. 3). Of the four that occupied adjacent territory, two (Nos. 10 and 2) lost the young of the first brood after they were out of the nest, then went back to the territory of the previous year, mated with the males there, and built nests 2.6 meters and forty-six meters respectively from the previous nests (Figs. 1 and 2). One of the above males (No. 23) already had a mate, and the other (No. 5) apparently had lost his young after they left the nest. No birds had the same mates during the season of 1935 that they had the year before, although two pairs of the previous year were in the woods.

The yearling male (No. 32) took up a territory 300 meters from the nest where he was hatched, and mated with the female that had been there the year before. His mother (No. 2 ♀) was in the woods, but she remained near her old territory. For a time after his arrival, he had to carry on continual warfare to keep another male from entering his territory, but he defended it successfully.

In 1935, five males and four females were banded, in addition to those which had returned, making a total of nine males and eleven females banded. This number consisted of eight mated pairs, plus one male with two mates, and a female whose mate I did not catch. In addition to the adults, about twenty-five banded young left the nest.

In 1936, seven of the nine banded males, including the three banded in 1934, returned and occupied their former territories (Fig. 2). Two of the third year males were among the first three to arrive, on April 29, but the two year old male banded in the nest was not seen until May 7.

Six of the eleven banded females returned in 1936 (Fig. 2). Three returned to their former territories, and two of these remated with their mates of the previous year. The remaining three found mates in territories adjoining those of the last year, although the former mates of two were present. The females returning to the same territories (Nos. 12, 35, and 23) built nests 7, 16, and 48 meters from the nests of the previous year. Four of the six returning females were present for the third season, and their nesting history is shown in Figure 3.

Table showing returns of banded birds.

	Males	Females	Males and females
1934	1 out of 1—100.0%	0 out of 1—00.0%	50.0%
1935	3 out of 11— 27.3%	7 out of 11—63.3%	45.5%
1936	7 out of 9— 77.8%	6 out of 11—54.5%	65.0%
Total for three years	11 out of 21— 52.4%	13 out of 23—56.5%	54.5%
Birds returning in '35 and '36	3 out of 11— 27.3%	4 out of 11—36.3%	31.8%
Total returns on young	1 out of 68— 1.5%		1.5%

Mating. It is evident from the foregoing data that both male and female adult birds return to their old breeding grounds, if possible. Old males have a good chance of obtaining their former territory either by arriving early or by driving out the other males. Returning females have more difficulty, however, since females probably return at more nearly the same time, and there is the additional factor in their adjustment, the male. It seems obvious, though it was not actually observed, that the female goes first to the old territory, and if the

male there already has a mate, she goes to an adjoining territory. The particular male in the territory seems to be of no consequence.

With both males and females attempting to return to the same place, there would seem to be a strong tendency for pairs to remate in subsequent years, and this has happened twice with banded birds, but it is by no means the rule.

From their first arrival, the females spend much of their time on the ground, feeding leisurely, and apparently surveying the ground, looking for a favorable place to nest. The male usually remains near, either walking on the ground or singing from a tree above. In several cases the female objected to his coming too close, and kept retreating as he came near. Other females, however, gave the mating call and seemed to desire copulation almost from the start. No courting performances were seen other than males chasing birds which were suspected of being females.

Sexual Relations. Copulation may take place either on the ground or up in the trees, on the ground being the more common. When it occurs in the trees, the male may mount and dismount quickly, with his head held high in the air, or he may hold to the female's crest and the two have a struggle. It was not an altogether uncommon sight to see a female perched on a limb, and a male hanging to her crest while fluttering and dangling in the air. When copulation takes place on the ground, it is practically always accompanied by a struggle, which looks more like a mortal combat than sexual intercourse. The fact that the female does not flee, and may even court the procedure, however, dispels any doubt as to her willingness. When they emerge from the struggle, the male usually flies to a nearby perch with an evident feeling of satisfaction, and the female, after shaking her ruffled feathers, proceeds with her eating or nest building. Copulation takes place ordinarily during the nest-building and egg-laying periods, though there was evidence of it occurring in exceptional cases both earlier and later.

Perhaps as a rule mated birds go about their nesting duties without undue attention to neighboring birds of the opposite sex, but there are plenty of exceptions. One female was seen copulating with a neighboring male three times, and a second neighboring male once, in the space of a few minutes. This took place in the female's home territory, and her mate was not present to object. She ate and gave the mating call between times. The female and both of the males wore colored bands from the previous year. About three hours later

I saw her copulating with an unbanded bird, presumably her mate. This female lost the young of her first brood and mated with one of the above neighboring males for a second nesting. Her sexual desires proved too much for him, and once as she approached him with fluttering wings wanting copulation, he turned and flew in the opposite direction. Just previous to this she had been in adjoining territory with a neighboring male, with whom she apparently copulated, and following the incident she went into a third territory, that of her former mate. Her second mate tried to follow her there, but the first chased him back. Twice the female uttered a mating call and flew toward the former mate when he sang, but as far as I could see, he paid no attention to her. He at this time was taking care of a young bird by their former mating. Several days later, after the female had begun to incubate her eggs, I found her again in adjacent territory, in company with the neighboring male. Her eggs and young did not suffer from her escapades, for her five eggs hatched, the birds left the nest, and later I found her caring for at least one bird twenty-six days old.

In another case where I was watching a female building a nest, a neighboring male slipped in and copulated with her, or attempted to, but finally was driven out by her mate. She went on with her building, and did not seem disturbed in the least.

Subsequent Matings. Two cases of bigamy were observed, and in both cases the male took on an extra mate while the first female was incubating. The procedure was probably no more than the male copulating with an extra female, and her settling down and nesting within his territory. One male, No. 9, helped care for his first brood until they were attacked by a predator at the age of six days and only one young bird escaped (Nest 9-3, Fig. 2). The female, No. 2, apparently took this bird, but it did not survive. The second brood (Nest 9X) hatched two days later, but the male failed to help feed the young until they were five days old. Meanwhile female No. 2 had lost her young bird and mated with a neighboring male (No. 23), while his mate was incubating. She laid four eggs and began incubating, but the nest (23X) was robbed by a red squirrel before hatching. Male No. 9 was near this last nest at times, and may have copulated with the female. The nest was on the border line between the two territories, but the males seemed to bear no ill feeling toward each other.

Oven-birds regularly start nesting anew if a nest is disarranged or the contents destroyed (Figs. 1, 2, and 3). Parents separate, however, when the young leave the nest, each ordinarily taking a part of

the brood, and they may then no longer be considered as mates. If a parent receives no young or loses them, it will mate again if opportunity is afforded and it is not too late in the season. In only one instanee have I found a bird raising a second brood, after raising a part of the first brood suceessfully. This male raised a young bird to at least thirty-five days of age, and late in the season was found caring for another young bird out of the nest.

Literature. Records of first arrivals in the literature must be eonsidered as those of males, since the females do not arrive until later. Wood's ('06) reeords from 1880 to 1905 and Wood and Tinker's ('34) reeords from 1906 to 1930 for the Ann Arbor region show first arrivals twiee before April 28 (April 3 and 18); four times from April 28 to 30; seventeen times from May 1 to 3; six times from May 4 to 6; and fourteen times after May 6. The first records, April 3 and 18 must be eonsidered as accidentals, and some of the late reeords were probably eases where the birds were not found promptly upon their arrival. The faet that they were reported seventeen times from May 1 to 3 seems very significant, and this may be taken as the normal time of first arrival of males in the Ann Arbor region.

Cooke ('13) considered the variation from year to year in the average arrival time of the Oven-bird at Lanesboro, Minnesota, and Grinnell, Iowa, as only 1.4 days, whieh he thought was due to the fact that it arrives late when the weather is settled. Cooke ('04) eoneluded also after studying several speeies of birds that "the southern-most breeding birds eonstitute the van in spring migration". Allen ('14), however, in studying the Red-winged Blaekbird, and Friedmann ('29), the Cowbird, found that "vagrant" males were the first to arrive, and they were followed by the migrant males.

The data on the Oven-bird show that the local nesting males are among the first to arrive, and that, praetieally the entire population of males arrives within a few days unless delayed by weather conditions. There are no reeords in the literature on the arrival of the females, other than nesting time.

Howard ('20), speaking of eertain British passerine birds, says that the male migrant remains in his territory from the time he arrives (p. 34). The boundaries, he says, are not definite lines, but areas wandered over by this owner at one moment, and by that at another (p. 153). He considers the ehoice of mates merely a matter of chance (p. 12). Howard ('29) states further of the birds under his

observation that the stealing of a mating by a male is by no means uncommon, despite the efforts of the owner of the territory to prevent it (p. 42).

Baldwin ('21) traced the genealogy of the House Wrens which nested on his farm, and found adults returning regularly. One pair only remated the second year, and only one young bird returned to nest. Birds as a rule changed mates for the second brood.

Mrs. Nice ('31a, '33a, and '34) found that male Song Sparrows usually retained their old territory during the following season, but a few were crowded out or deliberately went elsewhere. Females usually returned to their old territory if possible, yet a check showed that comparatively few remated with males of the previous year. Males welcomed the first females that came at mating time, and pairs usually remained mated for the second brood. Copulation started shortly before the beginning of nest building, and lasted until incubation began. There was no copulation between non-mated birds, but two males had two mates each. Returning young birds nested from 100 to 1550 yards from their birth place. Mrs. Nice ('30) in a review of the literature found that seven pairs of three species of passerine birds changed mates for the second brood in the same season, and twenty pairs of eleven species made no change.

Micheners ('35) found that Mockingbirds would go into neighboring territory to get food, or an unmated male would cross a line to try to win a mate, but no case of abduction of a mated female was noted.

Gibbs ('85) gives a very graphic description of a male Oven-bird's performance at mating time, in which it flew about the female, performing various capers and singing the flight song, but suddenly left when a second male appeared. This observation was made near Grand Rapids, Michigan, but the date was not given.

Singing

"Teacher" Song. The common song of the male Oven-bird is the well known "teacher" song. In the woods where the study was made singing could be heard in some part of the woods at almost any time of day, but was especially strong during the morning hours and in the evening. Low temperatures, approaching frost, in the morning redueed the amount of singing, as did also excessive heat in the middle of the day. There was some reduction in the amount of singing at mating time, and again at hatching time when feeding duties began.

Songs are given in series, and the time between different series is frequently spent on the ground in search of food. Songs of a single series come at more or less regular intervals, especially in the morning when the singing is strong. The intervals of one series for example, from the beginning of one song to the next, in seconds, were as follows: 23, 17, 22, 21, 25, 22, 22, 21, 23, 29, and 23.

Individuals vary somewhat in the length of the song, ranging usually from seven to ten double notes or "teachers". One series had the following numbers: 10, 10, 10, 10, 10, 10, 9, 10, 9, 10, 9, 10, and 10. Another series ran: 10, 8, 6, 8, 8, 8, 7, 7, 8, 7, 7, 8, 9, 7, and 7. One male was heard giving exceptionally long songs on a single evening, when the counts ran as follows: 14, 15, 13, 19, 20, 19, 17, 19, 23, and 18.

The first note of the double syllable of the song ends with an upward inflection, and the second with an accented, downward inflection, as *téa chèr*. The song ends with the accented syllable, ordinarily, but may not if the song is fragmentary, as it frequently is. The male starts the song holding his head in the normal position and with the tone almost inaudible, then as the song grows louder, raises his bill until it reaches an angle of about thirty degrees with the zenith. He opens his mouth once for each syllable, and the time between the "teachers" is only slightly greater than the time between the first and second syllables. The song does not grow gradually louder to the end, but reaches its full volume on about the sixth double note, in an eight or ten note song. In the single case above where the male sang as high as twenty-three "teachers", the full volume was reached at the eleventh or twelfth. I have not been able to note any variation in time or pitch as the song progresses.

There is some variation in the songs of different individuals. Some males sang exceptionally fast, and others very slowly. One male sang slowly and rather harshly, and another had a lisp which distinguished his song from others. These variations were very useful in distinguishing individuals in neighboring territories.

The male usually sings while sitting on a perch from five to ten meters from the ground. He changes perches from time to time, and has his "headquarters" in a local area, or areas, rather than a particular tree. When the female arrives, she may build the nest some distance from the original singing place, and in that case a male sings a part of the time near the nest, and the remainder at his original place. If a second nest is built, he spends some of his time singing near that. One male did much of his singing at a distance of 100

meters from the nest, but this was unusual. The male sometimes sings from the ground, but this is uncommon. One male started to sing the "teacher" song while on the wing and finished it after alighting on a perch, and another was seen singing with food in his mouth.

The significance of the song is at least two fold. First, of course, it is a proclamation of sovereignty of territory. Males seem to be continually conscious of the songs around them. They sing in alternation even in peaceful times, but do so more strikingly when there is a quarrel over territory. Secondly, the song is an "all's well" or recognition call to the female and young. Sometimes the female while incubating will turn her head and listen when the male sings. Many times when a female was disturbed on account of my presence and was chirping, the male would sing as if trying to quiet her. Frequently the male would join the female in a general chorus of disapproval chirps while I was at the nest, but would sing a "teacher" song as soon as I was fifteen or twenty meters away. Sometimes he gave the "all's well" song without knowing the facts, for I have heard a male singing merrily at a distance while I was banding his mate.

Young birds learn the meaning of the song by the time they leave the nest. Young that have been hushed up by the chirp of a parent will begin moving about and calling again when they hear the song of the male. Once when I was following a male and a young bird, the male sang repeatedly from the ground while trying to lead the young one away.

Singing continued during the season without much change until the males began to leave the woods, which was as early as July 5. Males which remained continued to sing until about July 20, but after that were seldom heard. The last song heard in 1934 was on July 27, though one male remained until July 31, and another until August 27. In 1935 two songs were heard in August, one on the fifth, and another on the seventh. One of these songs, and probably both, were sung by males which were caring for young. The cessation of singing by males which remain late is presumably due to molting.

Flight Song. The season for the "flight song" was practically the same as that for the "teacher" song (Table 1). The earliest flight song was heard on April 28, on the day the first male arrived in 1935, and the last, on July 26, 1935, when the singing of the "teacher" song had practically stopped. There was an increase in the number of songs beginning around July 1, and continuing until about July 20.

Table 1 shows the distribution of the flight songs during the day. The earliest song occurred at 4:26 A. M., on May 24, before it was

light enough to see the lines on my note-paper, and the latest in the evening was at 8:28 P. M., on May 26. There was a light concentration of songs around 8:30 in the morning, but by far the greatest number, 74 per cent, came in the evening after seven o'clock. This distribution of songs heard was influenced to some extent by the fact that I was in the woods less in the afternoon until late, and also by my being on the watch for songs in the evening. Both flight and "teacher" songs stopped sharply about ten or fifteen minutes after sunset, while it was still light enough to take notes, and no singing was heard thereafter. In fact, I found that the Oven-bird stopped singing comparatively early, for the Crested Flycatcher, Wood Pewee, Wood Thrush, and Cardinal were heard regularly after the Oven-bird had quit for the day.

The flight song usually starts with a few sharp chirps, which accelerate in speed and end in a warble in which one can recognize notes similar to the first notes of the "teacher" song, but without their rhythm. Often there are one or more "teachers" inserted, or added, which dispels any doubt as to the author. The song is never very loud, and lacks the carrying qualities of the "teacher" song, which doubtless accounts in some degree for the rarity with which it is heard. Some males are inclined to sing the flight song more than others. One male gave an elaborate song for a number of evenings at almost the same time. On the evening of July 7, 1934, I heard eight flight songs in sixteen minutes, but two males seemed to be involved in the singing. The fact that the male may move quickly from one place to another between songs may leave some uncertainty as to the author, but this is true of the "teacher" song as well.

Only relatively few times did I see the males while they were singing the flight song, and in most of these cases they were in pursuit of intruding males. One pursuing male finished up his song after he gave up the chase and lit on a limb, and another passed by me so closely that I could hear his wings fanning. Two males were seen flying late in the evening as they sang, and probably were not in pursuit. Two others were heard giving the flight song while they flew slowly with quivering wings, just after copulation. Another gave the song repeatedly while feigning injury, apparently as a part of the ruse. One male which I was watching flew nearly to the top of a tall tree and sang, apparently from a perch. A few singers which were not seen seemed to move some and others may have moved, but in the majority of these cases the song seemed to come from a single place, well up in the trees. The "spiral" or "soaring" flight described by

various observers was not seen a single time, though I remained in the woods until dusk, or later, more than ninety evenings, and in the majority of eases was stationed at favorable plaees watehing for this bchavior.

Call-notes. The most eommon of the Oven-bird ealls is the ordinary ehirp, given by both the male and female. The ehirp of the femalc is slightly lower in pitch than that of thc male, and may be distinguished under favorable eircumstanccs. The female usually chirps more than thc male, perhaps because she can not sing. I have sat in a blind for thrcc hours waiting in vain for a female to stop ehirping and resume her feeding duties, but this was unusual. Individuals vary greatly in the tcndency to chirp, and the male sometimes excceds the female.

The chirp indicates worry or fright, and is commonly heard when one approaches the nest, espeeially if the nest contains young which are about ready to lcavc. The female may usc the call to stop the male from singing whcn danger secms near, and parents use it to warn the young to "lic low" on account of danger. Thc warning to the young may be uttered in vcry emphatic, whistling calls, if thc parent is much disturbed.

The parent uses a chirp similar to the one above, but of a higher pitch, to attract thc young when out of thc nest, or perchance in trying to coax them out of the nest, if danger is near. Also a low, crooning call of one or two notes is givcn to get the attention of the young birds in the nest, if they do not open their mouths when the parent arrives with food. This call is so faint that it is barely audible when one is in a blind vcry closc to thc ncst.

The "mating" call of the female is a sort of drawn out chirp, or a series of chirps given in closc sueccssion, and scems to indicate that the femalc wants to copulatc. The call may be accompanied by a quivering motion of the wings, and advancement toward the malc. A similar call given occasionally by both scxes indicates displeasurc or approaching danger, and is used especially during thc early part of the nesting period.

Literature. Wilson (1831) seemed to underratc thc "teacher" song somewhat when he said of the Ovcn-bird, "It has no song; but a shrill, energetic twitter, formed by the rapid reiteration of two notes, *peche, peche, peche.*"

Burroughs ('71) rendered the song as "tcacher, *teacher*, TEACHER, TEACHER, *TEACHER*", with the accent on the first syllablc. Later ob-

servers, however, have not supported his idea of the accent (Jones, '00) (Eaton, '14). Burroughs, Mathews ('04), Saunders ('35) and others state that the song grows gradually louder to the end, and Howell ('24) and Roberts ('32) say that the song becomes faster as it progresses, but I have not been able to verify either statement. Saunders states that he did not note any variation in time and pitch, and this is in accordance with my observations.

Howell ('24) says that "In the south the Oven-bird seems to clip the first syllable, thus giving the song quite a different character from that of the northern birds." Such variations in songs are well known (Howard, '20, p. 159), and perhaps some of the differences of opinion concerning the Oven-bird's songs are due to actual differences in the songs themselves.

Mrs. Nice ('31b) noted the series of Oven-bird's songs, and timed the intervals within the series. Saunders ('35) gave July 20 as the date for the cessation of singing, the same as I observed here, but this obviously would vary in different places. Howard ('20) called a male bird's singing place his "headquarters" and Mousley ('19) called it the "singing tree". The first name is more appropriate for the Oven-bird.

Much has been written about the "flight" song or "passion" song. Nuttall (1832), Burroughs ('71), Samuels ('75), Jones ('00), Mathews ('04), Thayer (Chapman '07), Saunders ('29), Forbush ('29), and Roberts ('32) all have heard and described it, and most of them have seen the soaring flight, which the male may make while singing it. Seton ('90), Thayer, Saunders, and others have heard the song at night.

Jones says of the soaring flight, "I have seen the Oven-bird suddenly vault into the air, mounting to the tree tops on quivering wings, then dart back and forth in a zigzag course swift as an arrow, and finally burst into song as he floated gently down."

Roberts says of the same performance that he "has frequently seen the Oven-bird early in July thus disporting itself of an evening above the cathedral-like, terraced spires of the tall spruces on the shores of Lake Itasca." Roberts also noted an increase in the number of songs from July 1 to 20.

Seton says of the song, "that it may be heard at almost any hour of the night in the grove where a pair of these birds have settled for the love season."

Thayer says, "Here in southwestern New Hampshire, its full flight-song, delivered often from a height of a hundred or more feet

above the tree-tops, is one of the commonest night-sounds from early May to September."

Boardman (Baird '74) believed that the bird sang from a perch, for he says, "When it gets into the top of a tall tree, its strain is so rare and beautiful that but few know it as from that bird." Torrey ('95) heard it sing the flight song from a perch, and also from the ground.

Bolles' poem concerning the Oven-bird (Ball, '16) (Roberts, '32) seems to correspond with the observations of some, but not with mine. Only once was the last flight song heard as late as the Whip-poor-will's "clucking", and that was just as a Whip-poor-will began calling. Bats were seen with their "canvasses unfurled", but this was after the last songs of the Oven-bird had ceased.

After months of diligent watching, I have concluded that there must be considerable variation in the singing of the flight song in different parts of the country. Perhaps the song varies in the different kinds of forests. Further study must be made to clear up this point.

The common chirp of the Oven-bird was noted by Audubon (1834) and by practically all observers of the species since. Eaton ('14) correctly stated that it indicates worry or fright, and Mrs. Nice ('31b) noticed that it was given by both sexes.

The Nest

General Habitat. The present study was made in a forest where white oak (*Quercus alba*), black oak (*Quercus velutina*), sugar maple (*Acer saccharum*), shagbark hickory (*Carya ovata*), and basswood (*Tilia americana*) were the predominating large trees, while ironwood (*Ostrya virginiana*), and flowering dogwood (*Cornus florida*) were numerous as smaller trees below. The most conspicuous trees in the forest were large white oaks, of which there was a goodly number, some of them as much as a meter in diameter. The forest was open below, for the most part, but in places there were thick patches of small trees and shrubs (Pl. XI, C).

Among the herbaceous plants, the common wild flowers, spring beauty (*Claytonia virginiana*), yellow adder's tongue (*Erythronium americanum*), and trillium (*Trillium grandiflorum*) were common when the birds arrived. Later in the summer among the conspicuous herbs, were black snake-root (*Sanicula gregaria*), grasses (various species), bed-straw (*Galium* sp.), maidenhair fern (*Adiantum pedatum*), rattle-snake fern (*Botrychium virginianum*), May apple (*Podophyllum peltatum*), false Solomon's seal (*Smilacina racemosa*), small

Solomon's seal (*Polygonatum biflorum*), great Solomon's seal (*P. commutatum*), Aster (sp.), white snake-root (*Eupatorium urticaefolium*), goldenrod (*Solidago* sp.), tick trefoil (*Desmodium grandiflorum*), and rattlesnake root (*Prenanthus* sp.).

The more common birds, given in the general order of their frequency, were the following: Oven-bird (*Seiurus aurocapillus*), E. Crow (*Corvus b. brachyrhynchos*), E. Robin (*Turdus m. migratorius*), Black-capped Chickadee (*Penthestes a. atricapillus*), White-breasted Nuthatch (*Sitta c. carolinensis*), Red-eyed Vireo (*Vireo olivaceus*), N. Crested Flycatcher (*Myiarchus crinitus boreus*), N. Flicker (*Colaptes auratus luteus*), N. Downy Woodpecker (*Dryobates pubescens medianus*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), E. Cowbird (*Molothrus a. ater*), Wood Thrush (*Hylocichla mustelina*), N. Blue Jay (*Cyanocitta c. cristata*), E. Hairy Woodpecker (*Dryobates v. villosus*), Cerulean Warbler (*Dendroica cerulea*), E. Whip-poor-will (*Antrostomus v. vociferus*), E. Cardinal (*Richmondena c. cardinalis*), Scarlet Tanager (*Piranga erythromelas*), Tufted Titmouse (*Baeolophus bicolor*), Red-eyed Towhee (*Pipilo e. erythropthalmus*), Indigo Bunting (*Passerina cyanea*), Acadian Flycatcher (*Empidonax virescens*), E. Wood Pewee (*Myiochanes virens*), N. Barred Owl (*Strix v. varia*), and the N. Red-shouldered Hawk (*Buteo l. lineatus*).

The larger mammals known to be in the woods were as follows: Chipmunk (*Tamias striatus lysteri*), red squirrel (*Sciurus hudsonicus loquax*), fox squirrel (*Sciurus niger rufiventer*), gray squirrel (*Sciurus carolinensis leucotis*), woodchuck (*Marmota monax rufescens*), and the skunk (*Mephitis nigra*). Doubtless the racoon (*Procyon l. lotor*) was present also, but no direct evidence was noted.

The only reptiles seen were a few garter snakes (*Thamnophis s. sirtalis*), and only one of these had reached mature size.

The surface of the ground was rolling, and the area was crossed through the middle and at one side by small creek beds, which were dry except following freshets. (Figs. 1 and 2). A few ponds had water early in the season, but were dry in the summer. In 1934, which was a dry year, the ponds were dry by July 1, and the nearest open water was more than a mile away.

The woods, for the most part, had not been disturbed much in recent years, and the ground was well covered with a thick carpet of old leaves. Several old roads told of some early logging, and some of the roads were still in occasional use. Fallen timber had been kept well cleaned out. A boundary lane about three meters wide was partly grown up with small trees and shrubs. About August 15, 1934,

this lane was cleared out, and a wire fence placed in it, then sheep were turned into that portion west of the fence. The pastured part, which comprised about one-third of the area studied during that season, was soon cleared of all green leaves and edible plants within reach of the sheep. This had no particular effect on the Oven-birds for the season, however, for the few that were left kept in the unpastured part.

In 1935, but few Oven-birds went to the portion of the woods where the sheep had been, and only one successful nest was found in that area. Sheep were turned in again late in summer, but not until nesting was over. In order to find a sufficient number of birds for study in 1935, it was necessary to extend the area somewhat farther north, as shown in Figure 2. Much more available territory lay to the north and northeast, and the limits were determined largely by convenience. The area under observation in 1936 was about the same as that of 1935.

Nesting Site. With a few exceptions all of the nests were located where they could be approached by bird or man from any direction. Ease of approach and a certain amount of light are undoubtedly important factors in the choice of the location. All nests seemed to get a little sunshine each day, but in most cases the amount was small. None was located among dense shrubbery, but some were well surrounded by herbaceous plants.

With reference to small trees and bushes, the nests were located as follows:

	Number of nests	
With small tree at back of nest	4	
With small tree at side of nest	4	
Nest by a shrub or bush	8	
Nest by, or under, loose, scattered brush	9	
Nest in the open	35	(58%)

The trees mentioned above consisted of six ironwoods, one dogwood, and one white oak. All were small, the largest being about eight cm. in diameter.

There was a very positive correlation between the nesting sites and the roads, creek bed, boundary lane, or other open spaces in the woods (Figs. 1 and 2). Four nests were located in the boundary lane, two in old roads, and one in a space where fallen trees had been cleared away. The remainder, except seven, were located less than ten meters from a road or other open space. The average distance of all nests from such open spaces was 4.4 meters. Omitting the seven farthest, which were from twelve to twenty meters away, the remaining

fifty-three on which I had data averaged 2.8 meters distant. No nests were located nearer than twenty meters from the edge of the woods. The female obviously is responsible for locating the nest near the open space, since she chooses the exact nesting place.

The significance of locating the nests near the roads or other spaces is not very clear. In some cases the birds habitually approached the nest from the roadway when feeding the young, and at times used the space for a landing place, but neither of these was by any means universal. There is the possibility too that the space might be used as a landmark, but this has not been proved. I have examined the light above to see whether additional overhead lighting might be obtained, but this was not usually the case, since the roads were ordinarily little more than wagontracks through the woods.

A careful examination was made to see whether the position of the entrance was associated with any external condition. Overhead lighting and the position of the road or other open space showed no correlation whatever. The directions which the nests of 1934 faced with reference to the compass seemed significant, since none faced the south or southwest, but the 1935 data filled up the gap until the distribution was quite uniform in all directions.

The slope of the ground was examined, and considerable correlation was found between the slope and the facing of the nests. Many nests were located nearly on the level, or on slight elevations, and these were omitted from the comparison. Out of thirty-six nests located where there was appreciable slope, thirty-one (86 per cent) faced downward at some angle. Nests suffered but little, if any, from lack of drainage. One nest containing an Oven-bird's egg and a Cowbird's egg was found with water in the bottom after a heavy rain, but the water soon disappeared. The Oven-bird's egg failed to hatch, but it is doubtful whether this was due to the water.

Subsequent nests of the same pair of birds were built within the territory or at the border. The distance of fifteen known nests from the preceding ones, ranged from eighteen to sixty-six meters, averaging forty-two meters.

Structure of Nest. All of the nests found in the present investigation were arched over and quite uniform in structure (Pl. XI, A and B). One nest which was found after incubation began, and had but little top to it, evidently had caved in during a rain, and the female had made another opening higher up. Two nests which were well covered by sprigs of dry leaves had the usual top. As nests grow old

with use, the top frequently is pushed back, giving somewhat the appearance of an open nest.

The materials of which the nests are made are well represented by the analysis of a nest shown below, with the addition of a lining of horse hair:

Grass	2.7 gms.	11.3 per cent
Slender weed stems	3.1	12.9
Woody stems	.6	2.7
Fibrous bark	.9	3.8
Rootlets	.4	1.6
Dry leaves of trees, chiefly oak	16.3	67.7
Moss	small fragments	
Total	24.0	100.0

Other nests were compared with the one analyzed, and, for the most part, were quite similar. Some had a little more or less of the different components, the most variable materials being grass, moss, and rootlets.

All of the nests which were examined carefully when they were finished were found to contain long horse hair as a lining, with the exception of one, which contained short yellow hair. The number of horse hairs varied from one to several, and both white and black hairs were used. Horse hair, of course, has been used only in the last century or two, and supplants other material. The benefit derived from it is doubtful, as it frequently forms snarls, and sometimes the young birds attempt to swallow the hairs. The materials other than horse hair most commonly found in the lining were macerated leaves consisting of the fine veins, together with moss, rootlets, and fine plant stems.

Nests as a rule rested on the ground and were partly covered by the leaf bed. Examination of the ground beneath nests which had stood for some time showed that in practically every case there was a slight depression. Examination of fresh nests, however, usually failed to show any depression in the ground, and those found later were, to some extent, a result of the nest itself. A few nests rested on pieces of twigs which lay beneath the leaves. The leaves of the leaf bed ordinarily extend up over the edge of the nest at the sides and back, concealing it and shedding off the water. Leaves are commonly placed over the top also, so that the camouflage is complete. The threshold varies in height from the level of the leaf bed to three centimeters above it. The opening is a little wider than high, and as a rule is slightly smaller than the inner cavity.

The side walls of the nest are a continuation of the top and bottom parts, and the whole is united into a single mass. The side walls

at the front are the weakest parts, but the nest usually stands up well as long as it is occupied. Parents frequently step on the nest, and one male under observation did so repeatedly when he left the nest after feeding the young. When nests are no longer used, they often cave in at the door, but some remain intact for weeks. Most old nests under observation disappeared completely over winter.

The average measurements of the Oven-bird's nests are given below. These figures were compiled from measurements ranging from a few, in case of inside measurements, to more than twenty-five for outside measurements.

	MINIMUM	MAXIMUM	AVERAGE
Width, including loose leaves	18 cm.	30 cm.	23 cm.
Width of main part of nest	12	18	16
Front to back, over all	15	26	20
Front to back, main part	11	17	15
Height above leaf bed	7	17	12
Width of opening	4.7	8	6
Height of opening	3.5	7	4.5
Width of cavity inside	7	8	7.5
Height of threshold above leaf bed	0	3	1.1
Depth of cup	3	7	4.8
Thickness of bottom	1	2	1.6

Building of Nest. The nest of the Oven-bird is built by the female, and the male does not come to the nest often until after the eggs hatch. The time between the arrival of the female and the beginning of the nest was from one to six days, being a little longer in 1935 than in 1934, due apparently to the weather (Fig. 4). The main body of the nest is built rather rapidly, requiring only about two days, and the lining is put in a little more leisurely. The total time of building requires about five days for first nests, but may be shortened to four or a little less for second nests. The work is done chiefly in the forenoon.

The earliest nests found already had the framework up, but the procedure from the start is fairly obvious. The female clears the leaves from a circular spot, by pushing them back, raising up the edges, and perhaps removing some. She then, in some cases, digs up the ground, leaving fresh soil on the surface, and may remove some soil or push it aside. The digging must be done with the bill, for I have never seen an Oven-bird scratch. Nesting material is then carried and placed around the edge of the hole, chiefly on the back side, and the covering is extended over the top. The work is done almost entirely from the inside, but evidently a few leaves are placed on top and arranged from the outside.

I have watched a number of females building after the framework was up. One nest was so thin that one could see through it. In all cases that I have seen, the material was carried inside. One could see the whole nest move as the female arranged the material and shaped the nest.

Material was obtained at distances ranging from a few centimeters up to forty meters. The female walks while making the shorter trips, and flies during the longer ones, but even when resorting to flight she walks three or four meters in arriving and leaving. One female carried nearly all of her material from a creek-bed twenty meters away, where the material was more moist than that near by. This female made thirty-six trips in a little over three hours, averaging a trip about every five minutes, but she made several pauses of ten minutes or more each. She remained in the nest from a half minute to a minute each time. This was a first nest. Another female working on a second nest and gathering her material near by, worked much faster, making thirty-three trips in forty-eight minutes, or a trip about each one and one-half minutes. She remained in the nest from three seconds to two and one-half minutes, averaging twenty-four seconds. Her trips for material were from one-half meter to six meters distant, averaging 3.1 meters, and she flew only a few times.

The last material to be added to the nest is the hair, and the presence of this indicates a finished nest. The hair is often added a day or more after the remainder is finished, and doubtless causes the female considerable searching.

While the female is building, the male sings and keeps watch. If there is supposed danger approaching, he gives an alarm call, or may fly at the female to drive her away. Most birds are rather tolerant of an observer while they are building. I watched one female at a distance of twenty meters, and another at thirteen meters without serious objection, and one female which was especially tame worked away at her building while I was standing in plain sight 2.6 meters from the nest.

Literature. Concerning the Oven-bird with respect to its habitat, Audubon (1834) said, "its breeding places are in the interior or along the margins of shady woods watered by creeks and rivulets, and seldom seen by man." Baird ('74) "found them rather more abundant in woods upon high and dry ground, usually upon slopes of wooded hillsides." Chapman ('07) reported finding them in "dry rather open deciduous woods",also in "low swampy forest lands with heavy under-

growth." Burns (Chapman, '07) said in a sweeping statement "the wooded upland, hillside, or lowland are all alike to this bird." The studies of Mousley ('26) and Nice ('31b) were made in evergreen forests.

Audubon said concerning the location of the nest, "I have found it always on the ground, sometimes among the roots of a tall tree, sometimes by the side of a fallen trunk, and again at the foot of some slender sapling." Norris ('92) reported a nest in the end of a large pine log, and another beneath some fallen branches. Chapman ('07) said "The site selected may be at the foot of a bush or tree, or simply among dead leaves in more open spaces." The nest studied by Mousley ('26) and one studied by Mrs. Nice ('31b) were located in open spaces in the forest. Roberts ('32) noted the relation to roads, etc., when he said it "is usually in a little opening in the forest or along a trail or abandoned wood road." Burns (Chapman, '07) could find "no particular significance in the position of the entrance in relation to the exposure." Jones ('88) noted the relation of the facing of the nest to the slope, saying that the opening was always on the downhill side.

Mousley ('21) noted concerning birds in general that the female chooses the exact nesting place, though the male chooses the locality. Mousley ('17) also found in his study of subsequent nests that eighteen nests of fourteen species were located from 0 to 268 yards (average, 66 yards) from the previous nests.

The Oven-bird's nest was described by Wilson (1831), Nuttall (1832), Audubon (1834) and practically all writers since who have had occasion to discuss the bird. Wilson said of the nest, "This is formed of leaves and dry grass, and lined with hair. Though sunk below the surface, it is arched over, and only a small hole left for the entrance." Nuttall spoke of the "curious oven-shaped nest" whose surface was "scattered over with leaves and twigs so as to match the rest of the ground."

Baird ('74) said of the nest, "When placed under the shelter of a projecting root, or in a thick clump of bushes, the nest has no other cover than a few loose leaves resting on, but forming no part of it." He found one nest under vines and wild flowers which had no top or covering other than those plants. He described the usual nest as having "the appearance of two shallow nests united at the rim", a statement which bears some qualification. He also gave measurements for two nests, which fall within the limits of the above measurements.

Mrs. Nice ('31b) and Stanwood ('11) found pine needles as a part of the nest material, and Roberts ('32), slender weed stalks and rootlets. Roberts also gave the shape as sometimes "short cylindrical", which I have found true.

Burns (Chapman '07) found the width of the opening definitely greater than the height, and the chief difference in nests lying in the quantity of grass and leaves. He gave the lower edge of the entrance as being even with the leaf bed.

Concerning the building, Burns stated that the outside of the nest was built first, and in one case a nest was completed in two days after the "frail straw arch" had been constructed. He thought that both sexes helped in the building.

The Eggs

Egg-laying. The first Oven-bird's eggs were laid on the first, second, or third morning after the lining of hair was placed in the nest. The tendency was toward a longer period of time at first nests, and a speeding up at subsequent nests. Where eggs or broods were destroyed and subsequent nests built, the first egg in each of three nests was laid five days after the first nest was deserted. At another nest the first egg was laid four days after the first nest was deserted, but a complete clutch was not laid in the first nest. At still another nest which was not found until after incubation had begun, calculation indicated that the first egg was laid about three and one-half days after the first nest was deserted. This female had incubated over time on an infertile egg at the first nest, and probably the new eggs had started to develop in the ovary while she was still incubating.

All eggs were laid in the morning, usually before seven o'clock, and sometimes before six. One female went on the nest at 5:25 o'clock, and remained forty-two minutes in laying, and on the following morning went on at 5:04, remaining fifty-two minutes. Another female went on at 5:05, and remained one hour. Sunrise at this time was about 5:20. One female was seen on the nest three successive mornings before laying.

In all cases observed except two, the eggs of a clutch were laid on successive days. In one exception, I frightened the bird off, and no egg was laid in the nest that day, but a full clutch of five eventually appeared. In another exception there is a strong probability that the egg was removed by a Cowbird.

The dates of laying of first eggs in first nests, obtained chiefly by direct observation, but in a few cases by calculation, are shown in

Figure 4. In subsequent nests, the dates of the first eggs were as follows: In 1934, May 23, 25, 27; June 2, 17, 18, 28; and July 10. In 1935, May 26; June 1, 3, 4, 16, 25, 26; July 2 (third nest), and July 3. Only one female laid more than two clutches of eggs, though several built as many as four nests.

Eggs. The number of eggs in clutches where the nests were not disturbed by the Cowbird, or where all eggs were checked as they were laid, was as follows:

Number of eggs		Number of nests
3		2
4		6
5		18
6		1
Average	4.7	Total 27

The clutches with three eggs, and all with four except one were late nests, and were laid by females which had laid clutches previously. Two females laid two clutches of five, and another laid three, four, and three eggs respectively in three nests. The data show that first nests nearly always have five eggs, and subsequent nests from three to five. The largest number laid by any one female during a season was ten.

A number of clutches of eggs were measured and some of the results which seem significant are given below:

	Average length in millimeters	Average thickness in millimeters
Forty-eight eggs from sixteen clutches	20.3 (18.7 to 23.1)	15.6 (14.5 to 16.8)
Clutch of five eggs from No. 10A female in 1934 (first clutch)	21.5	15.7
First clutch of five eggs from No. 10A female in 1935	21.3	15.6
Second clutch of five eggs from No. 10A female in 1935	22.4	16.0
Clutch of five eggs from No. 12 female in 1934 (first clutch)	20.4	15.3
Clutch of five eggs from No. 12 female in 1935 (first clutch)	19.6	14.9
Clutch of six eggs from No. 2 female in 1934 (first clutch)	19.6	15.7
Three eggs from first clutch of five from No. 2 female in 1935	19.9	16.5

The eggs of the No. 10A female were above the average in size, in both 1934 and 1935. The second clutch in 1935 ran larger than the first, indicating that additional eggs are not characterized by a reduction in size. Eggs of the No. 12 female were considerably smaller

in 1935 than in 1934, and there was also a corresponding reduction in the size and vitality of the young. The No. 2 female laid six eggs in 1934, and only five in 1935, but the latter clutch ran a little larger in size.

Incubation. At all nests where accurate observations were made, incubation began on the day before the last egg was laid. This rule held good for clutches of three, four, five, and six eggs. At most nests, incubation did not begin until late afternoon or evening, or if it began earlier, it was more or less irregular.

The incubating is done entirely by the female. While on the nest she usually sits with her side toward the front, and her tail doubled off short toward the opening. Frequently one or two white spots show on the side of her rump where the feathers are ruffled. She changes position frequently, and heads in the opposite direction, always turning with her head toward the back of the nest. She sometimes pulls a leaf up in front of her, and may cover the opening of the nest with a leaf when she goes away. She is restless for a minute or two before leaving, moving her head about, or reaching out to look around. She always walks in leaving, unless badly frightened, and walks when returning to the nest. When entering the nest she sits down quickly, without any preliminary adjustments.

The male spends his time singing and watching, or perchance courting another female. He may come to the nest, but does not do so frequently (See p. 180). One male that approached too closely to the nest received a sharp rebuke from the female. Once a male came to a perch a few meters from the nest and chirped, whereupon the female left. Another time he called for her, but she only moved a little and did not leave.

The female Oven-bird is well known as a "close sitter", and may actually allow a person to step on the nest before she leaves. When flushed from the nest, she commonly feigns injury, walking about with her wings and tail dragging, and with the feathers raised on her back and rump. After a few minutes she usually hops to a perch and begins chirping.

Females under observation were flushed from the nest repeatedly, and most of them became reconciled more or less, allowing me to place my foot within a few centimeters of the nest before leaving. Some rarely feigned injury or chirped, and seemed disturbed but little at having to leave, often stopping to eat when only a few meters away. When flushed more than once a day, females, as a rule, left the nest sooner the second time than the first.

The time which three different females spent off of the nest daily was recorded by the itograph, and is shown in Tables 2 and 3. (See also Figures 5. Pl. XI. D and E). The time of one female, No. 15, was recorded in 1935 and again in 1936, thus making a total of four nests checked. This female was off fewer times, but for longer periods, in 1936 than in 1935 (Table 2). Female No. 6 probably was off of the nest more on account of the extremely hot weather at that time, though this did not affect No. 9. Table 3 shows some hourly tendencies. Soon after daylight, the females left the nest and returned, then left chiefly during alternate hours until noon. The 12 o'clock hour showed the lightest incubation of the day after the 5 o'clock hour, and this was followed again by a return to the nest. Late in the evening there was a tendency to leave again before going on for the night. Grouping the totals into three hour periods shows that the time off during the day was roughly proportional to daily temperature changes. There was no very apparent correlation between the total time off each day and the average daily temperature.

The incubation period was obtained on seventy-six eggs in twenty-one nests. The time ranged from eleven days, twelve hours, to fourteen days, with an average of twelve days, 5.6 hours. The average in 1935 differed only 0.6 of an hour from that of 1934. All of the eggs of a clutch including the last had about the same incubation period, and any variation of more than a few hours usually concerned all. One female, which hatched two clutches, incubated the eggs of the first an average of thirteen days, three hours, and the second, twelve days, two hours. No difference in incubation time was noted in cool and warm weather, or in nests containing Cowbird's eggs.

Hatching. Hatching occurred at various times of the day, and one egg is known to have hatched between dusk and dawn. Both Ovenbird's and Cowbird's eggs were pipped from fifteen to twenty hours before hatching, and the crack was extended about one-fourth of the way around before the shell broke open. After hatching takes place, the female eats the shells. One female was seen eating egg shells as she sat on the nest. She reached under her body for them, and ate at least three large pieces while I was watching. Another female spent four or five minutes eating three large pieces of shells of Cowbird's eggs as she stood in front of the nest. She slowly chewed up the shells, then swallowed them.

Eggs which failed to hatch were left in the nest. At one nest a sterile egg evidently was crowded out by Cowbirds, but on the following day it was back in the nest again.

Literature. Norris ('92) gave data on forty nests and eggs of the Oven-bird, which ranged in location from North Carolina to Maine. The most common number of eggs in the nests which did not contain Cowbird's eggs was five, and the average, 4.25. He gave measurements of the 170 eggs in the forty nests, the average length being 0.5 mm. less than mine, and the thickness 0.1 mm. less.

Herrick ('05) states that birds on the nest nearly always face the same way. The tendency of the Oven-bird to turn frequently may be due to her more or less cramped position in the nest.

The incubation period for the Oven-bird was correctly given by Burns (Chapman, '07) as twelve days. No particulars were given concerning the nest or nests where the data were obtained. Stanwood ('11) and Mousley ('26) also gave twelve days.

Baldwin and Kendeigh ('27), using a thermocouple and recording potentiometer, found that a female House Wren, during incubation, remained at the nest 14.3 minutes and away six minutes on an average. An accompanying graph showed that she was away from the nest at least thirty-five times during one day.

Bussman ('33), by use of the terragraph and by direct observation, found that the number of times per day which four different European birds left the nest were as follows:

Wryneck	40
Tree Sparrow	25, 30, and 13
Pied Flycatcher	90
Song Thrush	21 and 20

All of the above birds showed a greater activity than the Oven-bird.

Wilson (1832) gave one of the best descriptions of the female Oven-bird feigning injury, when he wrote as follows:

> "If you stop to examine its nest, it also stops, droops its wings, flutters, and tumbles along, as if hardly able to crawl, looking back now and then to see whether you are taking notice of it. If you slowly follow, it leads you fifty or sixty yards off, in a direct line from the nest, seeming at very advance to be gaining fresh strength; and when it thinks it has decoyed you to a sufficient distance, it suddenly wheels off and disappears."

Friedmann ('34) considers the feigning of injury a result of the inhibition of muscular action, as if the bird were unable to control its movements, but I have seen no indication of helplessness. One fe-

male Oven-bird would feign injury when I was two or three meters from the nest, but would fly at my hand and peek it when it was at the nest. Herriek ('05) considers the feigning of injury "an inherited instinct. the end and advantage of which is to distraet your attention from the nest to the moving bird."

Craig ('13) states that a hatehing dove ehipped the egg one-third of the way around in ten minutes, and later chipped it nearly around. Herrick ('35) says that a Bob-white prieked the shell in a full eirele. Cottam and Kelso ('33) found that the eggs of a Woodeoek hatched from thirty-six to forty-eight hours after the first craeks appeared.

Bigglestone ('13) saw a pair of Yellow Warblers eating a shell after hatching. the female eating most of it. Gabrielson ('13) reports that a female Catbird ate small bits of shell. and earried away two large pieces. Mrs. Nice ('32) saw a female Black-throated Green Warbler eating the shell of a newly hatched egg.

According to Herriek ('35). birds' eggs which fail to hatch are sometimes removed and at other times left in the nest.

The Nestling Stage

A. Young Birds in the Nest.

Day of Hatching. Average weight. 2.1 grams. Dark gray natal down eovers the young bird as follows: Coronal tract, seven mm. long; occipital. ten mm.: dorsal. twelve mm.; femoral. nine mm.; humeral. twelve mm.: and alar (seeondary), eight mm. This down grows but little after hatching. The primaries and secondaries of the juvenile plumage show as a faint. dark line beneath the skin. The eye slit, which is two mm. in length. can be pulled open. but does not open of its own accord. The edge of the mouth is cream colored, and the inside of the mouth very red.

The young bird uses its wings and feet for righting itself. if it is not lying properly. a behavior probably common to all young passerine birds. When opening its mouth. it may rise on its wing tips (Herrick. '05. Fig. 121). or may merely raise its head. The action of its feet tends to draw them out of a tangle. and a foot is readily slipped out of a loop of thread when one is tying it. unless the thread fits very snugly. The young bird will open its mouth in response to a noise as soon as its head is ont of the shell. Some of the young birds give audible peeps. but most of them only a snapping noise.

One Day Old. Weight, 3.3 grams. The juvenile plumage shows beneath the skin in the various tracts. exeept the eaudal. the primaries

and secondaries making a prominent dark streak. There is a marked increase in size.

Two Days Old. Weight, 4.9 grams. The young bird reaches toward the opening of the nest for food, and raises the rear, turning it toward the door, or attempting to, when voiding excrement. Evidently it can discern light from dark, though its eyes are still closed. It is beginning to discern between noises also, and does not open its mouth readily at all times.

Three Days Old. Weight, 6.9 grams. The feathers are coming through the skin, except in the caudal tract, and the eyes of some birds are beginning to open. The young bird tries to creep when taken from the nest, but does poorly. It does not seem to right itself much better than when it was hatched. The toes work vigorously when the bird is handled. The young grow restless in the nest when the mother is brooding, causing her to stand up.

Four Days Old. Weight, 9.0 grams. The feathers cover the surface of the tracts. The eye-slits are three mm. long, and can open some. The edge of the mouth is more yellow than at first. Birds can peep distinctly, and can do so with their mouths open. One can see the glottis open and close as they peep. Birds can sit up on the tarsus, and can crawl awkwardly on a surface; also they pick at themselves, and can scratch the head with a foot. They may creep around to the back of the nest after voiding excrement, thus causing a slow rotation in the nest. Young birds open their mouths for food, as soon as the female gets off of the nest, having learned that they are fed at that time, for the male is usually there with food. When the young are alone and a parent approaches the nest, they may hear it coming, and open their mouths before the parent comes in sight. The young are now large enough to band, and a brood of five just nicely fills the bottom of the nest.

Five Days Old. Weight, 11.0 grams. The tail feathers show as a transverse line. The eyes open readily, and peeping may be heard several meters away. A young bird may rise as if going to excrete, then act as if it was afraid of missing some food, and continue to face the parent. Such a bird settles down as soon as the parent leaves, for the stimulus to excrete is then removed.

Six Days Old. Weight, 12.8 grams. The young birds will open their mouths when out of the nest, but they fail to respond readily to noises to which they have been responding. They can hop if removed from the nest, and may leave the nest at this age in case of emergency.

They thrust the rear end over the threshold in voiding excrement, and may stand on top of other young birds while doing so. They stand up in the nest and struggle for room, especially when food is brought.

Seven Days Old. Weight, 13.6 grams. Young birds streteh their wings and legs for exereise, a leg and a wing on the same side of the body being stretehed at once. Presence of the parent is no longer neeessary for voiding exerement, and young birds sometimes baek over the threshold and deposit the excrement in front of the nest. Fear is developing. If birds are touched, or pushed around with the fingers, they aet as if they are dead, or if disturbed too much, they may leave the nest. Some leave the nest normally at this age. When ont of the nest, they travel by hopping.

Eight Days Old. Weight, 14.1 grams. The primaries are 20 mm. long, and extend out of the sheath over half their length. The greater coverts are unsheathed for three-fourths of their length, and the middle and lesser coverts for nearly the entire length. The tail feathers are two or three mm. long, and the ends projeet from the sheaths. Feathers on the back, breast, and abdomen are unsheathed for more than half of their length, and form a buffy covering for the body. The top of the head and breast are streaked with patterns resembling those of the adult. This is the juvenile plumage previously deseribed (Ridgway, '02).

The young are now ready to leave the nest, if they have not already done so. They are very aetive when the parents come with food, jostling eaeh other in the nest and peeping loudly but never fighting. Two or three sit or stand in the front row, and the others stay behind in the seeond row. As the parent approaehes, they reach forward with mouths wide open, and give a rapid buzzing call. The food disappears at a gulp, and the young bird calls loudly for more. The birds in front usnally get the food, and if one exeretes, it then may creep aromnd toward the back of the nest, giving plaee to one from the rear row. The birds in the baek crowd forward, also, as they get hungry, and may stand on the backs of those in front. Between feedings the birds usually lie quietly in the nest. A brood of five now completely fills the nest, so that the female could scarcely brood if she tried. When the young are out of the nest, they can flutter and run, as well as hop.

Weight and Growth. Young birds at hatching time varied greatly in weight, ranging from 1.46 grams to 2.29 grams. The heaviest one had not been fed, for it hatched in my hand. The growth of young

birds is shown by the curves in Figures 6 and 7. Weighing was not done at just the same time each day, but this was largely corrected in plotting the curves. The average daily weights given above were taken from the growth curves, and probably are accurate to within one-tenth of a gram. The feeding and excreting of the young birds make the weights of a single bird quite variable. An Oven-bird weighed again after it had excreted showed a loss of 8 per cent in weight, and a Cowbird under similar conditions lost 21 per cent. Broods vary considerably in the rate of growth, depending on the food supply. One brood which grew especially well seemed to owe its success to the extra large loads of food brought by the male. If young birds are very hungry, they may hasten the feeding by calling when the parents are away. This obviously is an emergency measure however, and not resorted to much in ordinary routine, though the young in later stages always call when the parents approach the nest. When the young leave the nest, they weigh approximately 73 per cent as much as the adults.

The weights of six adult birds, taken while the young were in the nest, were as follows: Males, 18.65 gm., 19.93 gm., and 19.78 gm.; average, 19.45 gm. Females, 19.45 gm., 19.40 gm., and 18.18 gm.; average, 19.01 gm. Average of males and females, 19.23 gm.

Temperature Control. Temperatures were taken by placing the thermocouple down the throats of the young birds while they were in the nest. Figure 8 shows the average temperature of a brood of four young birds, taken at five minute intervals (except one day) through a thirty minute period each day, for seven days, beginning with the day of hatching. During the first five days, or as long as the female brooded regularly, readings were taken following twenty minute periods of brooding. Outside temperatures follow the dates at the right.

As shown by the chart, the temperature dropped rapidly on the day of hatching when the female left the nest. On the second day there was less drop, and by the time they were three days old, there was little drop, though there was some fluctuation. The drop, of course, would depend to some extent on outside temperature, but fortunately the temperature was not very high during the entire period. Birds at the front of the nest cooled more rapidly at first, but later this made little difference. Birds holding their mouths open showed from one to two degrees Fahrenheit lower temperature, though the thermocouple was well down the esophagus. The female brooded the four day old birds, more or less, through the day, thus continuing the brooding at least one day after the young were able to keep warm

without her. Figure 9 shows temperature variations during a single day.

B. Parental Care of Young Birds in the Nest.

For several days after hatching, the female broods the young with much the same rhythm that she incubated the eggs. The brooding instinct reaches its maximum when the young are about one day old. One female at this time allowed me to stroke her breast and back, and finally push her out of the nest before she would leave. As the young birds get older, the female stands up a good deal in response to their wriggling, especially if the weather is hot. One female while standing over a young bird that was lying on its back, touched it under the chin three different times with her bill, causing it to struggle and finally right itself. When the female leaves the nest, she may act stiff, and perhaps stop to stretch. She never looks back when she leaves, but there is little danger of her throwing the young out of the nest unless she is greatly frightened.

When the young are hatched, the male aids with the feeding. Until near the close of the study, it was believed that the male never came to the nest until after the eggs hatched, but the itograph record in 1936 indicated that the male had come to the nest each morning on the ninth, tenth, and eleventh days of incubation. On the morning of the twelfth day I watched, and at 6:05 the male came with a mouthful of food. He went directly in over the triggers, and remained about three minutes, leaving without the food. The female apparently did not get out of the nest, though I could not see clearly, and do not know which one ate the food. This male was accustomed to the itograph triggers from the previous year, and his behavior probably represents that of the normal male. Another male was found in front of a nest containing a newly hatched Cowbird, at 8:27 A. M. At a third nest containing a newly hatched bird and another hatching at 7:26 A. M., the male was singing some distance from the nest, and probably knew nothing about it.

Food is usually found at some distance from the nest, though some is picked up in the immediate vicinity. When the young birds are small, the parents always walk from five to eight meters in approaching and leaving the nest. They have routes or runways which they prefer, but the route in leaving is not necessarily the same as the one used in approach. The birds generally avoid open spaces, keeping under the cover of vegetation.

The male and female usually approach the nest somewhat differently at first. The female, being more accustomed to going to the

nest, walks up quickly, feeds and broods. The male approaches more slowly, frequently taking five or ten minutes to come a few meters. He may stand motionless for several minutes, or may advance a few steps at a time, rather quickly. In this method of pause and approach, he is not easily seen. The streaked breast also aids in hiding the male as well as the female, by giving him protective coloration. As time goes on, the male gets bolder, and may surpass the female in his courage and speed of approach.

When the male reaches the nest, the female gets out, so that he can feed the young, and frequently she leaves at the sound of his footsteps, before he comes in sight. Males and females alike feed from one to three young birds at a time, the usual number being two when the young are small, and either one or two when they are older. Care is taken never to waste any food, and any portions dropped are always picked up and refed. When the food has disappeared, the parent waits to see if any excrement appears, remaining at the nest usually from one to three minutes.

When the female leaves the nest, she may "stand by" while the male is feeding, or may go away for food. Sometimes she opens and closes her mouth, as if she would like to have the food herself, and occasionally takes some and aids in the feeding. One female took a large green larva from the male, and he took it back again, then she took it a second time, and fed it to the young. There was no indication of irritation on the part of either parent during the performance. Another female, which insisted on doing the feeding stood in the way of the male, but he cleverly reached around her, and did some of the feeding himself.

A male that I was watching, after feeding the young, came straight to the tent where I was concealed, and walked under the edge. When he saw me, he started out, then came back, and finally flew through the door at the rear. During the next three days he came into the tent, or to the edge of it, seven more times while I was there, and undoubtedly passed through regularly when I was away. This behavior was apparently due to a desire to keep hidden while near the nest.

The excreta are swallowed by the parents at first, but after the second day some are carried away. The swallowing continues to some extent, however, as long as the young are in the nest. The male is perhaps more prone to carry the excreta away than the female. Parents usually carry these a considerable distance from the nest, but occasionally one may be seen alighting on a tree, within twenty or thirty meters, and wiping its bill.

About four or five days after hatching there is a marked change in the behavior of the parents. In place of brooding, quietness, and tolerance, there are increased feeding, chirping, and defiance. At this time temperature control has developed enough so that there is little need of brooding, while feeding has increased gradually and become the important factor. In approaching and leaving the nest the parents have shortened the walking distance until finally they may alight and take off within a meter of the nest. When approaching in this manner, however, they alight on a perch near by, before going to the nest. Time spent at the nest is shortened also, and on the last day or two parents may remain only long enough to deliver the food, and perhaps grab up an excretion that may be in front of the nest.

The food of the young Oven-birds, following hatching, consists chiefly of green and brown geometrid larvae. Parents carry these transversely in their bills, usually two or three at a time. Small earthworms also form a part of the diet. These are grasped at several places and folded into loops which protrude from the sides of the bill. As the young birds grow, adult insects, including crane-flies, moths, ants, and beetles are added.

A fairly accurate record of the feeding at four nests was obtained by the itograph (Tables 4 and 5). Table 4 shows an hour by hour record of the feeding at nest No. 9, which contained four Oven-birds and two Cowbirds, from the day of the first hatching up to the evening before the Oven-birds left the nest. Totals at the bottom show a rather constant rate of feeding throughout the day. There was an extra number of feedings between 5:00 and 6:00 A. M., obviously on account of not having food over night, and an easing up in the afternoon, perhaps due to the high temperature. The middle of the feeding day fell at 12:10, quite near the noon hour. The increase in the number of daily feedings is quite significant. Beginning with twenty-eight on the day of hatching, there was a gradual increase up to 160 on the day before the Oven-birds left. This brood was the largest found during the study. Each Cowbird required at least as much food as two Oven-birds, hence the brood was equal to about eight Oven-birds. All left the nest successfully, in spite of the fact that the nest was badly infested with mites.

At nest No. 6, which contained but two Oven-birds, the number of daily feedings increased from sixteen to sixty-seven (Table 5), but the young birds did not grow especially well. At nest No. 15 of 1935, containing five Oven-birds, the number of daily feedings increased from about twenty-seven to 123, and the young grew well. At nest

No. 15 of 1936, containing three Oven-birds, the feedings increased from twenty to sixty-one. The increase here was irregular, and it is doubtful whether this represents a usual condition. With some allowance made for the last nest, the data indicate that a larger number of birds receive more feedings, but not necessarily in proportion to the number of birds. The increased demand for food as the birds grow apparently is met by carrying larger loads of food as well as more of them. Furthermore, a small number of birds in a nest do not grow any better, and perhaps not as well as a full brood.

The relative amount of feeding done by the male and female varies with the pairs, and also with the time. Males usually feed more at first, because the females spend much of their time brooding. During the latter part of the period, males and females feed about the same amount, on the average, though with some pairs one may exceed the other. One male, which had two mates, let the second female do all the feeding of a brood of five until they were five days old, but the young fared well and grew at almost the normal rate. The males and females, when approaching the nest with food at the same time, frequently quicken their pace, each trying to reach the nest first.

Parents begin activities quite early in the morning. On June 8, I arrived at a nest at 4:30 A. M., when it was just light enough to see the lines on my note paper, and the itograph showed that the female had been off twelve minutes. Feeding stops in the evening about the time singing ceases, when it is still light enough to take notes without difficulty.

During the early days of the nestling period, parents leave in search of food with little apparent regard for the safety of the young during their absence. A few times parents were found standing quietly in front of the nest or near it, but in only one case was it obvious that the purpose was to guard the nest (Pl. XI, B). On this occasion a female remained near the nest almost constantly during the fifth and sixth days after hatching, leaving as a rule only when the male was near the nest, and returning when he left. She did very little feeding during this time, but the male brought large mouthfuls of worms, and the young had plenty to eat. Later the female helped with the feeding, and brought as much food as the male.

During the latter part of the nestling period, the parents become more alert, and spend considerable time watching from perches near by. If any danger comes in sight, they begin chirping, and do their utmost to protect the nest. Squirrels were sometimes attacked by the birds flying at them, if they approached too near, and a Blue Jay near

one nest caused considerable chirping, but the Oven-birds did not dare to attack it. An Acadian Flycatcher which lit in front of a nest was immediately driven away by one of the parents, presumably the male. A female on one occasion drove a strange Oven-bird away from the nest, by approaching it slowly with her mouth wide open. While the young of one nest were detained in a trap for study, the parents were annoyed greatly by two Barred Owls which were in the vicinity. When one owl perched within twenty meters of the young, the parents approached it and chirped for an hour, while the young were quiet for the most part. Finally I had to leave the blind, and the owl flew, putting an end to the disturbance. Later during the same day, two Hairy Woodpeckers came within two meters of the young Oven-birds, but the parents paid no attention to them.

Adult birds seem to be very much afraid at night. One evening when it was quite dark I went with a flashlight to a nest where the young Oven-birds were six days old, to see if the female was there. When I was about six meters from the nest, the female left in great haste and confusion, running noisily through the vegetation. When I arrived at the nest I found one young bird partly out of the nest, and another on its back. The female must have been badly frightened to leave in such a manner. At two other nests, where the young were seven days old, I watched from the blind until dark, and the females remained away.

Adult birds were banded when the young were from one to six days old. The best time is when the young are from one to three days old, after the feeding routine is established and before the parents grow defiant. Females could be distinguished from males by the large brood spot on the breast, frequently a convenient mark, since males and females were banded differently. Catching the parents made them more shy, but did not ordinarily interfere seriously with the care of the young. I dropped the trap over one female while she was sitting on the nest, and she did not move until I approached within a meter of her. The other extreme was a male which fluttered around in the gathering cage, and finally leaned backward with his tail doubled under him, and slowly tilted over on his back. His eyes were half closed and he lay there as if in a trance, but when I shook the cage he got up and seemed to be all right. Usually when one parent was being banded, the other chirped frantically until the mate was released. When a parent was disturbed by banding, or by the presence of the blind, camera, or other apparatus, it approached the nest with

some caution, frequently holding the tail high and giving it a quick flip backward at each step.

Opportunity was offered in the latter part of the nestling period to study the ability of the parents to learn. At one nest a sparrow trap with the second funnel moved back into the place of the first, and a hole made in the top for escape, was placed over a nest. This was to allow the parents to go in and out for feeding, but to retain the young for study, when they left the nest. Parents at first refused to go up the steep incline of the funnel, but when I turned the funnel over, offering an approach which was less steep, they entered readily. Later the funnel was turned back to the original position. A hole fifteen centimeters square in the top proved of no use as a place of escape, but when I loosened the netting over one-fourth of the top at the back end, the arrangement worked very well. Parents entered and fed regularly, usually going in at the funnel and out at the top, but sometimes reversing a part of the route. When the young were out of the nest, parents often attempted to feed through the netting, but this was not very successful.

At several other nests, a circular netting fifty centimeters in diameter and twenty centimeters high was used to retain the young for weighing. Parents were unable to enter this at first, because of the tendency to remain on the ground. A twelve centimeter piece was substituted for the higher one with the same result, but when a pile of sticks was placed by the netting, the parents would walk around the netting and mount the pile of sticks, from which they would then enter. Males seemed to find the entrance a little more readily than the females. After a few trips the birds entered with no hesitation. The 20-centimeter strip was then substituted for the lower one, and the birds entered with but little notice of the change.

In a similar manner, though earlier, the female was trained to enter over the itograph triggers. First the triggers and the netting were placed near the nest, so that she could become familiar with them, then the triggers and the side walls of the netting were gradually moved up to the nest. Lastly the netting was extended out over the top. From three to four days were required for the training. Dummy triggers were used at first, so that the itograph would not be kept in the woods unnecessarily. When the young hatched, the males learned the route apparently from the females and by trial and error. One male refused to enter the nest for three days, but with no serious results. The itograph was used on the same pair in 1936 as in 1935, and little training was necessary the second year.

C. Leaving the Nest.

Young Oven-birds leave the nest approximately eight days after hatching. The average time for fifty-seven birds in sixteen different nests was seven days, 22.5 hours, and ranged from six days, thirteen hours, to eight days, twelve hours. The average was not changed appreciably by omitting birds which left the nest on account of fright.

In the normal method of leaving the nest, the young hop out one at a time, and several hours may elapse between the leaving of the first and last birds. Frequently a bird will leave the nest, go a few centimeters, and then return, so strong is the attachment for the nest. In such cases the remaining birds in the nest set up the food call as the young one returns, showing that they cannot distinguish it from a parent. Sometimes young birds in leaving will turn around facing the nest, and then hop over the side of it.

When the first young bird leaves the nest, one of the parents leads it away and cares for it, leaving the remainder of the brood largely or entirely to the care of the mate. In two cases observed the male took the first bird, and in two the female took the first. The last two or three birds are apt to leave about the same time. Young birds leaving subsequently may be cared for by either parent, but the parent left with the nest is likely to be left also with more than its share. The first birds out of the nest receive plenty of attention, but by the time the last one goes the parental desire for young is well satisfied, and it may have trouble in getting a parent to claim it. The last bird or two are apt to be less mature than the first ones, also, making it more difficult for both parent and young.

Parents are always interested in the young leaving the nest, but I have not seen a parent deliberately trying to coax young out, under normal conditions. On the contrary they approach and leave the nest quickly from the side or rear, which tends to prevent the young from following or coming to meet them. As a result young birds usually leave after a parent has gone, perhaps stimulated to some extent by hunger, and a subsequent desire to follow.

One female left in care of a nest obviously stalled, somewhat, as she waited for the young to leave. She went through the motions of feeding when she had no food and walked around near the nest, though out of sight of the young. Finally she stepped on top of the nest and looked over, which was too much for the three remaining birds, and they hopped out.

When a young bird is once out of the nest, the parent leads it away very skillfully. It walks ahead, stopping frequently to hold

food in front of the young, to feed it, or to go through the motions of feeding when it has no food. In case the young bird goes ahead, or in the wrong direction, the parent follows up and again takes the lead. Young birds at first are led away from the nest from fifteen to twenty-five meters, if they travel well, then when the excitement of leaving the nest has quieted down, they are taken farther.

When the parents have divided the brood by each taking some of the young, their home life is ended, and each goes its own way. Delay in separating, or any excitement, such as the flushing of a young bird, may cause both parents to appear on the scene any time for a day or two, and one pair was seen together on such an occasion, five days after the young left the nest. Such excitement, however, may draw in neighboring birds as well. When separating, the male remains within the home territory unless it is late in the season, and then he may go outside. The female usually goes into neighboring territory, and may wander about to some extent. A female and young going into neighboring territory are treated kindly by the male of that territory, which frequently takes a lively interest in the visitors.

Young birds will jump out of the nest on account of fear, when they are six or seven days old. At one such nest, containing seven day old birds, I started to band the young, and when I took the first one out of the nest, they all jumped out. I tried to keep them in until I could get at least one parent banded, but it was of no use. I covered the opening with a chip, and finally with a heavy piece of wood, but they crept out over the top, or pushed the top of the nest back and escaped. The parents called frantically and this excited the young birds all the more. I succeeded in banding three of the young, but by that time the other two could not be found.

At two other nests this "emergency method" of departure operated under natural conditions. At the first, which had contained five birds, seven days old, the top of the nest was gone when I arrived and could not be found. The young birds were gone, but a later check showed that at least one survived. There were two excretions in the nest, and one in front, showing that the young had not been attended for some time before the nest was destroyed. Perhaps one of the Barred Owls known to be in the vicinity had come near and drawn the attention of the parents, then later attacked the nest. The parents were chirping when I arrived, but the male sang while I was examining the ruin.

At the second nest, which had contained three Oven-birds and a Cowbird, I heard the parents chirping, and upon investigation found

the nest empty. The bottom of the nest was disarranged, where the Cowbird had hung on as it was being unceremoniously dragged from the nest, perhaps by a red squirrel. Eight hours later I found one of the Oven-birds attended by a parent only twenty meters from the nest, but it finally perished also. Birds leaving the nest before eight days, are at a decided disadvantage, for they do not travel well, and are apt to fall prey to an enemy.

D. Literature.

Passerine birds when hatched are blind, helpless, and covered only by natal down. Specific cases are the Cedar Waxwing (Herrick, '05), the Bluebird (Allen, '30), and the Oven-bird (Nice, '31b). The eyes begin to open at varying times, examples being as follows:

Brown Thrasher	one day	Herrick ('35)
Magnolia Warbler	two days	Stanwood ('10)
Yellow Warbler	three days	Bigglestone ('13)
Cedar Waxwing	four days	Herrick ('05)

The development of natal and juvenile plumage in passerine birds has been studied carefully by previous workers (Jones, '07) (Boulton, '27), and appears to differ only in minor details in the various species. The natal down of the Oven-bird is distributed over more tracts than that of the House Wren, described by Boulton, resembling more closely that of the Cowbird (Friedmann, '29). The juvenile plumage develops much in the same manner as that in the House Wren, but a little more rapidly, corresponding to a shorter period in the nest. One exception in the comparative rate of growth is in the appearance of the primaries and secondaries, which show in the Oven-bird as a dark line at hatching, and similarly in the House Wren, three or four hours later.

The young of the Yellow Warbler (Bigglestone, '13) and the Prairie Horned Lark (Pickwell, '31) open their mouths at any noise until about five days old, then begin to discriminate between sounds. The Prairie Horned Lark, soon after this, learns to withdraw at the touch of the hand, but does not develop fear in the full sense until nearly time to leave the nest.

Mousley ('26) noted the increased activity of young Oven-birds in the nest just before time to leave, and also found that young Goldfinches ('30) stood up in the nest at eight days, when they were only half old enough to leave the nest. Bigglestone ('13) saw young Yellow Warblers fighting over food while they were in the nest, a behavior unknown to young Oven-birds. Mrs. Nice ('31b) described the

food call of the young Oven-birds when they were old enough to leave the nest.

Young Long-billed Marsh Wrens (Welter, '35) could peep audibly at hatching time, but did not open their mouths for food unless touched. Evidence of fear appeared as soon as the eyes were open, which was on the third day. Young wrens bore their weight on the tarsus on the fourth day, but kept the toes doubled up until the ninth day. The young learned to expect food at the sound of the approaching female without first seeing her. They also learned to turn the rear toward the door in excreting, and later to eject the feces clear of the nest.

Herrick ('10) found the Black-billed Cuckoo a little more precocial than the passerine birds. It could work its toes vigorously when hatched and soon was able to eject excreta over the edge of the nest. Young birds learned to associate the food reaction with the nest, and at seven days would not open their mouths when removed from the nest. Young cuckoos, when fed regularly and otherwise undisturbed, slept much of the time between feedings. Fear developed just before the young left the nest.

Growth of passerine birds in the nest, as determined by weight, has shown considerable variation. Some of the relative gains in weight while in the nest are as follows:

Species	Ratio of final weight to hatching weight	Time in nest	Reference
Cedar Waxwing	11-17	11 days	Herrick ('35)
Song Sparrow	11	10	Nice ('33-'34)
Prairie Horned Lark	6	11	Pickwell ('31)
Long-billed Marsh Wren	11	12	Welter ('35)
Barn Swallow	12	11 (not full time)	Stoner ('35)
Oven-bird	6.7	8	

The relative gain in weight of the Oven-bird while in the nest corresponds well with that of the Prairie Horned Lark, but the relative gain per day corresponds more nearly with that of the Long-billed Marsh Wren. The Oven-bird apparently is more precocial than most passerine birds, since it leaves the nest at eight days, and weighs at that time only 73 per cent as much as the adult. The young Barn Swallow, an extreme in the other direction, weighs more than its mother when it is eleven days old, and 89 per cent as much when it leaves the nest a week later. A slower growth rate, or an actual loss in weight, when the birds are about to leave the nest, is usually attributed to feather growth.

Baldwin and Kendeigh ('32) found that temperature regulation in the House Wren was established at nine days, but in their former work (Kendeigh and Baldwin, '28) their figures show that under natural conditions it was well established at six days. The young House Wrens studied ('28) remained in the nest fifteen days and were brooded for thirteen days. This showed an overlapping of from four to seven days, of the brooding period and the period when temperature control became established.

Stoner ('35) found that temperature control became established in young Barn Swallows about the ninth or tenth day.

Mousley ('26) watched a nest containing two young Oven-birds and observed the following parental behavior: Parents walked to and from the nest, keeping under cover of the vegetation, and the female left the nest when the male arrived with food. The male sang in reduced amount and was shy at the beginning of the period. The average brooding periods and the time between feedings decreased as time progressed. Both the brooding periods and the time between feedings were greater than for a number of other species studied. This statement would not apply to his later findings on the feeding of Goldfinches, however. Food consisted of soft, green larvae, small flies, moths, and other insects. He observed a "battle royal" between two males when a near-by pair of Oven-birds approached too close to the nest during the latter part of the nesting season. The young left the nest at eight days. He found the male caring for a young bird just out of the nest, and the female caring for the remaining one still in the nest. The female under excitement "poked the youngster out of the nest", and it fluttered off attended by both parents. This interest shown by the male during the excitement was, in all probability, only temporary.

Mrs. Nice ('31b) watched two Oven-bird's nests during the nestling stage and observed the following characteristic behavior: Parents walked to and from the nest at first, favoring certain routes, and keeping hidden as much as possible. Later they lit nearer the nest and flew sooner in leaving. The female left the nest and stood at one side while the male fed. The female's feeding was followed by brooding. The nestling period was divided into two rather distinct parts, the first four and one-half days showing brooding, slow rate of feeding, and indifference on the part of the male. During the remaining part watching was substituted for brooding, feeding was increased, and the male (at one nest) took a more active part in feeding and caring for the young. When one brood of two had left the nest, the male cared for

the one the farther from the nest, and doubtless as Mrs. Nice believed, the first one out, while the female cared for the other. Mrs. Nice noted also the slow rhythm of the Oven-birds in feeding, as compared with other warblers. Later ('32) she tabulated the brooding periods and the feeding rate of ten species of warblers, and found that the Oven-bird had the longest brooding period and slowest feeding rate of any.

Herrick ('10) states that the Black-billed Cuckoo's brooding reaches a climax when the young are about three days old, then shades off into intermittent brooding. In great heat the parent will sometimes stand instead of sitting on the nest. Also the parent will rise to accommodate the strenuous young, which seem never to rest, but burrow about constantly, uttering their low grating notes in chorus and poking out their heads. He states ('05) of feeding in general that strict economy is practiced, not a crumb being allowed to go to waste. One young Black-billed Cuckoo climbed a foot or more from the nest and returned. After the first young bird had left the nest, the male seldom if ever visited the nest, but gave his attention to the bird outside.

Sanitation, as observed in various species of passerine birds, is quite uniform. Herrick ('05) says, "The instinct of inspecting and cleaning the nest is mainly confined to the great passerine and picarian orders. . . . Shortly after being fed, the nestling becomes very uneasy, and raises its body as if to drop the sac over the edge of the nest. The old bird follows every movement, snaps up the package as it leaves the body, and either swallows it immediately or carries it off." He thinks that parents eat the feces to satisfy hunger, an idea supported by Pickwell ('31), who found that the Prairie Horned Lark ate more feces in early spring than later when food was more plentiful.

According to the observations of Howard ('07-'14), McClintock ('10), Gabrielson ('13), Bigglestone ('13) and others, there are from three to six feedings for every excretion, and excreting in nearly every case follows feeding. Mousley ('26) noted the tendency of the male Oven-bird and the males of several other species to carry the excretions away rather than eat them. Birds which carry excretions away have a habit of wiping their bills afterwards.

According to Kretschmer ('26), the behavior of the male Oven-bird that fell over backward in the receiving cage would be a "sham-death reflex", which he defines as a reaction in which the animal remains rigid and motionless until stimulated by touch or shaking.

The method used in training the Oven-bird to use the itograph was essentially the same as used by Kendeigh and Baldwin ('30), except

that they studied only birds with young in the nest, while in the present work recording was begun as early as the second day of incubation.

Stanwood ('11) found that young Oven-birds remained in the nest approximately eight days. Excreta which she found in front of the nest indicate that the young had not been attended previous to their leaving.

Gabrielson ('13) noted that when two young Brown Thrashers were in the nest and two out, the parents exchanged duties in caring for the young. The female did most of the feeding at the nest, however.

Pickwell ('31) says of the young Prairie Horned Larks that they leave usually by following a parent which has just brought them food. In one case he saw a female coaxing a last young bird out of the nest by holding food before it.

Young birds leaving the nest on account of fright and their unwillingness to remain in the nest after once out are well known. Examples are the Chestnut-sided Warbler (Herrick, '05), Black-billed Cuckoo (Herrick, '10), and the Goldfinch (Mousley, '30). This method of leaving must save the lives of a few birds, but the loss is necessarily heavy.

Young Birds After They Have Left the Nest

From the time the young emerge from the nest until they are ready to leave the woods, they pass through four rather distinct stages, which are as follows:

I. Hopping Stage, 8-11 days of age.
II. Early Flying Stage, 11-20 days of age.
III. Semi-dependent Stage, 20-30 days of age.
IV. Independent Stage, 30-40 days of age.

Hopping Stage, 8-11 days. Young birds hop when leaving the nest, going nearly as fast as a person walks. They stop frequently, often under any slight cover of vegetation that is at hand, but they do not creep under any object. They sit so closely, and their color so nearly resembles that of the leaf carpet, that the finding of a young bird at this stage is difficult. The chirping of the parent is a good general clue, but parents will not go to the young if a person is near, unless the young get hungry and begin to peep. One female kept on the opposite side of me from where a young bird was located when I was looking for it. If the young is flushed, the parent tries to lead it away, but leaves it the moment it becomes quiet. Young birds are kept separate at this time, if the parent is caring for more than one.

and the parent remains with the young bird only long enough to feed it, unless perchance he tries to lead it out of danger. Under favorable conditions young birds, especially those attended by males, may remain in practically the same place for several days after leaving the nest.

A brood of four young birds, which left the nest at seven days, were detained in a trap for three days, so that their behavior might be studied (See page 185). The trap was placed over the nest several days before the young left the nest, and the parents learned to enter and leave readily. When I arrived one morning all of the young were out of the nest, and the parents were trying frantically to lead them away. Failing in this, the parents gradually settled down to routine feeding. They tried repeatedly to feed the young through the netting, and sometimes succeeded, especially at the funnel where the mesh was a little larger.

The young were unable much of the time to distinguish their parents from their brothers or sisters, and consequently often refused food from the parents, or begged it from the other young. This confusion resulted from the young being kept together when they naturally would have been separate. The parents fed those which were calling perhaps more than those that were still, but sometimes seemed to go deliberately to those that were tired and quiet. When the young did not take the food readily, the parent would square itself around in front of the young bird and move its mouthful of food from side to side, as a Robin does, to attract attention. If this failed, the parent went to another bird.

The female once dropped a bit of food through the netting in the bottom of the trap and spent about two minutes trying to get it. She turned quickly from side to side, sometimes describing nearly a complete circle. Later the male spied the same morsel and spent about a minute trying to get it, but finally gave it up.

Parents as a rule paid no attention to excrement. Once a young bird, after being fed, turned around and excreted, whereupon the male took the excrement and flew out. The behavior on the part of both was apparently the result of confusion on account of the trap.

The young hopped at first, and when resting, placed the tarsus flat on the ground. By the third day they took steps about half of the time. They were quite agile, and could easily hop over their fellows. Sometimes one would hop completely over its astonished parent, as the parent approached with food. Much of the time the young birds seemed more concerned with escaping than obtaining food. One

favorite action was to jump and flutter up the side of the trap in an effort to escape. On the first day they could jump fifteen centimeters, the second day eighteen, the third day twenty-five, and on the morning of the fourth day they flew over the top, which was thirty-three centimeters high. Three of them were gone when I arrived, and in a few minutes the fourth flew to the top of the trap, poised for a moment and flew down outside, where it was led away by the female.

Early Flying Stage. 11-20 days. Young birds are still kept separate at this stage. They are able to fly, due to the unsheathing of the wing feathers, and when flushed they fly from five to thirty meters at a time. They usually alight on the ground, often behind a tree or stump from the observer, but may alight as much as four or five meters from the ground, on a limb or the side of a tree. If a person follows one of these birds, it flies readily when one comes within two or three meters of it, and eventually goes around in a circuit, coming back near the original location. This habit was noted first in 1934, and during the following season it was tested several times, always with the same result. One young bird but eleven days old flew, ran, and hopped for seventy meters, over the edge of a hill into the creek bed, then returned to within two meters of the place where it started. The female followed a part of the time and tried to entice it with food, but it paid little attention to her.

If the birds are not crowded too much when the young is flushed, the parent will walk along and the young one follow, being encouraged by an occasional feeding and by the parent calling. One male used the "teacher" song repeatedly when trying to coax the young bird away. If the young bird alights in a tree under such conditions, the parent will endeavor by calling and by example to coax it down. One male flew two different times from near a young bird to the ground, trying to get it to follow.

Semi-dependent Stage. 20-30 days. This stage begins when the young bird starts to pick up food for itself. The typical scene at this time is one or two young birds accompanied by a parent, walking about within a few meters of each other, picking up food. The young bird's efforts are supplemented by those of the parent, which occasionally gives the youngster an extra feeding. A person can usually approach to within a few meters of the young, but the parent gradually leads away from the supposed danger. If crowded too closely the parent will fly away without the deep concern exhibited earlier, and the young will follow. Although the parent and young are fre-

quently found together at this time, the association is not a constant one, and parents, especially singing males, may often be seen alone in trees, and an occasional young bird may be found alone. Early in this period the young birds begin the post-juvenal molt, which is quite conspicuous around the neck.

Independent Stage. 30-40 days. This stage begins when the parents leave the young, and the young must shift for themselves. The time may vary as much as several days, since it is dependent on the parent as well as the development of the young. Parents ordinarily leave the woods at this time, but one and perhaps two exceptions were noted. The time of leaving is apparently more variable with the males, since it is associated to some extent with the defence of territory. In one case where no apparent pressure other than migration influenced the parents to leave, a male and female, each caring for two birds in different territory, remained with the young until they were twenty-eight days old. The fact that they left the woods at the same time indicates that the physiological cycle was well timed. (See p. 196 for time parents leave).

Independent young birds wander about picking up food, and appear to be perfectly contented. They may be alone, or two or three together, or one or more may follow another parent with semi-dependent young. The parent in this case pays no attention to the extra birds. Young birds associated together do not necessarily represent members of the same brood, as banding has shown. These birds sometimes show a playful spirit where two will pursue each other and describe small circles as they whirl rapidly through the air.

The stage ends when the young have attained their full first year plumage, which makes them look exceedingly prim compared with the molting adults. The young birds are now physically ready to migrate, and some may do so, but others remain for some time.

Literature. Pickwell ('31) noted that young Prairie Horned Larks did not run but hopped, a performance which he thought might be an ancestral trait. Young Prairie Horned Larks can not fly when they leave the nest, but at five days can fly 100 yards. Parents find the young out of the nest by seeing them rather than by hearing them.

Welter ('35) says that young Long-billed Marsh Wrens, when they first leave the nest, run along the ground, and hop or half fly from one flag to another. The male aids in the feeding, though he does not help while the young are in the nest. Parents feed the young for at least two weeks, but the young help secure their own food after

the first ten days. Young birds of a brood remain together as late as September, and wander about in search of food.

Departure in Summer and Autumn

The adult Oven-birds disappeared from the woods in nearly every case, as soon as the young were old enough to care for themselves. The disappearance of the males was much more noticeable, since they began leaving before singing ceased, and because they more commonly remained in their own territory until time to leave the woods.

There was a great variation in the time the parents left the woods, due to difference in success in rearing young. The earliest record for leaving was that of two males which were seen last on July 5. On that day one of these males entered the other's territory, perhaps attracted by a wandering female caring for a young Oven-bird and a Cowbird. The owner of the territory sang, but made no effort to expel the intruder. The young of the intruding male were twenty-eight days old, and that of the owner, twenty-six days. Apparently the instinct to defend the territory had become so weak that it no longer functioned, and to remain without defending it was undesirable. Neither of these males was seen again.

Another male was seen last on July 9, in his own territory, caring for a young bird, thirty-one days old. A female was seen last on July 10, at the south end of the woods, in company with a young bird thirty-one days old. Still another male was seen last on July 18, when a neighboring male entered his territory. His young at this time were thirty-seven days old. The male and female mentioned on page 195 were seen last on July 31, when the young were twenty-eight days old.

The latest adult seen in the woods was the male which reared young of two broods to the independent stage. He was seen last on August 26, caring for a belated young bird about twenty-six days old. This male had not sung since July 25, and was in the midst of molt, with all of his tail feathers out. He was the only adult seen after July 31, in the 1934 season. The last adult seen in 1935 was a female seen on August 15, caring for a young bird twenty-seven days old.

The earliest of the young Oven-birds attained their first year plumage about July 15, and were then able to migrate. Those of later broods matured during the latter part of July and in August, and one as late as early September. In 1934, which was a hot, dry season, young birds left the woods almost as soon as they were able, and the last two of the season were seen on September 2. In 1935, however,

the weather was more nearly normal, and some appeared to be in no hurry to go. Four birds in first year plumage were seen on September 3, one of which wore a band, and was at least forty-five days old. A part of this group remained and one or two birds were seen frequently through September in the same locality. When I would come upon them, they would usually fly up to a perch and perhaps approach to satisfy their curiosity, then go on with their feeding, or, if crowded too much, they would fly off some distance and light in trees at considerable height. Young birds were seen occasionally in other parts of the woods, and the last of the season was seen on October 2.

There was little direct evidence as to the course the birds took when they left the woods. In a few cases birds appeared to go to the south end of the woods then disappear, but the evidence was not very conclusive. When the first birds began to disappear in 1934, I looked carefully around a small lake a mile away which was the nearest body of water, but no Oven-birds were found. It was obvious that no large number of birds were migrating through the forest, for the birds from the remainder of the immediate forest would easily account for all of the unbanded birds seen. It is probable that birds leaving the forest start immediately on their southern journey, and that they keep in the open rather than in thick forests during migration.

Literature. Butler ('97) noted the early disappearance of the Oven-birds in July and August, during dry seasons, and stated further that they might be seen singly or in little flocks, making their way southward during August, and occasionally in September and early October.

Wood and Tinker's records for the Ann Arbor vicinity from 1907 to 1930 show that the Oven-bird was recorded for the last time in the season at various times in September, on October 2, 4, and 9, and on November 13. The last record was probably of a bird which had been unduly delayed, and the three October records may be regarded as the last normal ones of the season. All of these late birds were probably young ones.

Reproduction and Survival

Success and Loss. In calculating the success and loss in reproduction, it was necessary to count the females only, since double and subsequent matings made the relation of pairs too complicated for practical consideration. The number of males involved was known to be one less than the number of females in 1935, and perhaps was one less in 1934. Males and females doubtless occur in about equal

numbers in the species, but this ratio did not quite hold true for the area studied.

The table below gives the data and the calculations in percentages for cases followed through the season. The numbers given for the eggs and young are approximately correct, but were estimated in a few cases. The estimation of the number of young birds that left the woods was based on the number of young birds seen accompanying the various parents, and is believed to be fairly accurate.

	1934	1935	Total number	Total per cent
Breeding females	13	11	24	
Eggs laid	80	81	161	100
Young hatched	57	45	102	63.4
Young fledged	42	28	70	43.5
Loss of eggs and young from nest	38	53	91	56.5
Taken by predators	13	25	38	23.6
Loss to Cowbirds	13	16	29	18.0
Broken eggs	3	3	6	3.7
Infertile eggs	3	3	6	3.7
Interference of study	3	1	4	2.5
Crushed by truck	....	2	2	1.3
Apparent suffocation in nest	1	....	1	.6
Unknown cause	2	3	5	3.1
Loss of eggs per day (15 days)	....	....	....	2.5
Loss of young per day (8 days)	....	....	....	2.5
Loss of young after leaving the nest	18	13	31	19.3
Young leaving the woods	24	15	39	24.2
Young per female leaving the woods	1.8	1.4	1.6	
Theoretically perfect production of five young per female leaving woods	65	55	120	100.0
Success of season in relation to perfect production	24	15	39	32.5
Females unsuccessful in rearing young	1	4	5	20.8

Although the 1934 season was hot and dry, it proved to be a better season for the Oven-birds than the following one. The increased loss in 1935 was due chiefly to the Cowbird and predators, and apparently was not correlated with weather conditions. The 1934 season was perhaps better for insect food, but this did not seem to be a determining factor.

Enemies. (See list of animals, p. 164). The adult Oven-birds under observation escaped rather well, considering the potential dangers. One female was caught on the nest, near the close of the study in 1936. Many feathers were found in front of the nest, but the eggs were not disturbed, except one was cracked.

Many nests were disarranged or torn out, often before they were finished. In 1936, three nests built by the same female were torn out in one part of the woods, and in another part four nests built by one female were destroyed in succession, and the female mentioned above

was eaught on her seeond nest, after having the first nest torn out. This tearing out of nests was believed to be the work of the Barred Owl, whieh probably diseovered the nests by seeing the females enter. Barred Owls were seen at different times in the woods, and aroused great exeitemet and fear in the parents when they were near a nest. (See p. 184). A fluffy feather of an owl was found a meter or so from a freshly destroyed nest.

The loss of many eggs and young was attributed to the red squirrel. In a number of eases a part of the eontents of a nest disappeared, and later the remainder was taken at one or more visits. At one nest, three out of four eggs disappeared just before noon, and I deeided to wateh for the robber to return. I remained until dark, and returned again early the next morning. About 6:00 A. M. a red squirrel eame to the nest, got the remaining egg and started off with it. When I approaehed, it ran up a tree and ate the egg, holding it in its paws as it ate. At another nest whieh eontained only a Cowbird nearly ready to leave, a red squirrel suddenly appeared on a tree, head downward, just above the nest. It hesitated a moment until the Cowbird gave the food eall, then seized it by the head and ran away with it. Red squirrels evidently diseover the nests by aeeident, as they run about looking for food. The Oven-birds often ehase them away from the vicinity of nests, or the loss would be mueh greater.

One nest was robbed of young by a mammal whieh left hair resembling that of a gray squirrel. Another was robbed just before hatehing by a larger, noeturnal animal, whieh mashed down the grass as it eame and left. This may have been a skunk or raecoon. One skunk was seen within the area, walking about in seareh of food, and perhaps this speeies was responsible for some of the losses. There was little evidenee during the study that any predator, sueh as the skunk, followed my trail from one nest to another.

A house eat was seen watching for birds a few times at the edge of the woods, and onee was seen walking along a road within the woods. It passed within two meters of a female Oven-bird on a nest, whereupon the male set up a ehirp and followed it, but stopped and sang when it was twenty-five meters away. It is doubtful whether it took any Oven-birds.

Two nests were badly infested with mites. In one of these, whieh eontained two Cowbirds and four Oven-birds, the infestation was espeeially heavy, but apparently all of the young left the nest safely. Mites, pale in eolor instead of red, were still in the nest forty-six days

after the young left. In the other nest two of the young died, but their death may have been due to other causes.

Snakes, which in some cases are enemies of birds, probably did no damage here. A few garter snakes were seen in the woods, only one of which was mature in size.

Little is known of what became of the young birds which were lost after they left the nest. I once saw a red squirrel spring toward a young bird, but whether or not it was springing at it was not clear. The bird was old enough to fly well and lost no time in getting out of the way.

The Cowbird of course is an enemy, but it will be discussed under a separate heading.

Literature. Mrs. Niee ('33b) found that the loss of adult Song Sparrows during the nesting season was 12 per eent for the males and 20 per cent for the females. The percentage of eggs hatehed was 66.5, and the pereentage fledged, 41.5, comparing favorably with the success of the Oven-bird, but the number of young per pair during the season was much greater for the Song Sparrow (4.3), due to additional broods. The greatest loss, 36 per eent, was due to predators, the Cowbird accounting for only 5 per eent. The loss of eggs per day was slightly less than the loss of young (2 per eent and 2.5 per cent). In her review of the literature, Mrs. Niee gives other data for nesting successes, whieh range from 61.1 per cent to 77.4 per eent for hateh-ing, and from 40.5 per cent to 45.1 per cent for fledging. The data on the Oven-bird as well as that of the Song Sparrow come within these ranges. It is interesting, though perhaps not very significant, that the success of fledging in all of these eases falls within the narrow limits of 4.6 per cent of the number of eggs laid.

Barrows ('12) states that, "The Oven-bird suffers mueh from squirrels, skunks, weasels, snakes, and other prowlers, so that the first nest is often broken up and the bird eompelled to lay a second or even a third time. Doubtless this accounts for the fact that the young, or even eggs, may frequently be found late in July or occasionally in August, for we do not think the bird rears two broods as a rule." This observation is true in general, but as shown in the figures above, the Oven-bird has about the same percentage of losses as other species.

The Cowbird

Finding the Nests. Cowbirds frequented the woods but little until the arrival of the male Oven-birds, but after that they were seen and heard often. This may have been due to the fact that the Oven-birds

are among the first hosts to enter the woods, and their arrival puts the Cowbirds on the watch for nest building.

On two different occasions a female Cowbird was seen intently watching an Oven-bird building a nest. Once the writer was sitting in an automobile watching an Oven-bird building, and suddenly a Cowbird appeared on a perch near the nest. She flew successively to the ground, to another perch, and finally to the ground twelve meters away, opposite the opening of the nest. She then approached slowly, taking a few quick steps at a time, and lowering her head as she walked. She stood on a rock ten centimeters high for several minutes watching, then moved gradually forward, remaining so quiet between moves that one had trouble in following her. Only once did she waver from her one purpose of spying on the nest, and that was when she picked up a morsel of food . When she had watched for twenty-two minutes, and had reached a point 4.5 meters from the nest, she suddenly rose, and with the customary call for the male, flew off to a distant part of the woods. She showed no fear of me as I sat in the automobile, though I was but ten meters away, nor did her presence or leaving seem to bother the unsuspecting Oven-bird in the least.

On another occasion a female Cowbird was seen watching a nest which was under construction, and the male Oven-bird sang from a perch just above her. Two facts seem obvious from the above behavior. First, the Cowbirds discover the nests by seeing the female building, and secondly, the Oven-birds do not recognize the Cowbirds at sight as enemies. (See p. 207).

Egg Laying. The Cowbird's eggs were laid early in the morning, and on two occasions the writer witnessed the laying. On May 23 a Cowbird's egg was laid in a nest with a first Oven-bird's egg, and during the day the Oven-bird's egg disappeared. Expecting a second egg, I set up a blind five meters away, and was in it dawn the next morning. At 4:55, still twenty-seven minutes before sunrise, I heard a flutter of wings, and two minutes later a female Cowbird flew to the ground not far from the nest. She looked all around, walked to the nest and paused for a minute, then quickly entered. She turned her head to the left, then outward, and sat down, but her body more than filled the nest. In a few moments she raised up and, half standing, spread her wings slightly as if straining. She flew from the nest immediately after this, about one minute after she entered, leaving an egg. Six minutes later I looked up from my note writing, and the female Oven-bird was on the nest. She remained one hour in laying, as opposed to the Cowbird's one minute.

On the following morning while watching from a blind at another nest, I saw a female Cowbird depositing an egg, within two minutes of the same time of day as the first. She likewise lit on the ground near the nest, this time about three meters away, but while she was hesitating, the female Oven-bird came and entered the nest. In a few moments the Cowbird approached the nest from the rear, walked around the side and appeared in front of the entrance. The Oven-bird left with a screech, and the Cowbird, not dismayed in the least, entered the nest. She had more room in the nest than the previous Cowbird, and was entirely inside except her head. She left in about thirty or forty seconds, being hurried in laying perhaps by the Oven-bird, which tried in vain to frighten her off. This nest then contained two Cowbird's eggs, but the Oven-bird had not laid yet, though she had sat on the nest on the previous morning. She did not return that day, but sat on the nest again on the following day, and laid on the next day after.

The time of day of laying at a third nest corresponded closely with these two cases. On July 4, I arrived at a nest at just 5:00 A. M., and a Cowbird's egg had already been laid. The data indicate that the Cowbird is in the habit of laying before the Oven-bird lays, and does not hesitate to drive the Oven-bird off if she gets in the way.

Usually the Cowbird's eggs were laid during the laying period of the Oven-bird (Figs. 10-20). Extreme cases, however, were three days before the first Oven-bird's egg was laid, and three days after incubation began (Figs. 18 and 20). Only a single Cowbird's egg was laid in any nest during one day.

The number of Cowbird's eggs laid in nests varied from one to four, with an average of 1.8. Ten nests received one egg each; eight nests, two eggs; two, three eggs; and two nests, four eggs. However, not more than two eggs hatched in any one nest. The entire number of nests parasitized was twenty-two out of a total of forty-two which received eggs, or 52 per cent. Early nests were parasitized more than late ones. (See table, p. 206). This was due apparently to the early laying period of the Cowbird, and also to the presence of more nests of other species later in the season. The most common other probable hosts in the woods, in the approximate order of their frequency, were the following: Red-eyed Vireo, Wood Thrush, Eastern Cardinal, Red-eyed Towhee, Scarlet Tanager, and Indigo Bunting.

Removal of Eggs. Time after time I noticed the disappearance of eggs during the day, from nests in which Cowbird's eggs had been laid in the morning, or were laid on the following morning (Figs. 10-

20). On two different occasions when conditions seemed right for the disappearance of an egg, I went to get a blind so that I could watch, only to find on my return that an egg had already been taken. At one of these nests upon my return, a female Cowbird called from a perch near by, as if scolding me for encroaching on her domain. At the third nest, I was more successful (Fig. 13). The first Oven-bird's egg was laid there on May 26, and on the following morning another Oven-bird's egg and a Cowbird's egg were laid. Conditions being favorable here for the taking of an egg, I set up a blind 4.5 meters from the nest and began the watch at 7:45 A. M. At 9:01 a female Cowbird lit at the side of the nest and paused a moment standing on the edge of the nest. She then walked around in front, reached deeply into the nest, secured an egg and flew away with it. I looked out at the side window and saw her still going, about thirty meters away. Her bill appeared to be sunk deeply into the shell. As usual none of the egg contents was found in the nest.

At another nest, I happened upon a female Cowbird accidentally, as she was taking an egg. I was about fifteen meters away as the Cowbird approached a nest, which contained two Oven-bird's eggs and a Cowbird's egg. She flew nervously to three or four perches, then down to the ground within a meter or two of the nest. She was then behind the shrubbery from me, and I approached to within ten meters of her. After twenty or thirty seconds she flew from the region of the nest with an Oven-bird's egg in her mouth, and alighted in a roadway fifteen meters from the nest, where she proceeded to eat the egg. I watched her through binoculars as she chewed up the shell, and I approached to within ten meters of her before she finally grabbed a piece of shell and flew. A small amount of egg-white was found in the nest and on one of the remaining eggs, but the nest was not deserted. Two other nests in which some of the egg contents leaked out were deserted by the Oven-bird.

On one occasion while I was watching for an egg to be taken, the female Cowbird arrived at 8:22 A. M., lit on a perch within four meters of the nest, then flew to a second and third perch in a semi-circle around the nest. She apparently was disturbed by the blind, however, and left without going to the nest. I watched a little longer, then removed the blind, but she did not come back. This was the only parasitized nest under observation where the full clutch of Oven-bird's eggs was retained for incubation. One egg failed to hatch, however, and a full brood was not obtained (Fig. 14).

During the investigation approximately thirty Oven-bird's eggs disappeared from nests during the laying period, under circumstances which indicated that the Cowbird had taken them. Nor was the Cowbird always discriminating, for in addition to these, four eggs of her own species were missing under the same circumstances. The number of eggs of the host taken was 75 per cent of the entire number of Cow-bird's eggs laid, or if the four Cowbird's eggs are included, the number was 85 per cent of the number laid. In nests not parasitized only a single egg was known to disappear during the laying period, and a Cowbird may have taken that.

Concerning the relative time when eggs were taken, as nearly as could be calculated in twenty-three known cases, ten eggs disappeared on the day before the Cowbird's eggs were laid, ten on the same day, and three on the following day (Figs. 10 to 20). Data in eight instances all show that the eggs were taken in the forenoon. The earliest was before 7:15 A. M., and the latest between 9:30 and 11:15. One other disappeared after 10:35, and may have been taken in the afternoon. In no case was there any evidence that an egg was taken at the time a Cowbird's egg was laid.

Incubation and Hatching. The incubation period of the Cowbird's eggs ranged from approximately 11.1 days to 11.8 days, with an average of 11.6, which is 0.6 of a day less than the average for the Oven-bird's eggs. This difference in incubation time gives the Cowbird a slight advantage over the Oven-bird from the start.

When a Cowbird's egg hatches, a half shell sometimes slips over the end of an Oven-bird's egg and remains there. This, however, does not interfere with the hatching of the Oven-bird's egg. The female Oven-bird usually eats the shells, but in this case she leaves them.

Young Cowbirds. Cowbirds are easily distinguished from the Oven-birds at hatching time by their large size, light colored down, and characteristic shape of the beak. Difference in size is more noticeable as they grow older. At hatching time the weight of the Oven-bird is 81 per cent of that of the Cowbird, but when they leave the nest it is only 53 per cent, the Cowbird averaging at that time 26.6 grams.

A difference in activity and instinctive behavior between the species is evident quite early. Cowbirds are able to peep as well when hatched as Oven-birds are at three days, and can call more loudly throughout the period in the nest. They also vibrate the head more while calling for food, which gives them some advantage. In other ways, however, the Cowbirds are slow or poorly adapted. They

continue to reach toward the top of the nest for food for two or three days after the Oven-birds are reaching toward the door, and they do not turn the rear toward the door in excreting, or rotate in the nest. They continue to sit firmly after the Oven-birds are able to stand up and move about, and remain in the nest about one day longer than the Oven-birds.

The foster parents, as far as they are able, give the Cowbirds as good care as they do their own young. In fact they seem to give them more attention about the time of leaving the nest, perhaps on account of their awkwardness and greater size. The inability of the Cowbirds to obey the alarm call of the parents may account for the fact that if predators begin taking young from the nest, the Cowbirds are among the first to go, however, size and position in the nest may be factors here also. After the young leave the nest, the Cowbirds are prone to fly up to a perch above the ground. This is quite disconcerting to the foster parents, which like to keep the young on the ground until they are able to care for themselves.

Injury to Host. The loss of Oven-bird's eggs and young, attributed to parasitism, was about 18 per cent of the entire number of eggs laid, but as some nests were deserted and later replaced, the loss was only about 13.5 per cent of perfect production. Since a loss of twenty-nine eggs and young was attributed to the Cowbird in cases followed through the season, and only ten Cowbirds were fledged, the loss was approximately three Oven-birds for each Cowbird fledged. The chief loss was in the removal of eggs from nests, and sometimes in prolonging the nesting period, thereby increasing the danger from other sources.

There were five cases of nest desertion by the Oven-bird directly traceable to the Cowbird. Two of these apparently were due to broken egg contents, two to the Cowbird's laying first, and one to the excessive taking of eggs. Desertions under these conditions do not necessarily mean losses, for the females ordinarily build other nests and lay again.

Strangely enough, with only one exception, the growth of the Oven-birds in parasitized nests was approximately equal to that in normal nests, as shown in Figure 7. In the one exception a single Oven-bird in a nest with two Cowbirds appeared weak from the start, and when it was of the age that it should have left the nest, it was found on its back in front of the nest dead. It is possible that if a greater number of broods were weighed, a slight difference would appear, since the non-parasitized broods which were weighed did not

do especially well. With the Cowbirds consuming large amounts of food, it is obvious that the rate of feeding must be increased if the Oven-birds are to hold their own. The parents usually provide the necessary increase, and also distribute the food well, so that the Oven-birds suffer but little if any. Nests with two Cowbirds fared approximately as well as those with one, and one nest fledged two Cowbirds and four Oven-birds, in spite of the fact that it was badly infested with mites.

Reproduction and Survival of the Cowbird. The table below shows the seasonal time of laying for the Cowbird. The dates for 1935 and about one-third of those for 1934 are exact, and the remainder in nearly every case are within one or two days of the exact date. The laying in 1935 was later on account of the Oven-bird's season being delayed by weather conditions. The figures, especially those of 1935, show that at least three females were involved in the laying each season, since at different times three eggs were laid on the same day. It is quite possible that there were more than three, since eggs are known to have been laid in the nests of at least one other species, but the Oven-bird, nesting comparatively early, doubtless received most of the first eggs.

		1933	1934	1935			1933	1934	1935
May	20	....	2	....	June	14	....	....	....
	21	....	3	....		15	....	....	....
	22	....	1	....		16	....	....	....
	23	....	3	1		17	....	....	....
	24	....	3	2		18	....	....	1
	25	1	1	2		19	....	....	....
	26	....	1	....		20	....	....	....
	27	....	2	3		21	....	1	....
	28	....	1	3		22	....	....	....
	29	....	....	1		23	....	....	....
	30	....	....	1		24	....	....	....
	31	....	....	1		25	....	....	....
June	1	....	....	1		26	....	....	....
	2	....	....	1		27	....	....	....
	3	....	....	....		28	....	....	....
	4	1	....	....		29	....	....	....
	5	....	....	1		30	....	....	....
	6	....	....	....	July	1	....	....	....
	7	....	....	....		2	....	....	....
	8	....	....	....		3	....	....	....
	9	....	....	....		4	....	....	1
	10	....	....	....		5	....	....	....
	11	....	....	....		6	....	....	1
	12	....	....	....			—	—	—
	13	....	....	....		Total	2	18	20

From the forty eggs laid, twenty-two young were hatched, ten left the nest, and at a liberal estimate not more than five left the woods.

This leaves a survival of only 12.5 per cent of the number of eggs laid, compared with the 24.2 per cent of the Oven-bird. If each female laid eight eggs, which is about the highest number one could allow according to the table, the production at the same rate would still be only one young bird per female, compared with the Oven-bird's 1.6. One must conclude from the data that the survival rate of the Cowbird in Oven-bird's nests, either for the number of eggs or the number of parents involved, is rather low.

It probably is significant that in each of the two cases where a female Cowbird was seen watching an Oven-bird building a nest (p. 201), a Cowbird's egg was laid just five days later. These eggs might well have been laid sooner, as far as nest conditions were concerned, for in each case the egg was laid on the same morning as the third Oven-bird's egg. At another time two females were seen near a nest where a female Oven-bird was building, and a Cowbird's egg was laid four days later in the empty nest. At a fourth nest a Cowbird, whose sex was not ascertained, was flushed from a bush near where a female was building, and four days later an egg was found in the hole from which the nest had been torn. There is a possibility that this egg might have been laid on the previous day but probably not. This data showing the relation between the watching of the nest building and the laying of eggs, lends support to the view that the development of eggs in the ovary of the Cowbird is stimulated by the sight of nest building, and indicates that the first eggs are laid four or five days later. In fact I can see no other way to explain the delicate timing between the parasite and host, for the maturing of the eggs of the two species at the same time from May 23 to July 6 by mere chance is incredible. Moreover, the nest parasitized in July was bounded on three sides by nests parasitized in May, and probably one of the same females did the laying. A more plausible explanation seems to be that just as the Oven-bird, when the occasion demands, can produce additional eggs in five days, so can the female Cowbird, upon seeing a nest under construction, produce eggs to lay in that nest, and perchance other nests that may be in the right stage. For the cause of egg production in either case, we must look to the endocrine glands, which appear to be stimulated first by the mental condition of the bird, and later, no doubt, by copulation.

Literature. The heavy parasitism of the Oven-bird by the Cowbird was noted by Wilson (1831), and has been mentioned by many observers since. Jones ('88), Norris ('92), Hess ('10), Hicks ('34), and others have given data showing the extent of the parasitism, which

ranged from 20 per cent to 100 per cent of the nests observed. Hess found a female Oven-bird incubating seven Cowbird's eggs only. He states also that he repeatedly found as many eggs of the rightful owner lying on the ground under the nest, as he found Cowbird's eggs in the nest, referring here to nests of species in general.

Friedmann ('29) noted that Cowbirds remained in their territory more closely after the first of May, when other birds began to nest. He observed them watching nest building, and saw one lay an egg, but doubted whether they took eggs regularly from nests. He thought that each female laid four or five eggs on successive days. He gave the incubation period as ten days, the time in the nest as nine and one half days, and the average weight at leaving as thirty-three grams. He described the young and their inability to obey the danger calls of the foster parents, and found the presence of young Cowbirds in nests usually fatal to the young of the hosts.

Mrs. Nice ('33-'34) found that when Cowbirds came near a Song Sparrow's nest, the sparrows became alarmed, so that if there was any watching of nest building it was necessarily done from a distance. She concluded from the egg types that each female Cowbird laid three series of eggs, with from six to twelve day intervals between. The first series contained five or six eggs, and later ones perhaps less. In about one-fifth or one-fourth of the nests where Cowbird's eggs were laid, an egg of the host was removed, and twice she saw a female Cowbird take an egg and eat it. The incubation period of Cowbird's eggs in Song Sparrow's nests is eleven or twelve days. One Cowbird can be raised with little effect on the Song Sparrow's brood, but two Cowbirds greatly reduce it. Each Cowbird was raised at the expense of about one Song Sparrow. The number of young Cowbirds fledged was 36.8 per cent of the total number of eggs laid, as compared with the 25 per cent in the Oven-bird's nests.

Hicks (Mss) thinks that the female Cowbird lays as many as sixteen eggs in a season, that the number of young per pair is much greater than I have figured, and that the Oven-bird accordingly is a favorable host.

Craig ('13) found that ovulation could be induced in doves and pigeons by various means. Chance ('21, '22) believed that it was induced in the European Cuckoo by the sight of nest building, and that an egg matured five or six days later. Friedmann states that ovulation is induced in "some of the Cowbirds" in the same manner. It seems quite likely that the Cowbird has regular cycles of laying that

it goes through where nests are numerous, and this condition may be modified where the number of nests is limited. Probably in either case ovulation may be stimulated by the sight of nest building.

Summary and Conclusions

The male Oven-birds which breed locally are among the first to arrive in the spring, and practically all of the males of the vicinity arrive within a few days unless delayed by weather conditions. Old residents ordinarily go to their former territory, and the new ones occupy the remaining space. The first females noted in the study arrived from nine to fourteen days after the first males, but their arrival was spread over a shorter period, and the average time between the arrival of all males and females was about seven days. Females go to their old territory if possible, and the choice of mates appears to be only a matter of chance. The number of breeding birds returning in the following year was twenty-four out of forty-four banded (54.5 per cent), and the number returning the second year was seven out of twenty-two (31.8 per cent). Only one young bird out of sixty-eight which left the nest returned to breed in the area.

Territories varied in size from 0.2 to 1.8 hectares (0.5 to 4.5 acres), and the average population in the area studied was about one pair to each 1.2 hectares (three acres). There is some contention and fighting between males, but no injury was ever noted as a result. Copulation between non-mated birds is common, and in two cases observed males had two mates each.

"Teacher" songs usually have from seven to ten double notes each, but in exceptional cases run higher. The first note ends with an upward inflection, and the second with an accented, downward inflection. The song ends with the accented syllable unless it is fragmentary. The song does not grow gradually louder to the end, but reaches its full volume on about the sixth double note, in an eight or ten note song. No variation in time or pitch could be noted as the song progressed. Singing continued with little change until the males began to leave the woods, which was as early as July 5. Males that remained continued to sing until about July 20, but after that were seldom heard. Only two songs were heard in August.

The season for the "flight" song was practically the same as that for the "teacher" song, or from the time of arrival until July 20. There was an increase, however, about July 1, continuing until July 20. Flight songs were heard occasionally throughout the day, but by far the greater part came in the evening, with a strong concentration

about sunset. Both flight and "teacher" songs stopped sharply ten or fifteen minutes after sunset, and the Crested Flycatcher, Wood Pewee, Wood Thrush, and Cardinal were heard regularly after the Oven-bird had quit for the day. Males were seen only a few times while giving the flight song, and in most of these cases they were pursuing other males. The majority of these songs seemed to come from single places well up in the trees. The "spiral" or "soaring" flight was not seen, though a continuous watch for it was maintained throughout the study.

Nearly all nests were located in or near old roads or other open spaces, and 58 per cent of them were in the open, away from any tree, shrub or bush. There was no correlation between the facing of nests and the points of the compass, over-head lighting, or roads, but there was a tendency for nests to face down slope where the ground was not level.

The female builds the nest, working chiefly in the forenoon, and completes it in four or five days. Nesting material is secured at distances ranging from a few centimeters up to forty meters, and nearly all of the building is done from the inside. Subsequent nests were located from eighteen to sixty-six meters from previous nests, and were built a little more quickly than the first. Several females built four nests in a season, and two probably built at least five.

All eggs were laid in the morning, usually before 7:00 o'clock, and sometimes before 6:00. The number of eggs in a clutch was commonly five for the first, and from three to five for subsequent ones. Females laid as many as ten eggs in a season, but only one laid as many as three clutches. Subsequent nests regularly received the first egg five days after the desertion of the previous nest.

Incubation began on the day before the last egg was laid, and was done entirely by the female. The females were quite regular in their incubating habits, as shown by the itograph records, though different individuals showed considerable variation. The average incubation period was twelve days, 5.6 hours, and differed but 0.6 of an hour in 1934 and 1935. All of the eggs of a clutch had about the same incubation period, and any variation of more than a few hours usually concerned all. No difference in incubation time was noted in cool and warm weather, or in nests containing Cowbird's eggs.

Eggs were pipped from fifteen to twenty hours before hatching, and the crack extended about one-fourth of the way around before

the shell broke open. The female ate the shells, but left the eggs which failed to hatch, in the nest.

Young Oven-birds are more precocial than most passerine birds, leaving the nest regularly at eight days. They learn to reach toward the opening of the nest for food, and turn the rear toward the opening in voiding excrement, at the age of two days. At four days they begin creeping toward the back of the nest after voiding excrement, causing a slow rotation in the nest. Weight increases from 2.1 grams at hatching time to 14.1 at eight days, which is about 73 per cent of the adult weight. Temperature control is developed enough at three days to maintain a constant temperature in the absence of brooding, under usual conditions.

During the first few days after hatching, the female broods with much the same rhythm that she incubated, the brooding instinct reaching the maximum when the young are about one day old. The male comes to the nest after hatching to aid in the feeding, and one male was known to visit the nest four mornings in succession just before hatching. The male is very shy when coming to the nest at first, but the shyness wears off in a few days.

Parents walk from five to eight meters in approaching and leaving the nest at first, but the distance grows less as time passes. They have routes which they prefer, but the one used in leaving is not necessarily the same as the one used in approach. They generally avoid open spaces, keeping under the cover of vegetation.

Food for the newly hatched young consists of geometrid larvae and small earthworms, but later adult insects are added. There was a rather constant rate of feeding throughout the day, but the records showed a marked increase early in the morning, and a slight drop during the afternoon. The increased demand for food as the young birds grow is met by an increase in the size of the feedings, and a gradual increase in the number of feedings.

The relative amount of feeding by each parent varies considerably with different pairs. The male usually feeds more at first while the female is brooding, but later they feed about the same. As a rule each parent delivers its food to the young, but sometimes the female takes food from the male and aids in the feeding.

Parents continue to swallow the fecal sacs to some extent as long as the young are in the nest, but after the second day, they carry some of them away to a distance.

About four or five days after hatching, there is a marked change in the behavior of the parents. In the place of brooding, quietness and tolerance, there are increased watching, chirping and defiance. As the young grow more active, the anxiety of the parents increases, reaching a climax when the young leave the nest.

Young birds normally leave the nest at eight days, on an average. When the first young bird leaves, one of the parents leads it away and cares for it, leaving the remainder of the brood largely or entirely to the care of the mate. Young birds leaving subsequently may be cared for by either parent. When the parents have divided the brood, their family relations are ended, and each goes its own way. The male remains in the home territory, unless it is late in the season, and the female goes into neighboring territory. Young birds may leave the nest on account of fright as early as six and one-half days.

From the time the young emerge from the nest until they are ready to leave the woods, they pass through four rather distinct stages, which are as follows:

I. The Hopping Stage, 8-11 days. Young birds hop at first, but gradually learn to flutter and run. They are kept separate during this stage and the following one, and, if undisturbed, may remain in approximately the same place for several days.

II. The Early Flying Stage, 11-20 days. The young can fly for short distances, up to thirty meters, and if followed will finally make a circuit, returning to the approximate place where they started.

III. The Semi-dependent Stage, 20-30 days. They now begin to pick up food for themselves, but the parent continues to feed them. Young birds may be kept together if the parent is caring for more than one. The post juvenal molt begins early in this period.

IV. The Independent Stage, 30-40 days. The young are left to shift for themselves at this time. They may remain alone, or two or three together, or may follow another parent with dependent young. The stage ends when the young have attained their first year plumage and are ready to migrate.

Adult birds usually left the woods as soon as the young were able to take care of themselves, which was as early as July 5. The last adults to leave the woods were a male seen last on August 26, 1934, and a female seen last on August 15, 1935. Some of the young birds left the woods as soon as they were able, which was as early as July 15, but others remained for some time. The last of the two sea-

sons, 1934 and 1935, were seen on September 3, and October 2, respectively.

Of the total number of eggs laid, 63.4 per cent hatched, and 43.5 per cent produced young which left the nest. The greatest loss was due to predators, and the next greatest to Cowbirds. The number of young leaving the woods was estimated to be 24.2 per cent of the number of eggs laid, or 32.5 per cent of perfect production (five young per pair).

About 52 per cent of the Oven-bird's nests which received eggs were parasitized by the Cowbird, and from one to four eggs were laid in a nest. Female Cowbirds discover the Oven-bird's nests by seeing the females building. Furthermore, it is probable that the development of eggs in the ovary of the female Cowbird is stimulated by the female watching the building of nests, and that the first eggs mature in four or five days. The Cowbirds lay early in the morning before the Oven-birds lay, and on two occasions they were observed from a blind, as they entered and deposited their eggs. They remained in the nests about forty and sixty seconds respectively, and one frightened off the Oven-bird which had entered just ahead of her. Oven-birds do not recognize the Cowbirds as enemies, unless they are very close to the nest.

The female Cowbird usually visits the parasitized nest on the day before, or soon after the laying of an egg, and removes an egg of the host. As nearly as could be determined in known cases, ten eggs were taken before the Cowbird's egg was laid, ten on the same day, and three on the following day. On two different occasions the Cowbirds were seen taking these eggs. The number of Oven-birds eggs removed in this manner was 75 per cent of the number of Cowbird's eggs laid, and in addition four Cowbird's eggs were taken, making the total number removed 85 per cent of the number laid. In all cases where an accurate check was made, eggs were taken in the forenoon. From nests not parasitized, only a single egg was known to disappear during the laying period.

The incubation period of the Cowbird's eggs averaged 11.6 days, which is 0.6 of a day less than the period for the Oven-bird's eggs. When a Cowbird's egg hatches, a half shell sometimes slips over the end of an Oven-bird's egg and remains there, but does no harm.

The loss of eggs and young of the Oven-bird due to parasitism by the Cowbird was estimated at 18 per cent of the total number of eggs

laid, or 13.5 per eent of perfect production. Young Oven-birds in parasitized nests grew approximately as well as in non-parasitized nests, due to their aetivity and early development, and to the favorable distribution of food by the parents. The chief loss to the Oven-bird was in the removal of eggs by the Cowbird, and sometimes in prolonging the nesting period, thus inereasing the danger from other sourees.

Young Cowbirds remained in the nest about one day longer than the Oven-birds, making the total time in the nest about nine and one-half days, whieh is the average in the nests of other species. Although the Cowbirds grew relatively faster than the Oven-birds, their weight when they left the nest was about 20 per eent below the average in the nests of other speeies. The survival rate was low, also, sinee out of forty Cowbird's eggs, only twenty-two hatched, ten birds left the nest, and probably not more than five birds left the woods. In this light the Oven-bird ean not be considered a very favorable host.

TABLE 1.

The number of flight songs heard, and the ten minute intervals in which they were given, during 1934 and 1935. Each dash represents a song.

A. M.		
E. S. T.	4:20 -	12:40
	4:30 -	12:50
	4:40	1:00
	4:50	1:10
	5:00	1:20
	5:10	1:30
	5:20	1:40
	5:30	1:50
	5:40	2:00
	5:50	2:10
	6:00	2:20 -
	6:10	2:30
	6:20	2:40
	6:30 -	2:50
	6:40	3:00
	6:50	3:10
	7:00 -	3:20
	7:10	3:30 -
	7:20 -	3:40
	7:30 -	3:50 -
	7:40	4:00
	7:50 -	4:10
	8:00 - - -	4:20
	8:10 -	4:30
	8:20 - - - -	4:40
	8:30 - - - - -	4:50 -
	8:40 -	5:00
	8:50 - -	5:10 -
	9:00 -	5:20 - -
	9:10 - -	5:30
	9:20 -	5:40
	9:30 -	5:50
	9:40	6:00 -
	9:50 -	6:10
	10:00	6:20 -
	10:10	6:30 - -
	10:20 -	6:40 -
	10:30	6:50 - - - - -
	10:40	7:00 - - - - - - -
	10:50	7:10 - - - - - - - - -
	11:00	7:20 - - - - - - - - - -
	11:10	7:30 - - - - -
	11:20	7:40 - - - - - - - - - - -
	11:30 -	7:50 - - - - - - - - - - - -
	11:40	8:00 -
	11:50 -	8:10 -
	12:00	8:20 - - - - - - - - - - - - - - -
P. M.	12:10	8:30
	12:20	
	12:30	Total 189

Scale: 10 20 30 40

Number of songs heard each month during 1934 and 1935:

April	1
May	43
June	41
July	104
Total	189

Table 2.

A summary of the time which three females spent off of the nest, as recorded by the itograph.

	Day of incubation	3	4	5	6	7	8	9	10	11	12	Av. per day
	Times off nest	----	----	----	----	----	----	----	7	6	9	7.3
No. 9 ♀	Minutes off nest	----	----	----	----	----	----	----	134	124	172	143
	Percentage of total time off nest	----	----	----	----	----	----	----	----	----	----	10.0%
1934	Percentage of daylight time (15½ hours) off nest	----	----	----	----	----	----	----	----	----	----	14.3%
	Average temperature for days specified	----	----	----	----	----	----	----	----	----	----	79.9 F (26.6 C)
	Times off nest	----	----	----	----	----	12	12	13	11	12	12.2
No. 6 ♀	Minutes off nest	----	----	----	----	----	238	234	300	228	218	244
	Percentage of total time off nest	----	----	----	----	----	----	----	----	----	----	16.9%
1934	Percentage of daylight time off nest	----	----	----	----	----	----	----	----	----	----	26.9%
	Average temperature	----	----	----	----	----	----	----	----	----	----	80.2 F (26.8 C)
	Times off nest	----	----	8	10	9	11	9	9	8	11	9.2
No. 15 ♀	Minutes off nest	----	----	133	168	141	158	137	134	142	144	145
	Percentage of total time off nest	----	----	----	----	----	----	----	----	----	----	9.7%
1935	Percentage of daylight time off nest	----	----	----	----	----	----	----	----	----	----	15.0%
	Average temperature	----	----	----	----	----	----	----	----	----	----	58.9 F (14.9 C)
	Times off nest	7	6	5	6	5	7	6	5	6	5	5.8
No. 15 ♀	Minutes off nest	171	169	169	141	132	111	87	104	97	87	127
	Percentage of total time off nest	----	----	----	----	----	----	----	----	----	----	8.8%
1936	Percentage of daylight time off nest	----	----	----	----	----	----	----	----	----	----	13.7%
	Average temperature	----	----	----	----	----	----	----	----	----	----	63.0 F (17.2 C)

TABLE 3.

The total number of minutes which three females spent off of the nest each hour of the day, during the periods recorded by the itograph. The females and hours are the same as in Table 2.

Hour of day	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
No. 9♀ (3 days)	0	49	0	27	15	45	24	5	49	32	26	49	0	22	50	37	0
No. 6♀ (5 days)	38	44	80	67	20	97	78	83	148	22	120	51	103	94	46	69	58
No. 15♀, 1935 (8 days)	15	125	26	88	16	107	33	116	66	56	74	59	60	85	64	106	61
No. 15♀, 1936 (10 days)	0	179	0	64	146	26	80	107	104	40	77	87	54	80	57	107	60
Total minutes per hour	53	397	106	246	197	275	215	311	367	150	297	246	217	281	217	319	179
Total minutes in 3 hour periods	450		549			801			814			744			715		

TABLE 4.

A summary of the number of feedings, as recorded by the itograph, at nest No. 9, which contained four Oven-birds and two Cowbirds.

Hour of day	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	Total feedings
June 3*	0	4	1	3	0	2	2	0	1	3	2	0	1	2	3	2	2	28
4**	0	3	3	1	1	2	2	3	2	2	1	2	2	3	3	2	1	33
5	1	5	4	4	2	3	3	4	2	1	2	4	1	2	2	3	2	45
6	1	3	3	4	2	3	3	3	3	3	4	3	4	6	6	5	1	57
7	3	9	5	7	5	6	5	6	5	6	7	9	5	7	6	5	2	98
8	4	9	9	7	5	8	11	7	10	6	6	6	8	5	7	6	2	116
9	2	10	7	9	12	7	6	8	12	11	10	8	4	6	9	7	1	129
10	1	12	9	6	20	13	12	10	11	13	8	7	9	6	8	11	4	160
11	Oven-birds left nest.																	
Total feedings	12	55	41	41	47	44	44	41	46	45	40	39	34	37	44	41	15	666

12:10
Middle of feeding day.

*All hatched except one Oven-bird.
**Last Oven-bird hatched.

Table 5.

A summary of the approximate number of feedings at four different nests, as indicated by the itograph. The average number of feedings per bird was obtained by dividing the total number of feedings by half the number of birds, assuming that two birds was the average number fed at each trip. In nest No. 9, each Cowbird was counted as two Oven-birds, but this was only an estimate.

Day in nest		1	2	3	4	5	6	7	8	Total fedings
No. 9 nest	Feedings per day	28	33	45	57	98	116	129	160	666
4 Oven-birds	Average per Oven-bird	7.0	8.2	11.2	14.2	24.5	29.0	32.2	40.0	166
2 Cowbirds	Average per Cowbird	14.0	16.5	22.5	28.5	49.0	58.0	64.5	80.0	333
No. 6 nest	Feedings per day	16	17	30	34	43	46	51	67	304
2 Oven-birds	Average per bird	16	17	30	34	43	46	51	67	304
No. 15 nest 1935	Feedings per day	27	32	40	44	65	103	123	114*	548
5 Oven-birds	Average per bird	10.8	12.8	16.0	17.6	26.0	41.2	49.2	45.6	219
No. 15 nest 1936	Feedings per day	20	32	32	30	30	40	44	61	289
3 Oven-birds	Average per bird	13.3	21.3	21.3	20.0	20.0	26.7	29.3	40.7	192

*One young bird was out of the nest in the evening, and probably one parent was doing most of the feeding at this time.

EXPLANATION OF FIGURES

The males found early in the season of 1934 were numbered in accordance with their location, but those discovered later made the numbering somewhat irregular. Females and nests were given the same number as the males. For the birds returning in 1935, the original numbers were retained, and for new males, 20 was added to the number of the male in the territory during the previous year. Where returning males had new females for mates, the females were distinguished by the number of the year. The system of numbers used in the figures is modified somewhat from the original to make it more consistent.

FIGURE 1. Map of the area studied in 1934. The irregular lines not otherwise marked represent old roads through the forest. The dark circles represent nests which produced young Oven-birds, and the open circles, unsuccessful nests. Those connected by lines were built by a single female, in the order indicated by the arrows. The dotted lines show in general the extent of each territory, but they do not necessarily indicate the shape of the territory. One bird, male No. 10, was banded in the previous year near the site of nest No. 13.

The success or fate of each nest was as follows:

No. 2. Six eggs were laid, and all hatched, but only five young left the nest.

No. 2A. The first nest was robbed of first egg, causing desertion. The second nest produced three young.

No. 3. The nest produced three Oven-birds and one Cowbird.

No. 4. The first nest was torn out before it was finished, and the second produced three young.

No. 5. The first nest was found after desertion, and the second produced one Oven-bird and one Cowbird. This Cowbird, according to a later report from the Biological Survey, was killed by a boy with a "nigger shooter" (sling shot) at Crowley, Louisiana, on or about February 24, 1936.

The nests marked X were built by a different female, and it is believed that the male had two mates at the same time. In the first nest the female hatched one Oven-bird, but deserted it when a trap was placed over the nest. The second nest had been deserted when found, and contained a Cowbird's egg. In the third nest, four Oven-birds were hatched, and male No. 5 aided with the feeding, but none of the young lived to leave the nest.

No. 6. The female deserted the first nest after incubating nineteen days, and ending up with a stale Cowbird's egg. The second nest produced two young.

No. 8. The nest was deserted after incubation began, probably on account of a Cowbird's egg, or my presence at the nest while taking pictures. The later history of the pair is not known.

No. 9. The nest produced four Oven-birds and two Cowbirds, the largest brood found during the study.

No. 10. The first nest was deserted on account of broken egg contents left by a Cowbird, and the second nest produced five young.

No. 10A. The nest was torn apart by a predator when the five young were about ready to leave, but at least one young bird escaped.

No. 11. The nest produced five young.

No. 12. The nest produced five young.

No. 13. The nest was deserted on account of the early laying of a Cowbird's egg. The parents apparently left the territory on account of its small size, and their inability to obtain more room.

No. 15. The first brood was taken by a predator, and the second nest produced four young.

No. 17. The nest was found after the brood left.

No. 18. The nest was disarranged and deserted before it was completed. The later history of the pair is not known.

Figure 2. Map of the area studied in 1935. About the same number of pairs was studied as in 1934, but the area was extended a little farther into the forest.

Three adult males, Nos. 5, 9, and 10A of the previous year returned and occupied their old territory. Females 5 and 10A returned and mated with neighboring males, though their old mates were present. Females 2 and 10 also moved to other territory, but Nos. 6, 12, and 15 occupied their old territory and mated with new males.

The success or fate of each nest was as follows:

No. 5. The nest produced two Oven-birds and two Cowbirds.

The X nests were built by female No. 10, which mated with male No. 5 after both had lost their young. The first nest was deserted, but the last produced five young. The last nest was but 2.8 meters from the second nest of female No. 10 in the previous year.

No. 9 (No. 2♀). The first nest was crushed by some animal or person, and the second was deserted for a reason which was not obvious. The third was raided by a predator, and one young Oven-bird escaped, but later disappeared. The female then mated with male No. 23 while his mate was incubating on her last nest, but the eggs of the nest (23X) were taken by a red squirrel. The XX nest, found several days later back in No. 9 territory, perhaps was built by this female, but it produced no young.

No. 37. The eggs were taken from the first nest by a predator just before hatching time, and the young were taken from the second nest just before time for them to leave, on July 9. No more nests were found.

The X nest was built by another female while No. 2 was incubating on her third nest, and produced three young. The male was not seen feeding the young of this brood during the first five days, but he doubtless was interested in them, and it was during this period that female No. 2 mated with male No. 23.

No. 10A. The nest produced three young. The X nest was found late, and its history is uncertain.

No. 21. The first nest was disarranged before it was completed, and the second had been deserted when found. The third was abandoned on account of broken egg contents left by a Cowbird, and the fourth was deserted before it was used. The later history of this pair was not followed.

No. 23. The first nest was deserted on account of excessive laying and taking of eggs by the Cowbird (Fig. 18), and the second nest was robbed of its young by a predator. The third was found after it had been deserted, and the fourth was crushed by a truck after some of the eggs had hatched. There probably were no more attempts at nesting, as the fourth nest was destroyed on July 17. For the 23X nest, see No. 9 above.

No. 26. The nest produced two Cowbirds.

No. 31. The first nest was disarranged before completion, and the second produced three Oven-birds and two Cowbirds. The female lost her share of the brood, and mated later with male No. 5.

No. 32. The young of the first nest were taken by a predator, and the second nest was torn out before completion. The third had been deserted when found, and its history is uncertain. Evidently a brood was finally reared, for the male was seen caring for a young bird late in the season.

No. 35. The nest produced five young birds.

No. 36. The first nest was torn out about the time it was completed, and the second was robbed of its young by a predator. The third nest produced four young.

In 1936, seven of the nine banded males returned and occupied their old territories. Six of the eleven banded females returned, and the manner of mating, is shown in the table below. Those *italicized* returned for the third season after being banded.

Males	Females	
No. *5*	—New	
No. *9*	—No. *6*	Adjacent territory for female
No. *10A*	—New	
No. 32	—No. *12*	Same mates as in 1935
No. 35	—No. *15*	Same mates as in 1935
No. 36	—No. *10A*	Adjacent territory for female
No. 37	—New	
Not banded in 1935	No. 23	Same territory for female. May have been the same male
New	No. 36	Adjacent territory for female

FIGURE 3. Map showing the nests built by the four females which were present during 1934, 1935, and 1936.

The No. 6 female nested two seasons in the same territory, and the third in a neighboring territory, having a different mate each season. The 1936 mate (No. 9 male) was present in his territory during 1934 and 1935. In 1934, the female deserted the first nest after incubating nineteen days and ending up with a stale Cowbird's egg. The second nest produced two young. The 1935 nest produced two Cowbirds only. In 1936, the first nest was torn out before it was completed; the second and third nests were robbed of their eggs; and the fourth torn out probably before it was completed. The later history was not followed.

Female No. 15 nested in the same territory during the three seasons, and had the same mate during the last two seasons. The first nest of 1934 was robbed of its young, and the second produced four young. In 1935 the pair raised five young, and in 1936, three. The itograph was used at the nests of 1935 and 1936.

The No. 10A female changed mates and territories each season, though in both 1935 and 1936 her old mates were present. Her mate of 1936 was present in his territory also in 1935. The nest of 1934 was torn apart by a predator when the five young were about ready to leave, but at least one young bird escaped. In 1935, the eggs were taken from the first nest by a predator just before hatching time, and the young were taken from the second nest just before time for them to leave. In 1936, the first nest was torn out during the incubation period, and at the second nest the female was killed by a predator during the incubation stage. This was the only adult bird killed during the study.

The No. 12 female nested in the same territory during the three seasons, and had the same mate during the last two seasons. The nest of 1934 produced five young. In 1935 the young of the first nest were taken by a predator, and the second nest was torn out before completion. The third was deserted when found, but a brood was finally reared, though the location of the nest was not known. In 1936 the first two nests were torn out about the time of completion, and the third was destroyed during the incubation period. A fourth was destroyed before completion, and the later history of the pair was not followed.

FIGURE 4. This chart shows, by means of graphs, the mean daily temperature during the time of arrival and early nesting of the Oven-birds, for the seasons of 1934, 1935, and 1936, as recorded at the University of Michigan Observatory. The usual signs for male and female show when the birds arrived, those in black (♂) indicating banded birds. The rectangles (□) indicate the beginning of first nests; the open ovals (○), first eggs in first nests; and the black ovals (●), first Cowbird's eggs in first nests.

The records for the arrival of the females and the beginning of nest building are incomplete, since not all cases were observed. Records for first eggs in first nests were diminished considerably in 1935 and 1936 by the destruction of first nests.

In 1934, nearly all of the males arrived during three successive days, in the midst of a warm spell. It was somewhat cooler when the females arrived, but they came close together in point of time, and began nesting in a few days. First eggs in first nests were laid on six successive days, and the time from the arrival of the first male to the laying of the first egg was seventeen days.

In 1935, three males arrived at the beginning of a cold, rainy spell, and no new arrivals were seen for nine days. When better weather finally came, the remaining males arrived, and soon were followed by the females. The weather remained cool, and to a considerable extent cloudy, however, and associated with this were slow nest building and laying. From the time of arrival of the first males to the laying of the first egg was twenty-six days.

In 1936, the arrival of the males was rather gradual, through more than a week of mediocre weather. The females came more at one time, as usual, during a warm spell, and began nesting almost immediately. The time from the arrival of the first males until the laying of the first egg was sixteen days.

Figure 5. Copies of the itograph record. The record of nest No. 6 is shown from the time the itograph was set up on June 25 to the evening of July 1. The first young bird hatched on June 30, and the second on July 1, there being only two in the brood. The male apparently did not come to the nest until July 3, on account of the wire netting (Pl. XI, E), but the young suffered no ill effects. The graphs here are shortened, the length of the original being 1.35 meters, or nearly two meters for twenty-four hours. The upper horizontal line shows the time the female was on the nest, and each dip indicates when she left and returned.

The record of nest No. 9 shows the visits of both parents to a nest containing four Oven-birds and two Cowbirds, the largest brood found during the study.

Figure 6. Chart showing the gain in weight of two Cowbirds and three Oven-birds in the same nest. The Oven-birds left the nest when eight days old, but were kept inside a netting another day for weighing. One Oven-bird was recaptured and weighed when ten days old, and another when fourteen. The Cowbirds hatched one day before the Oven-birds, and left the nest one day later.

Figure 7. Chart showing the average gain in weight of Cowbirds, Oven-birds parasitized by Cowbirds, and unparasitized Oven-birds. There were five Cowbirds in three different nests, distributed 2, 2, and 1, and eight parasitized Oven-birds were in the same nests with these Cowbirds, distributed respectively 3, 2, and 3. There were sixteen unparasitized Oven-birds in four nests, distributed 5, 4, 4, and 3.

Figure 8. Chart showing the development of temperature control in young Oven-birds. Temperatures were taken at five minute intervals (except one day) for thirty minutes, during seven successive days, beginning with hatching. During the first five days, readings followed twenty minute periods of brooding. Temperatures given are the averages for four young birds. The numbers following the dates, indicate outside temperatures in Fahrenheit.

Figure 9. Chart showing three series of temperature readings taken on July 14, when the young birds were five days old.

Figure 10. Chart showing the time of laying and disappearance of eggs from nest No. 5 in 1935. The open circles represent Oven-bird's eggs, and the black circles, Cowbird's eggs. The eggs were numbered as they were laid, and the order is indicated above.

Further explanation of the chart is as follows: On May 26, the first Oven-bird's egg was laid. On May 27, the second egg was laid, and later in the day No. 1 disappeared. On May 28, another Oven-bird's egg and a Cowbird's egg were laid, and later in the day No. 3 disappeared. On May 29, an Oven-bird's egg and a Cowbird's egg were laid, and on May 30, the last Oven-bird's egg appeared. This is a typical case where the eggs were taken on the day before the Cowbird's eggs were laid.

FIGURE 11. An egg disappeared from this nest during the morning of May 27, after the Cowbird's egg was laid, while the writer was away getting a blind to watch for its removal. Two Cowbird's eggs were laid in this nest, but only one egg of the host was taken.

FIGURE 12. Oven-bird's egg No. 1 was removed from this nest while the writer was away getting a blind to watch. Later in the day a Cowbird's egg was taken when no egg of the host was in the nest.

FIGURE 13. Two Oven-bird's eggs were removed from this nest, and only one Cowbird's egg laid. The asterisk (*) marks one of the eggs that the writer saw taken by a female Cowbird.

FIGURE 14. The writer was watching this nest from a blind, expecting the female Cowbird to take an egg, and she came, but was afraid to go to the nest. This was the only parasitized nest under observation which retained the full number of eggs of the host during incubation.

FIGURE 15. The Cowbird's egg marked here with an asterisk (*) was laid while the writer watched from a blind. Later in the day a Cowbird's egg was removed from the nest while an egg of the host was present, but after this the Oven-bird's egg disappeared also. The Oven-bird's egg marked with two asterisks (**) was not seen, but evidently was taken before the writer visited the nest at 8:16 A. M.

FIGURE 16. A small Cowbird's egg was laid in this nest before any eggs were laid by the host, causing the desertion of the nest, and later a normal Cowbird's egg was laid.

FIGURE 17. This nest was torn out by some animal, and two Cowbird's eggs were laid in the hole where the nest was.

FIGURE 18. This nest and the two following ones belonged to the same female. After three eggs of her own and two of the Cowbird were taken, she finally deserted the first nest, but the Cowbird returned and laid another egg.

FIGURE 19. Two Oven-birds and a Cowbird were hatched in this nest, but were taken by some animal, presumably a red squirrel.

FIGURE 20. After two Oven-birds and a Cowbird were hatched here, this nest was crushed by a truck.

This female built four nests, laid ten eggs, was host for seven Cowbird's eggs, was frightened off of the nest once by a Cowbird, shared her mate with another female, and ended the season with no offspring.

PLATE XI.

A. An Oven-bird's nest with four eggs. Early nests usually received five eggs, and late ones from three to five.

B. A female Oven-bird with her nest and young.

C. The habitat of the Oven-bird. The shallow creek bed is shown on the right, near which several nests were located.

D. The itograph. This instrument was built largely after the pattern of Kendeigh and Baldwin, but differed in two respects. First, there was a mechanism below, made from an alarm clock with the balance wheel removed, which kept a tension on the paper and wound it up. Secondly, needles placed in the spool which was attached to the minute hand of the clock perforated the paper once every fifteen minutes, and twice at the end of the hour. Magnets were taken from door-bells, and the triggers were patterned after those used by Bussmann with his terragraph. The instrument worked very well when the weather was dry, but poorly when it was wet.

E. The triggers of the itograph with their cover of netting at the nest, and the female Oven-bird leaving.

PLATE I

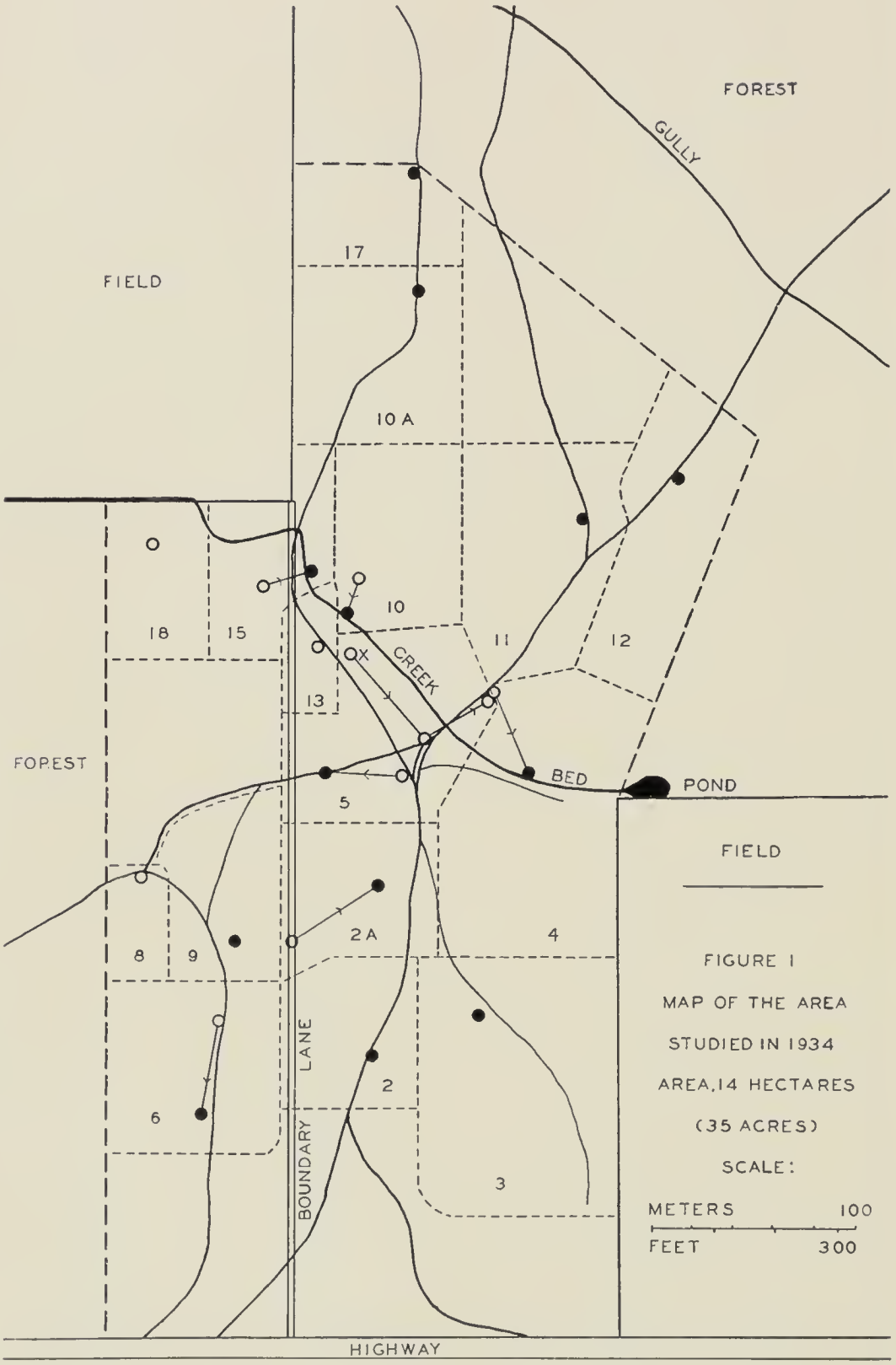

FOREST
GULLY
FIELD
17
10 A
10
18
15
11
12
CREEK
13
FOREST
BED
POND
5
FIELD
2A
4
8
9
LANE
2
6
BOUNDARY
3
HIGHWAY
FIGURE 1
MAP OF THE AREA
STUDIED IN 1934
AREA, 14 HECTARES
(35 ACRES)
SCALE:
METERS 100
FEET 300

PLATE II


37♂
10A♀
GULLY
FOREST
FIELD
36
32♂
12♀
X
10A♂
5(34)♀
35♂
15♀
31♂
10♀
CREEK BED
5
FOREST
POND
FIELD
X
2♀
XX
23X
23
9♂
26♂
6♀
LANE
BOUNDARY
21
HIGHWAY
FIGURE 2
MAP OF THE AREA
STUDIED IN 1935
AREA, 16 HECTARES
(40 ACRES)
SCALE:
METERS 100
FEET 300

PLATE III

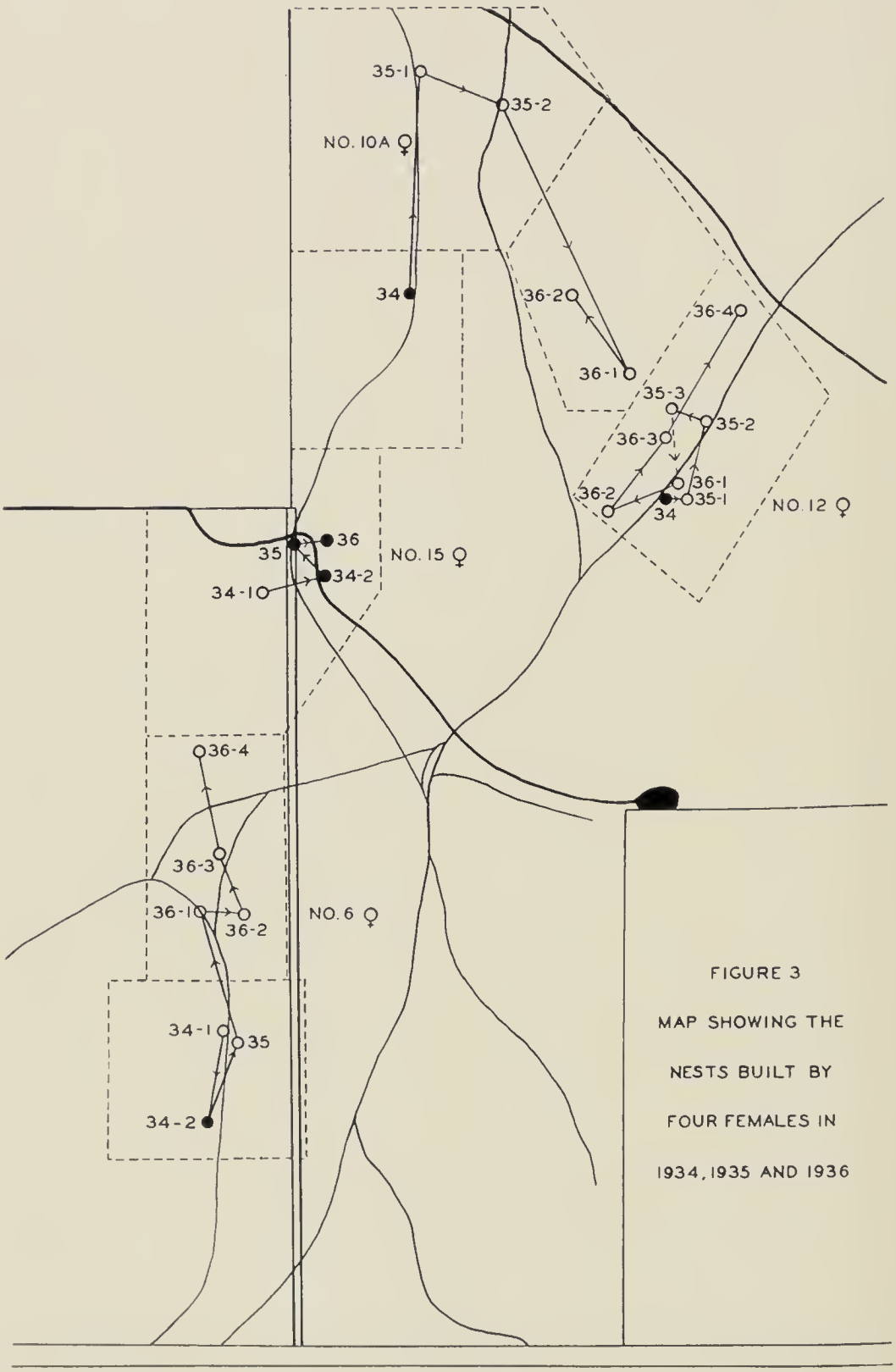


FIGURE 3

MAP SHOWING THE NESTS BUILT BY FOUR FEMALES IN 1934, 1935 AND 1936

PLATE IV

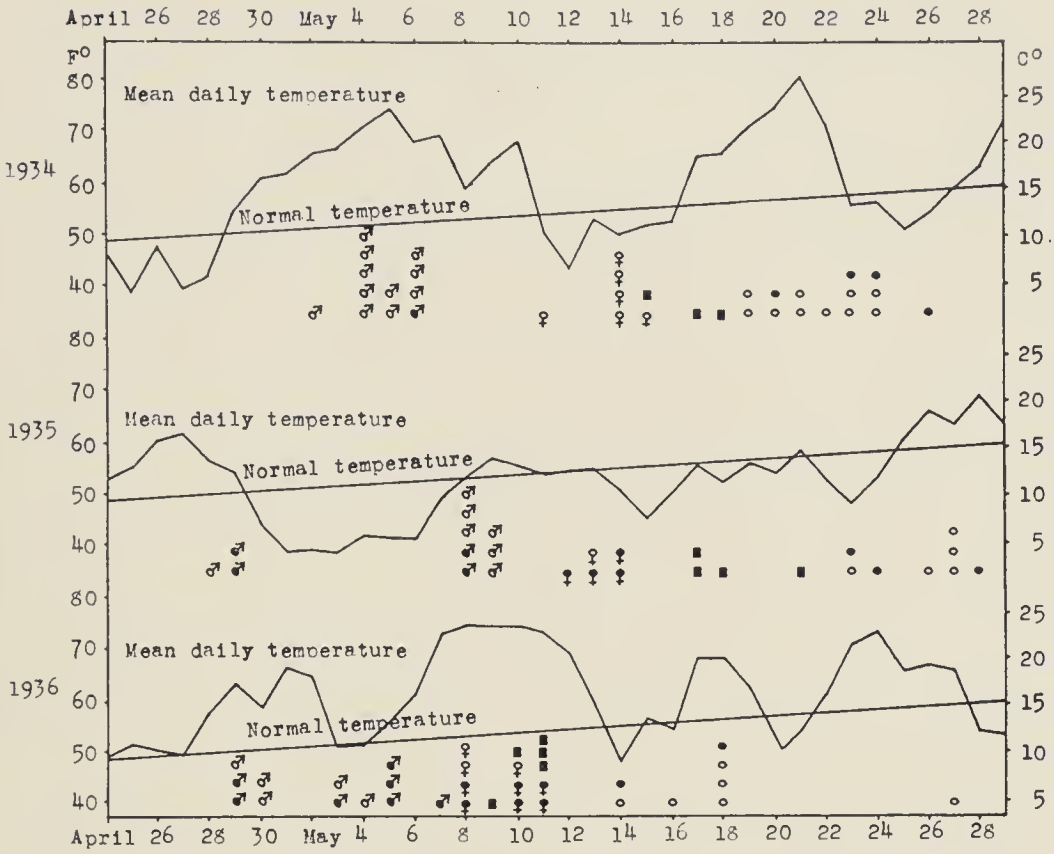
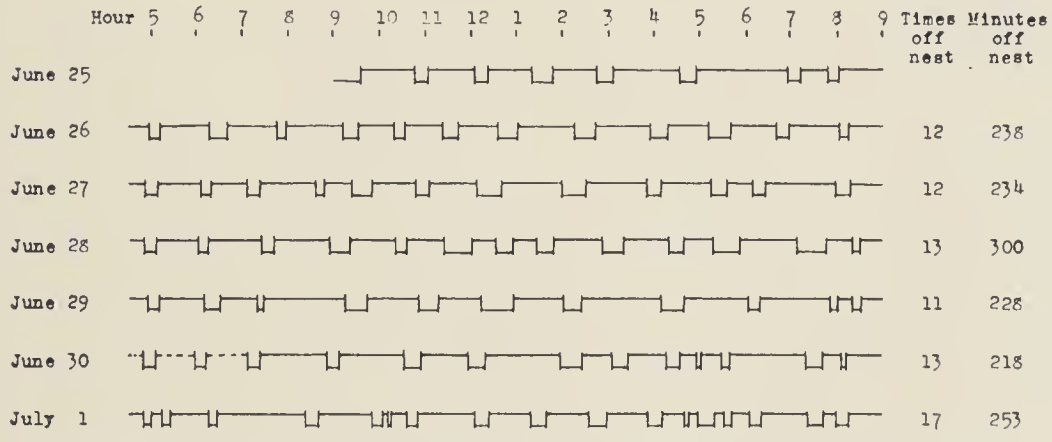
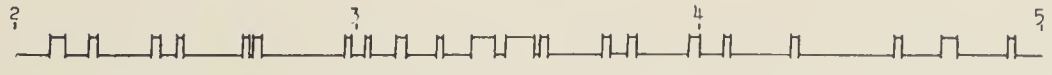


Figure 4



Condensed copy of the itograph record of nest No.6 through the second day of brooding.



Copy of the itograph record of nest No.9 through three hours of feeding when the young were four days old.

Figure 5

PLATE V

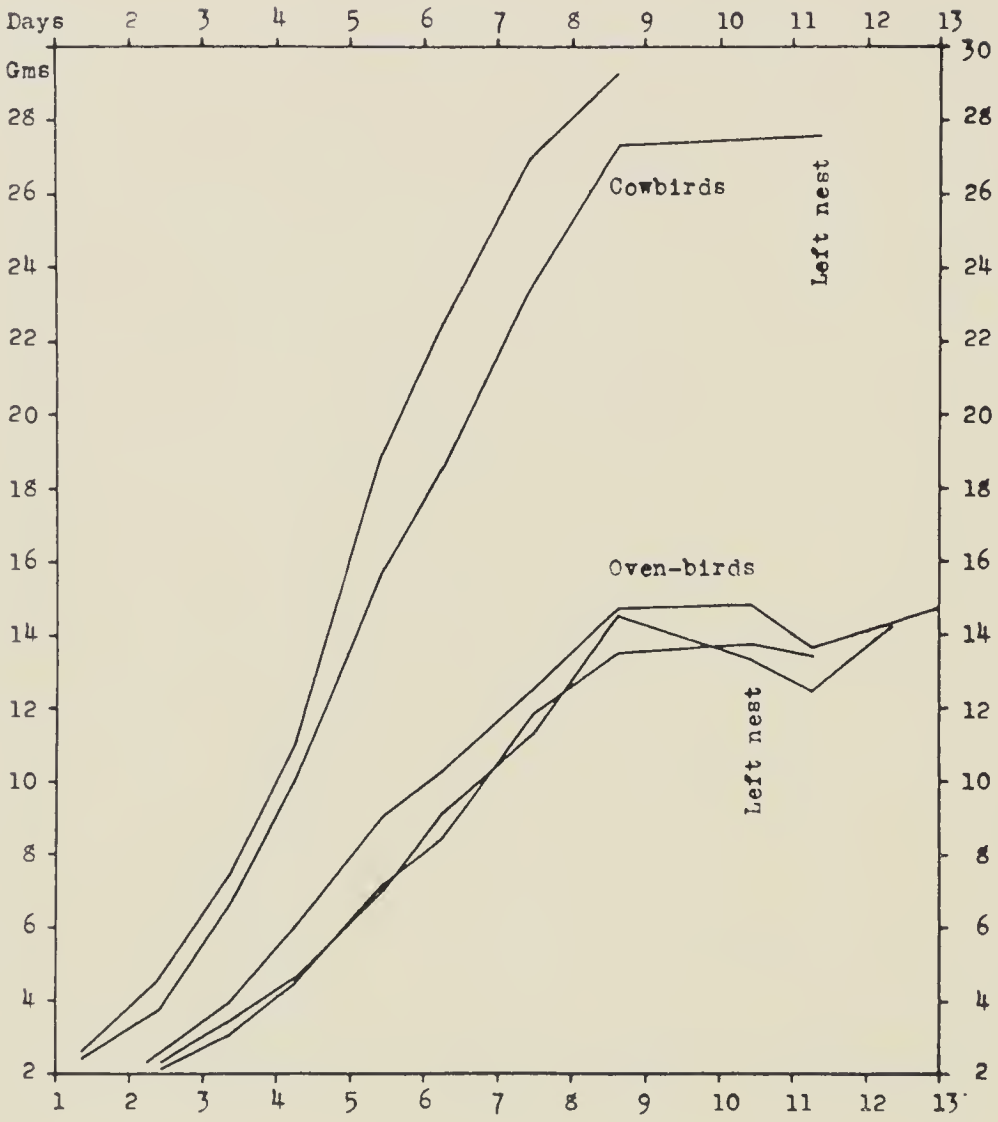


Figure 6

PLATE VI

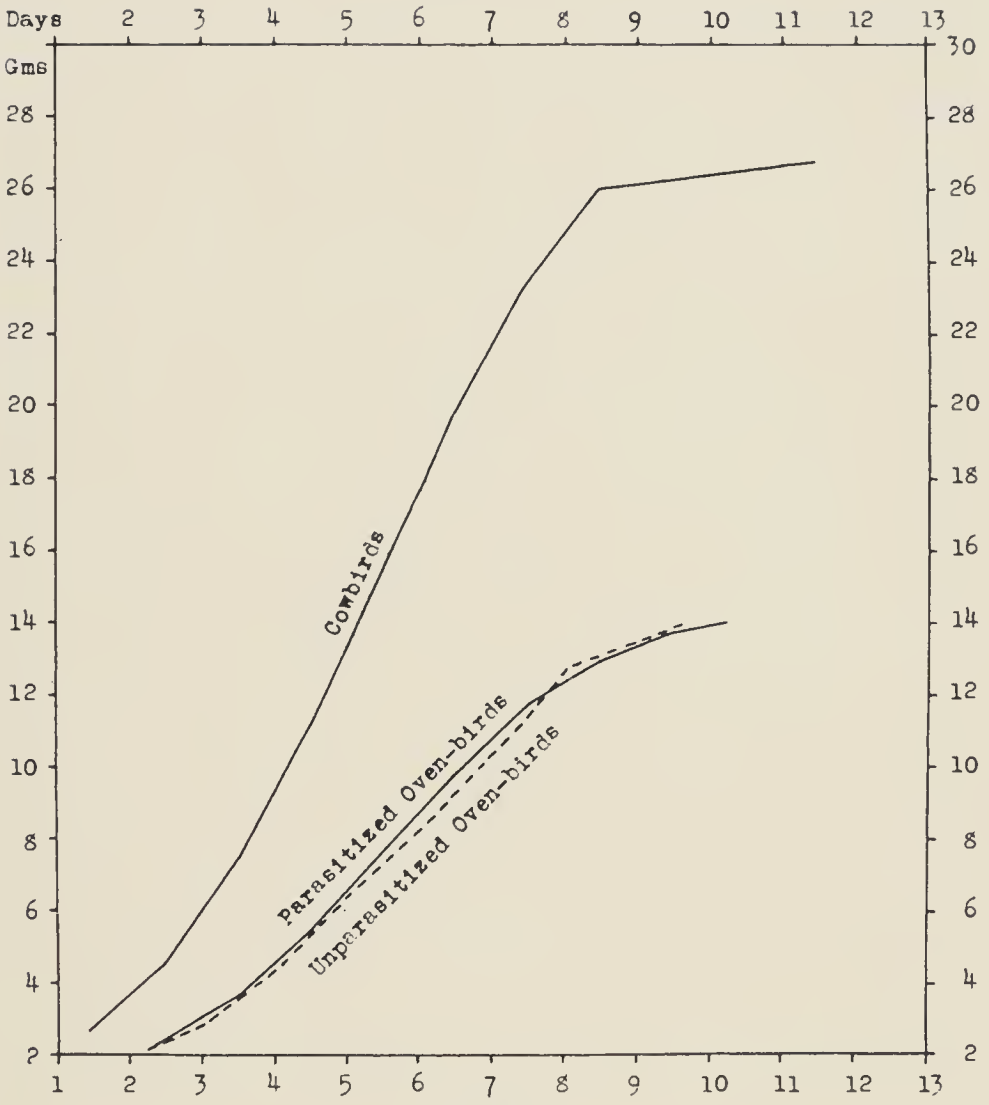


Figure 7

PLATE VII

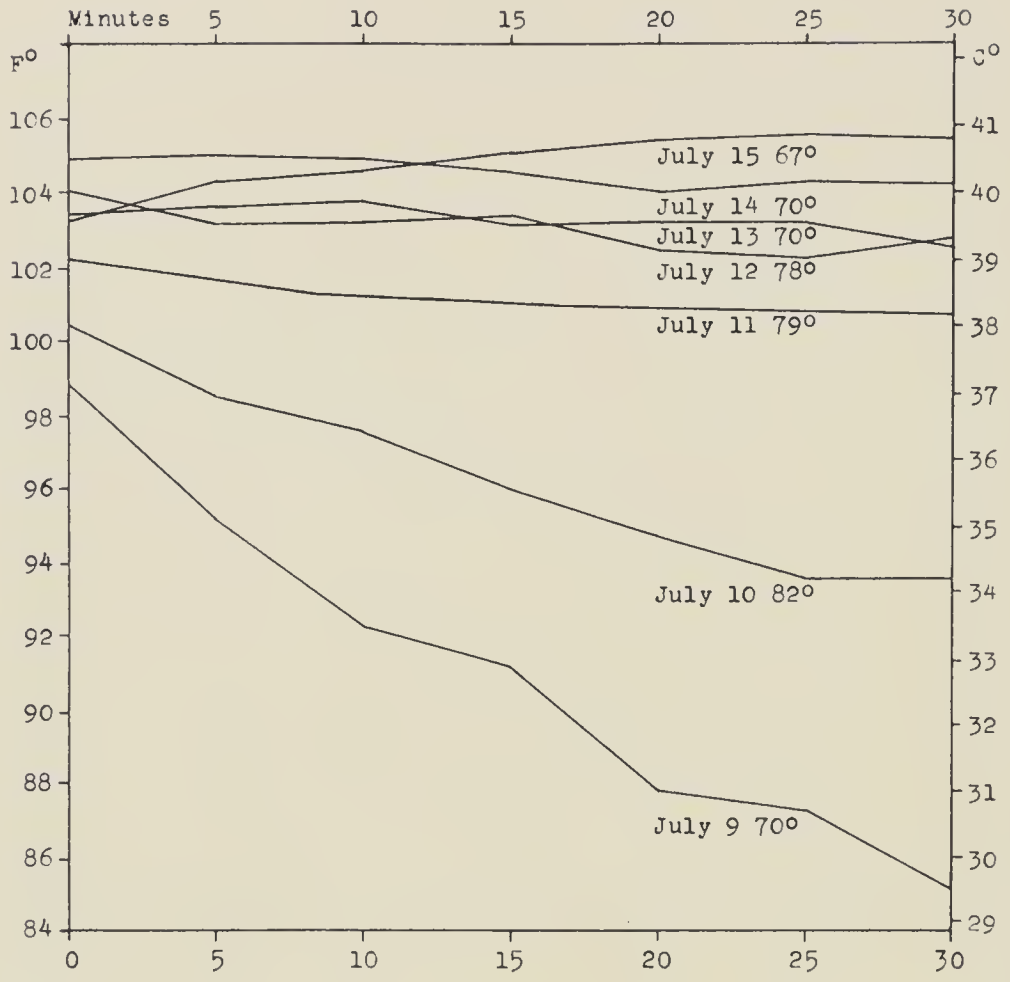


Figure 8

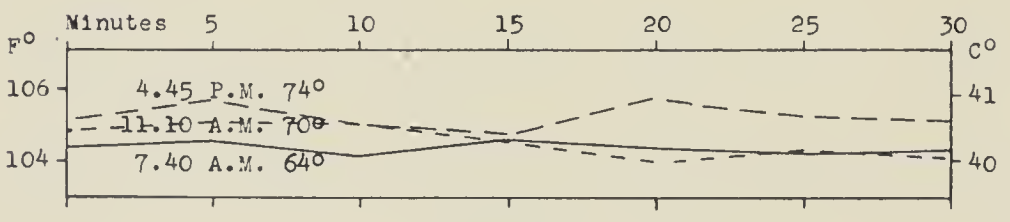


Figure 9

PLATE VIII

Nest #5	1	2	3	4	5	I	II	III
May 26	O							
May 27	O	O						
May 28	—	O	O			●		
May 29	—	O	—	O		●	●	
May 30	—	O	—	O	O	●	●	

Figure 10

Nest #31-2								
May 26	O							
May 27	O	O				●		
May 28	O	—	O			●	●	
May 29	O	—	O	O		●	●	
May 30	O	—	O	O	O	●	●	

Figure 11

Nest #36-3								
May 31						●		
June 1	O					●	●	
June 2	—	O				—	●	●
June 3	—	O	O			—	●	●
June 4	—	O	O	O		—	●	●
June 5	—	O	O	O	O	—	●	●

Figure 12

Nest #9-3								
May 26	O							
May 27	O*	O				●		
May 28	—	O	O			●		
May 29	—	O	—	O		●		
May 30	—	O	—	O	O	●		

Figure 13

PLATE IX

Nest #37-2	1	2	3	4	5	I	II	III
June 16	O							
June 17	O	O						
June 18	O	O	O			●		
	Cowbird came but was afraid							
June 19	O	O	O	O		●		
June 20	O	O	O	O	O	●		

Figure 14

Nest #26								
May 23	O					●		
May 24	—	O				●	● *	
May 25	—	—	O			—	●	●
May 26	—	—	O	O **		—	●	●
May 27	—	—	O	—	O	—	●	●
May 29	—	—	—	—	O	—	●	●

Figure 15

Nest #13			
May 23	Nest deserted	●	Small egg
May 25		●	●

Figure 16

Nest 4-1			
May 18	Nest torn out		
May 20	Egg in hole where nest was	●	
May 21	Second egg in hole	●	●

Figure 17

PLATE X

Nest #23-1

	1	2	3	4	I	II	III	IV
May 24	Female sat on nest				●			
May 25	Female chased off by Cowbird				●	●		
May 26	Female sat on nest				●	—		
May 27	O				●	—		
May 28	—	O			●	—	●	
May 29	—	—	O		●	—	● —	Incubation begun
								Deserted
May 30	—	—	—		●	—	—	●

Figure 18

Nest #23-2

June 3	O							
June 4	O	O						
June 5	—	O	O		●			
June 6	—	O	O	O	●			

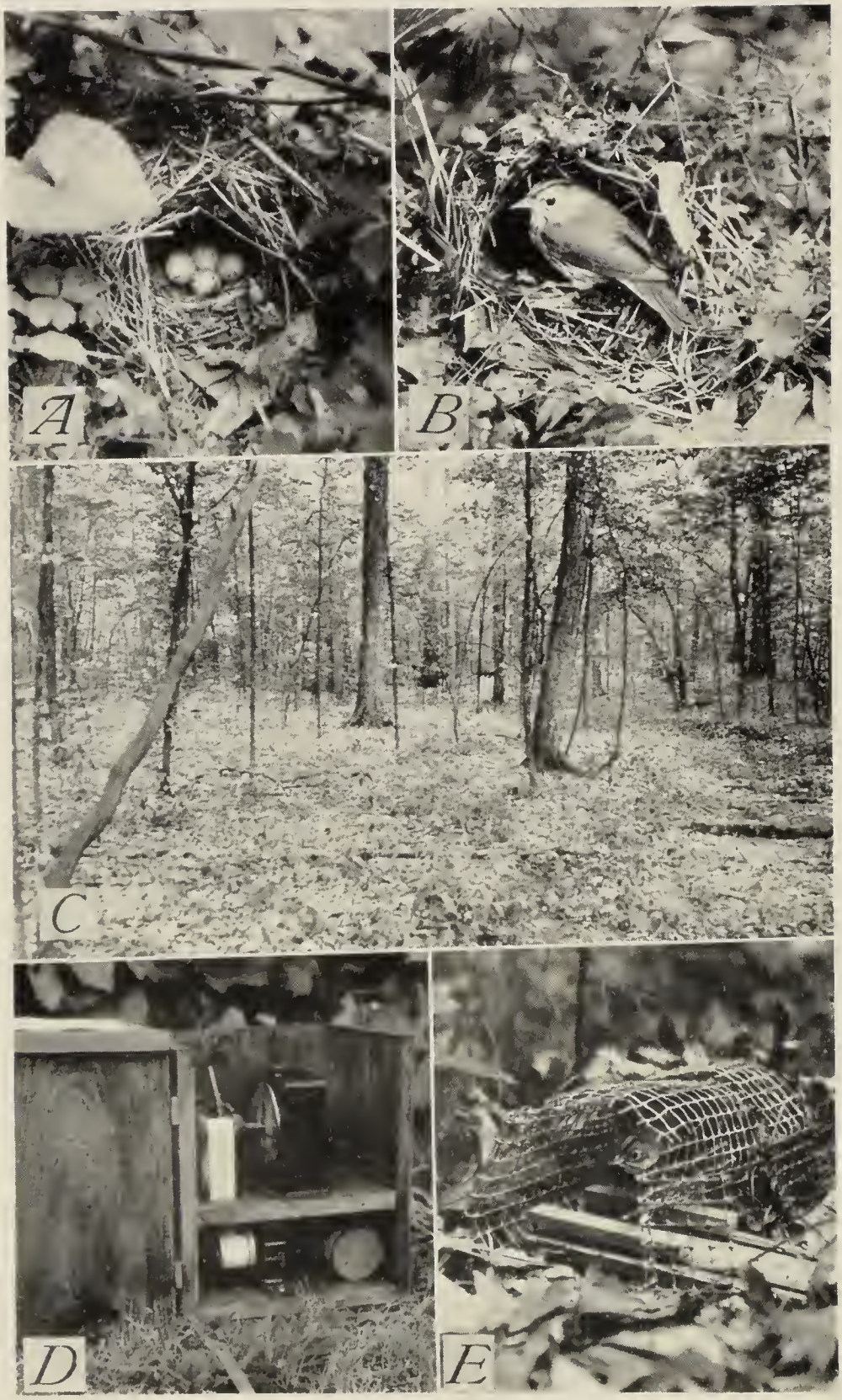
Figure 19

Nest #23-4

July 2	O							
July 3	O	O						
July 4	O	—	O		●			
July 6	O	—	O		●	●		

Figure 20

PLATE XI



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Department of Zoology,
University of Michigan,
Ann Arbor, Michigan.

EDITORIAL

The Twenty-third Annual Meeting of the Wilson Ornithological Club will be held in Indianapolis, Indiana, on December 27 and 28, Monday and Tuesday. The Secretary's Annual Letter will be distributed in the fall, giving such information as is then available. In the meantime Mr. S. E. Perkins III, as Chairman of the Local Committee, has sent us the following advance announcements.

We have received word from the National Offices of the American Association for the Advancement of Science that the English Hotel has been assigned as our headquarters, and that the Columbia Club, one-half square away, and also on Monument Circle, has been assigned for our program sessions. These locations are in the very heart of the city, and are accessible to the meeting places of other groups by bus from Monument Circle. The English Hotel is due north, and about four blocks from the Union Railway Station. Both the English Hotel and the Columbia Club face the 300-foot Memorial Monument to the Civil War Veterans.

Indianapolis is known as the "Crossroads of America". The home of Benjamin Harrison, former United States President, is located at Delaware and Thirteenth Street, and is now being remodeled as a shrine. Indianapolis was the long-time home of James Whitcomb Riley, and is his burial place; and the home of Kin Hubbard (Abe Martin), and his burial place. It is the home of Newton Booth Tarkington; Dr. Stanley Coulter, Dean Emeritus of Purdue University, author of many works on botany; of Dr. Willis S. Blatchley, world renowned entomologist, and author, among other things, of the "Colcoptera of Indiana"; and of Dr. Amos W. Butler, dean of Indiana ornithologists and author of ""The Birds of Indiana". And it is with the deepest regret that we announce the death of Dr. Butler, at his home, on August 5, 1937, at the age of seventy-six years. His presence at our coming annual meeting would have made it memorable for all in attendance.

There are several reasons for expecting that our 1937 meeting will surpass all previous ones. The central location of Indianapolis with respect to our membership population will assure an unusually good attendance. Plan to attend this meeting and enjoy the stimulation, the fraternity, and the instruction which it invariably affords.

We can not be sure that many of our members and readers will be able to attend the International Ornithological Congress in Europe; but they may wish to keep informed. Therefore, we are glad to print the following announcement from the Secretary of the Congress, Mr. Jean Delacour, and which has been transmitted to us by Dr. A. Wetmore, American member of the Executive Committee.

The Committee charged with arrangements for the Ninth International Ornithological Congress announces that the meetings will open in Rouen, France, on May 9, 1938. The Congress will be organized in four sections, as follows:

1. Taxonomy and Zoögeography.
2. Anatomy, Physiology, Palaeontology, and Embryology.
3. Biology (including Ethology, Genetics, Migration, and related studies).
4. Applied Ornithology.

During the course of the meetings there will be excursions to points of interest in and near Rouen, to Cleres, and to the Forest of Brotonne and the Valley of the Seine. May 14 and 15 will be devoted to a visit to the Natural History Museum and related institutions in Paris, while an excursion to the Camargue from May 16 to 19 will give opportunity to view the varied avifauna of that well known area.

Those who expect to attend the sessions should notify the Secretary of the Congress, Mr. J. Delacour, at Cleres, Seine Inferieure, France, well in advance. If it is desired to present papers he should be advised as to the title and length, stating whether or not there will be illustrations by lantern slides or motion pictures (giving sizes of slides or films). There will be a fee of 100 francs gold assessed against all persons in attendance.

The Provisional Program of the Ninth International Congress has been received since the above paragraphs were prepared, and space permits the reproduction of the greater part. The President will be Professor A. Ghigi, of the University of Bologna.

PROVISIONAL PROGRAMME

Monday, May 9th
- 9—12 Registration of members of Congress at the Secretariat.
- 11.00 Meetings of the International Ornithological Committee.
- 14.30 Opening of the Congress at Town Hall.
- 17.00 Reception at Town Hall.
- 18.00 Excursion: La Corniche de Rouen. Bonsecours.

Tuesday, May 10th
- 10.00—Presidential Address.
- 10.40—12.30 General Meeting.
- 14.00—17.00 Meetings of Sections.
- 17.00—18.30 Visit to the Natural History Museum.
- 21.00 Soirée at Theatre des Arts.

Wednesday, May 11th
- 10.00—12.30 Meetings of Sections.
- 14.00 Excursion to Clères.

Thursday, May 12th
- 9.00 Long Excursion in the Valley of the Seine. Lunch at Caudebec-en-Caux. Forest of Brotonne, Manny, Roches d'Orival.
- 20.00 Banquet.

Friday, May 13th
- 10.00—12.30 Meetings of Sections.
- 14.00—17.30 Meetings of Sections.
- 20.30 Meeting of the International Ornithological Committee.
- 21.30 General Meeting in the Town Hall.
- Close of the Congress.

PARIS

Saturday and Sunday
May 14th and 15th

Visit and reception at the Museum and to establishments associated therewith.

Monday to Thursday
May 16th to 19th

Long Excursion to the Carmargue.

N.B.—Visits to Monuments and Museums in Rouen, conducted by representatives of scientific and art societies, will be organized during the hours not occupied by the Meetings and Excursions of the Congress.

Conforming with the desire of the Permanent International Ornithological Committee expressed at the last Congress, it is proposed that questions concerning the Protection of Birds be dealt with during the Meetings of the International Committee for Bird Preservation which will take place in Rouen immediately before the opening of the Congress, on the 6th and 7th of May, 1938.

The Resolutions adopted and the proposals put forward will then be presented for the approval of the Congress at the final General Meeting.

Communications

Those who wish to give papers must send intimation to the Secretary by January 31st, 1938, giving the following information:

(1) Title of paper, with number of typed pages and approximate time required.
(2) Section for which it is intended.
(3) Whether illustrated by lantern slides, films, or photographs and prints. (Size of lantern slides must be given and full details of film, i. e. whether flam. or non-flam., size, and length). An epidiascope will be provided.

All manuscript must be handed in before the close of the Congress or it will not be included in the Proceedings.

Membership

In addition to representatives of Governments, Museums, Scientific Societies, etc., all persons interested in ornithology will be welcome as members of the Congress. The fee for each member is £1 and if accompanied by a lady 10/- extra.

Names and addresses of those wishing to become members of the Congress should be sent to the Secretary as early as possible in order to receive the final programme with full information concerning hotels, excursions, etc.

All correspondence should be addressed to the Secretary:

Monsieur Jean Delacour,
Chateau de Clères,
Clères,
Seine Inférieure
France

The Wilson Bulletin is glad to present in this issue a most complete and painstaking field study of the Oven-bird. In doing so we depart from our policy of offering a variety of subject-matter in every issue. A long article to occupy the entire number of the magazine is a distinct innovation, and we will be glad to know what our readers' reactions are. Will you tell us whether you approve or disapprove of the longer articles?

TO OUR CONTRIBUTORS

Our members are urged to submit articles for publication in the BULLETIN. Short items are desired for the department of General Notes, as well as longer articles pertaining to life-history, migration, ecology, behavior, song, economic ornithology, field equipment, methods, etc. Local faunal lists are desired, but limited space makes slower publication inevitable. In preparing such lists for publication in the BULLETIN follow our existing style, and use the nomenclature of the fourth edition of the A. O. U. Check-List.

THE MANUSCRIPT. The manuscript, or copy, should be prepared with due regard for literary style, correct spelling and punctuation. We recommend the *Manual of Style*, of the University of Chicago Press, as a guide in the preparation of manuscripts. Use paper of good quality and of letter size (8½x11). Avoid the use of thin paper. Write on one side only, and leave wide margins, using *double spacing* and a reasonably fresh, black ribbon. The title should be carefully constructed so as to indicate most clearly the nature of the subject matter, keeping in mind the requirements of the index. Where the paper deals with a single species of bird it is advisable to include the scientific name of the species in the introductory paragraph. If the author will mark at the top of the first page the number of words in the paper, a little of the Editor's time will be saved.

ILLUSTRATIONS. To reproduce well as half-tones photographic prints should have good contrast with detail. It is best to send prints unmounted and untrimmed. The author should always attach to each print an adequate description or legend.

BIBLIOGRAPHY. The scientific value of some contributions is enhanced by an accompanying list of works cited. Such citations should be complete, giving author's name, full title of the paper, both the year and volume of the periodical, and pages, first and last. In quoting other works care should be taken to carry over every detail, *verbatim et literatim.*

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SEPARATES. The club is unable, under present financial conditions, to furnish reprints to authors gratis. Arrangements will be made, however, for such reprints to be obtained at cost. A scale of costs, based on the number of pages, is given below. If a blank page is left in the folding it may be used as a title page, which will be set and printed at the rate indicated. If a complete cover with printed title page is desired it may be obtained at the rate shown in the last column. Orders for reprints should accompany the returned galley proof on blanks provided for that purpose.

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200	2.20	3.05	4.70	6.05	7.45	8.80	10.20	11.55	12.95	14.30	15.70	3.30
300	3.05	3.85	5.50	6.90	8.25	9.65	11.00	12.40	13.75	15.15	16.50	4.40
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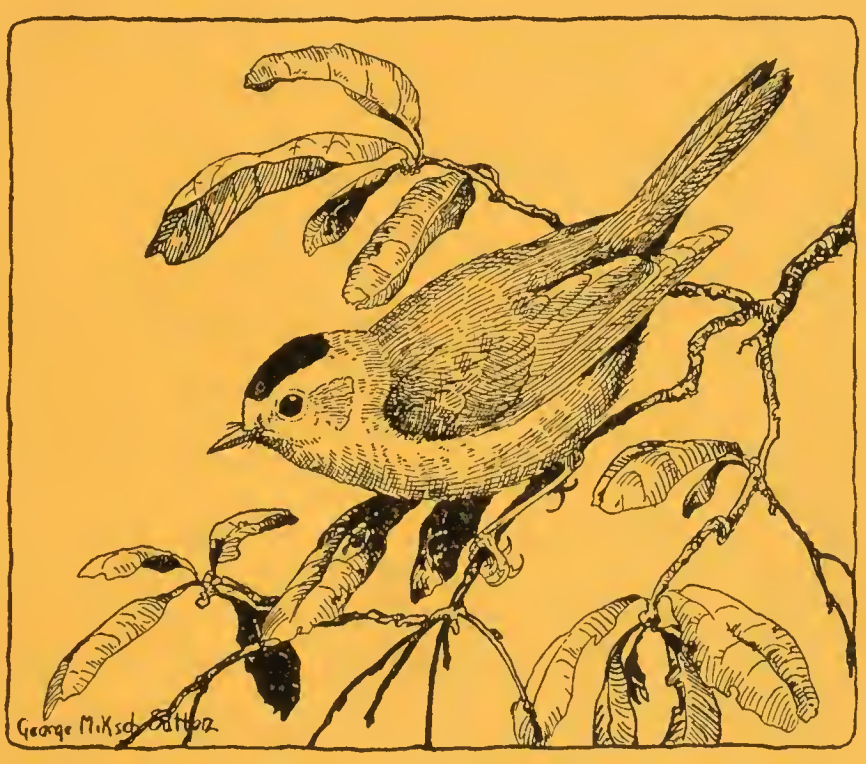
THE WILSON BULLETIN



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CONTENTS

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The current issue of the Wilson Bulletin is printed by the Verstegen Printing Company, Sioux City, Iowa.

THE WILSON ORNITHOLOGICAL CLUB

Founded December 3, 1888. Named after Alexander Wilson, the first American ornithologist, and called the "Father of American Ornithology".

The officers for the current year are:

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Treasurer—Mr. S. E. Perkins III, 709 Inland Bldg., Indianapolis, Ind.
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PHOTOPERIODICITY IN BIRDS[1]

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In the spring a fuller crimson comes upon the robin's breast;
In the spring the wanton lapwing gets himself another crest;
In the spring a livelier iris changes on the burnished dove;
In the spring a young man's fancy lightly turns to thoughts of love.
—*Tennyson, Locksley Hall.*

Introduction

It has long been recognized that various activities of birds are related to the daily cycle of light and darkness and to seasonal change from short days in winter to long ones in summer. In one case notice has been taken of an apparent relation to time at which increasing moonlight from waxing moons in spring adds its stimulus to that of lengthening days. These photoperiodic activities are various and include daily times of waking and beginning of song and bodily activity, daily changes in the periods of sporulation of bird malarias and other typical cyclic diseases, seasonal changes of plumage, migrations, periods of sexual activity and quiescence accompanied by changes in breeding behavior and courtship display.

It is proposed to discuss, rather incompletely, but as suggestively as possible in small space, selected phases of this apparent dependence of the activities and functions of birds upon variations in daily and seasonal illumination as factors in their environment. It is emphasized from the first that many other factors in their environment also affect the physiology and behavior of birds, often more profoundly than do changes in exposure to light. There also appear to be intrinsic rhythms more or less independent of environmental influence. This paper will merely bring out relations to the light factor without excluding others.

Martin said, in "A Voyage to St. Kilda" (London, 1698), "The inhabitants observed that when the April moon goes far in May the fowls (sea birds) are ten to twelve days later in laying their eggs than ordinarily they use to be." This implies a summation effect of length-

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ening days and waxing moonlight upon the incidence of reproduction in sea birds. Sharpey-Schafer (1907), on theoretical grounds, suggested that duration of daylight "may well be considered a determining factor in migration, and it has the advantage over other suggested factors that it applies to the northerly as well as to the southerly movement." But he considered it improbable that migration is the result of developmental changes in the sexual organs, since the sex-glands of spring migrants are still almost as small as in autumn. Such early suggestions regarding physiological and behavioristic photoperiodicity of various types as exhibited by birds may be multiplied almost *ad lib.*

Daily Rhythms

Temperature

Kendeigh (1934) has discussed daily rhythms of birds very thoroughly. He points out a daily rhythm of body temperature and metabolism, highest at noon or early afternoon in sparrows and lowest near 2:15 A. M., in part related to exercise, but rising before the birds leave the nest in the morning. Under starvation, very low temperatures, etc., survival time is shortest and loss of weight greatest in the light and longest in darkness or in winter time when periods of light are shortest (63 per cent greater than in summer). Summer birds survive high temperatures better than winter ones, though loss of weight before death is not consistently different. Winter birds have lower metabolic rates, temperature for temperature, than summer birds and greater average weight. Wrens differ from sparrows only relatively in these respects. Average night temperature and number of hours of darkness without food are important factors in survival time under starvation, both related to length of day. Other authors do not emphasize the temperature factor so much but stress duration of daylight and feeding periods. Kendeigh points to daily maximum temperature as the critical factor. Continuous light reduces survival time, at high temperatures. Temperature x hours of darkness constitute the critical factor for survival at low temperature.

Daily Activities of Day and Night, or Twilight, Foragers

There can be little doubt that times of roosting, of evensong, and of return from foraging are controlled by the decreasing of light-intensity and the coming of twilight in birds that hunt by day. With such birds the time of morning song, of leaving the nest or roost, and even cock-crow are related to incidence of daylight and vary in correlation with it (Allard, 1930; Shaver and Walker, 1931; Lutz, 1931; Wynne-Edwards, 1930).

On the contrary, in birds, like flycatchers of some species, night hawks, owls, etc., that hunt by twilight or night, there is increased activity when light-intensity recedes to varying degrees. In caged birds that are migratory there is increased activity at night during the seasons of spring and fall migration for the species (Wagner, 1930).

Mitotic Rhythms in Sex-glands

Foley (1929) and Riley (1936) found a diurnal rhythm of spermatogenesis in sparrows, with active mitoses confined to the period of darkness. Reversal of light and dark periods leads to a change over of these mitoses from between 2:00 and 4:00 A. M. to the afternoon hours. The wave of mitotic activity is dependent upon lowered body temperature. If body temperature is lowered experimentally during the light hours, mitotic figures appear within two hours; if birds are kept active during night hours and temperature thereby kept up, spermatogenesis is retarded. Injections of gonadotropic hormone cause rapid increase in the size of gonads, attributable largely to increased activity at low body temperature at night. Riley reasons that the spermatogenic cycle is controlled by a combination of environmental and internal factors; that reduction of body temperature in the dark period makes the germ-cells responsive to stimulation by the gonadotropic hypophysial hormone.

Avian Blood Diseases

Boughton (1932, 1933) and Boughton, Atchley, and Eskridge (1935) pointed out a diurnal rhythm in avian isospora with diurnal oöcyst production in the sparrow modifiable experimentally by changes in the length of the periods of light and darkness to which host birds are exposed. They conclude that peaks of oöcysts can not be explained as due to ingestion of infective material nor to increased fecal discharge during the feeding periods, which Boyd (1929, 1933) considered to be important in controlling reproductive periods in *Plasmodium cathemerium*, the parasite in canary malaria. They found that the mechanism controlling the periodic production of oöcysts operates in a light-dark period which precedes the appearance of oöcysts by approximately forty-eight hours. Daily activity of the host appears to be the primary factor. Otherwise the reproductive cycle appears to resemble the periodic asexual sporulation of the plasmodium of the canary, in which Boyd (1933) found no relation to fatigue of the host. Wolfson (1936a, 1936b, 1937) also found a relation of plasmodium species (3) to daily light cycle.

Manwell and Herman (1935) find at least seven species of malaria in birds and several others that are as yet questionable. Incidence is higher in migratory birds and in those going farther south than in non-migrants. Ducks and swallows are infected with a malaria-like disease due to *Leucocytozoön anatis*. The infection occurs principally when the birds roost near streams where the black fly vector of the disease breeds. So, much is to be done in study of the relations of these diseases to environmental factors.

Some of these diurnal rhythms of birds and of some of their blood parasites correlated with internal physiological rhythms of the birds are directly conditioned or controlled by the light-dark cycle, while others are only indirectly so through consequent cycles of temperature, physical activity and fatigue, and maximum and minimum consumption of food. Some may therefore be described as primarily photoperiodic; others as only secondarily so. In most cases the complete and exact mechanism involved is still only partly known or open to controversy. Much further study of these phases of physiological activity and behavior is required and this is a most fertile field for ornithological study.

Seasonal Rhythms

Temperature, Basal Metabolism, Thyroid Activity

Since Kendeigh (1934) has discussed these phases thoroughly it is enough here to draw attention to some of the findings bearing on these cycles. Riddle and Fisher (1925) and Haecker (1926) found that thyroid activity is greater in winter cold than in warm summer months. This affects basal metabolism. But Kendeigh (1934) found that winter birds withstand low temperatures better than summer ones, and summer ones high temperatures the better; that winter birds have lower basal metabolic rates, temperature for temperature, higher initial body weights and a lower rate of loss of weight than summer birds, under starvation. Plumage weight is greater for adult birds in winter than in summer. Even in summer it is greater in adult than in juvenile birds. Beebe (1908) and Walton and Marshall (unpublished data) found that plumage changes in some birds (Scarlet Tanagers, Bobolinks, wild ducks) are conditioned by light cycles.

Kendeigh found that the average night temperature plus the number of hours of darkness without food are the important factors in determining survival time of birds under starvation. Groebbels (1927-1932) emphasizes duration of daylight rather than darkness and stresses temperature much less as a factor. Rowan (1931) emphasizes shortness of feeding time per day in winter and short days as a limit-

ing factor which prevents the gathering of enough food by some species. Survival time is shortened by high humidity at high temperatures, by continuous light, increased activity and winds. Species of birds is a factor in all cases. The above factors are related to length of day and intensity of light.

Seasonal Abundance

Shaver (1933) found that the factors related to seasonal abundance of birds in order of importance are temperature, duration of sunshine, relative humidity, wind velocity, atmospheric pressure, and precipitation. This is related to movements of migratory species and, as will be shown below, is related to seasonal and even to daily cycles of light and dark periods. Consumption of food is greater per day in summer than in winter (Groebbels, 1931; Rörig 1905) correlated with higher temperature, metabolism, and activity of many body tissues of which spermatogenesis and ovogenesis are but two.

Plumage

Differences in weight and thickness of plumage with the seasons have been mentioned above. Many birds also pass through one or more changes in type and coloration of plumage each year in correlation with the seasons. Molting occurs in many birds in late summer and early autumn when temperatures are high and the heavier coat is put on at this season (Kendeigh, 1934). For birds in the temperate zones this is just a short time after the change over from lengthening days of increasing light intensity to decreasing intensity and shortening days and the taking on of the heavier coat occurs when temperatures are still relatively high; therefore cold could hardly be a factor in causing the change.

Some species, like mallard ducks, tanagers, bobolinks, lapwings, or even pheasants and domestic fowl, take on a different plumage or assume brighter head furnishings before or at the breeding season, or in autumn and spring to assume less striking colorations at the season for incubation or rearing the young, in contrast to showy breeding plumage. Others like Starlings and sparrows, change the color of their bills under the influence of the hormones from the gonads or the hypophysis, with the seasons. Even the plumage changes have been shown to be dependent upon changed hormone action of the thyroid and pituitary, as well as the sex-glands, and these upon changes in daily period and intensity or wave-length of light (Beebe, 1908; Goodale, 1910; Seligman and Shattock, 1914; Bissonnette, 1930 *et seq.*; Keck, 1932, 1934; Witschi and Keck, 1935; Tallent, 1931; Jaap, 1934;

Miller, 1935; Zawadowsky, 1929; Walton and Marshall, unpublished data; Bissonnette and Csech, 1936b).

Sexual Photoperiodicity

It has long been known that sex-glands, secondary sexual apparatus, sexual behavior, and related activities, including changes of plumage and erectile head furnishings, in many birds are subject to seasonal changes. Tennyson, in "Locksley Hall", wrote the stanza at the head of this paper.

It was taken for granted till recently that these rhythms were conditioned and controlled directly by the succession of warm and cold seasons, through temperature.

Studies on this subject published before 1934 have been reviewed by Bissonnette (1935, 1936c) and Walton (1933) for animals in general, and by Kendeigh (1934) in connection with the influence of environmental factors upon the physiological rhythms of birds. The latter showed that nesting and laying are considerably modified and controlled by changes in temperature. Sudden drops in temperature interrupt nesting and laying and postpone incubation. But these are only secondary variations in the reproductive cycles of birds, superimposed upon a more fundamental primary drive to reproductive activity.

Rowan (1925-37) first showed that reversing the daylight curve in autumn and winter with electric lighting would cause the sex-glands of juncos, canaries, and crows to enlarge and produce sperms in winter instead of at the normal time in April or May. This was correlated with migration and will be discussed somewhat more fully under that topic because much of the work on migration can not be dissociated from that on sexual photoperiodicity. Duplication to some degree can not be avoided unless the two topics are reviewed together.

Weak light from electric bulbs, added after nightfall in increasing periods and then withheld periodically, brought about the breeding condition four or more times in a year. Rowan came to the conclusion, based upon an experiment with increased exercise instead of increased light with birds already well stimulated with light increases, that it was the increasing periods of exercise and wakefulness rather than increase of light, as such, that was the fundamental cause of the stimulation to increased sexual activity in juncos. This he still maintains though he uses light as his activating factor in his subsequent experiments and not exercise, and in the face of increasing evidence that, in all other animals tested and showing this reaction, it is light, *qua* light, that is the primary stimulus. Amount of food consumed

did not appear as a factor in the reaction, at least when it was varied and sufficient to prevent inanition. The work of Bissonnette (1930 *et seq.*) and others supports the statement that amount of food consumed is of relative unimportance. But it is quite evident that inadequate variety of food or improper quality, so far as salts, vitamins, proteins, and fats are concerned, may act as a limiting factor preventing activation by the usual stimuli and may even play a more important rôle in some cases (Bissonnette, 1933b). Longer feeding periods or shorter night periods without feeding have been looked upon by poultry men as the cause of increased laying of fowl in autumn and winter when they are subjected to "night-lighting". But the experimental studies on birds by Rowan (1925-37), Cole (1933), Miyazaki (1934), Benoit (1934-6), Petty (Brill, 1934), Martin (1935), Riley (1936), Scott and Payne (1937), Keck (1932), Kirschbaum and Ringoen (1936), Bissonnette (1930-37), Bissonnette and Wadlund (1931-3), Bissonnette and Csech (1936a, b, c, 1937), Clark, Leonard, and Bump (1936, 1937) and others, and similar studies upon mammals and amphibia (Bissonnette, 1935, 1936c) rather indicate that the larger consumption of food is the result of increased reproductive activity, caused by increased lighting, instead of its cause.

Between 1926 and 1928, Bissonnette (1930a, b) and Bissonnette and Chapnick (1930), and since that time, Bissonnette and Zujko (1936) studied the normal sexual cycle of the European Starling (*Sturnus vulgaris*), a bird which at that time migrated but little in this country. Of all environmental variables studied in correlation with this cycle, the seasonal change in duration of daily daylight periods was the only one which was regular enough to account for the very precise regularity of the recurrence of the various phases of the sexual cycle (Bissonnette and Chapnick, 1930).

Experimental studies were then begun to test the effects of altering the daylength by added illumination, in autumn evenings after sundown, along with those of similar periods of forced exercise, which Rowan (1928 *et seq.*) maintains is the fundamental factor inducing activation of the sexual apparatus in the junco and in birds in general with similar sexual cycles. Experiments were carried on from December to April inclusive, and repeated with variations in subsequent years. Added exercise periods without added light were not effective to induce sexual activity in the Starling and even tended to reduce the size and activity of the testes. Light added for the same periods, on the contrary, was very potent to induce activation of the sex-glands, in males more consistently than in females (Bissonnette, 1931a).

By modifying the experimental method and the previous sexual conditions of the birds used, it was found that increasing exercise periods led to a lag in onset of changes in the testes induced by changes in daylength, whether these changes consisted of increase of exposure to light, inducing increased activity of the testes, or of reduced lighting, leading to decreased activity of these glands. That is, if birds already undergoing increase of activity of their sex-glands stimulated by added lighting were changed from increasing to decreasing periods of light, the testes of those placed at the same time on increased exercise periods continued to increase in size and activity for a considerable time thereafter before undergoing regression or slowed activity. Those not put on increased periods of exercise, but with similar reduction of lighting periods, very quickly went over into regression or slowed down their activity, just as did Rowan's juncos. But the reverse experiment was also performed and birds undergoing regression from reduction of their daily light periods were divided into two groups. For one group the daily lighting was increased but forced exercise was not given. For the other group both forced exercise and added lighting were begun at the same time for similar periods daily. In those with increased lighting alone, there was an early response by increasing size and activity of the gonads. In those with equal periods of both added light and forced exercise, regression continued for a considerable time before activation by added lighting became operative. They then responded with somewhat more accelerated activation so that they often overtook the birds of the first group finally. This was taken to indicate that, while increased exercise was not itself an activating factor, it modified the response to lighting, the major factor in these cases. Of course it is dangerous to reason by analogy from one species to another. But the great similarity of the results of the first group of these experiments to those of Rowan with juncos under almost identical conditions make them highly suggestive; though strictly speaking, as he says (Rowan, 1937), they may prove nothing. They do, however, make it impossible to accept his conclusions for birds in general and show that his are not the only valid conclusions from his data, even with juncos.

Further studies (Bissonnette, 1931b, 1932a; Bissonnette and Wadlund, 1931, '32, '33), aided by grants from the National Research Council, Committee for Research in Problems of Sex, showed that the rate or degree of stimulation of testis activity in a given time varies with the intensity of illumination used. Birds under a 10-watt bulb were slower to reach maximum activity than those under a 15-watt

one at the same distance, and these again than those under a 25-watt bulb, and so on, with equal periods of exposure. Birds with added periods of both light and forced exercise were slower to begin activity, but later often overtook those with only added light of similar intensity and duration. The optimum intensity or duration of the daily period have not been determined as yet; but that such an optimum intensity at least exists is already evident.

The degree of stimulation for Starlings depends also on the color or wave-length of visible light used, not on its ultra-violet content (Bissonnette, 1932a; Bissonnette and Wadlund, 1931, '32, '33). Red is very highly stimulating; green of equal luminous intensity, used for the same daily periods, is not stimulating at all; white is less stimulating than red, probably because of smaller content of red or other stimulating rays. With much lower luminous intensity, violet was not stimulating but the testes appeared to decrease slightly in size as compared with those of controls receiving no added exposure to light. This difference in the effect of red, green, white, and violet lights was not due to difference in heat or total energy intensity, as measured by a thermocouple, but to apparent wave-length specificity. Benoit's (1934 *et seq.*) work with ducks has confirmed these findings in general and even as to most of the details. He finds that green and violet are not stimulating while reds and yellows are. Scott and Payne (1937) with turkeys, find red and white effective, but blue ineffective.

That this strictly localized wave-length specificity in the visible spectrum is not found in all animals was shown by Marshall and Bowden (1934, 1936). They found that for ferrets all wave-lengths tested from near infra-red through near ultra-violet were approximately equally effective. Animals subjected to near ultra-violet had greatly prolonged sexually active periods. Bissonnette (1937), however, found prolonged oestrus in ferrets brought into heat early in spring by experimental lighting with little or no ultra-violet. Beyond these limits Marshall and Bowden found no wave-lengths effective. They found that if time times intensity were constant, approximately constant degrees of activation resulted. So it is evident that, even among birds showing photoperiodicity, all wave-lengths will not be equally effective and the most effective ones will probably vary with different species if not with different strains of the same species.

Improper food, low in salts, proteins, vitamins, and fats, even if sufficient in quantity, acts as a limiting factor which may prevent even

highly stimulating exposures to light from inducing sexual activity or greatly reduce their effectiveness (Bissonnette, 1933b).

No mating or egg-laying under these experimental conditions was observed even in Starlings brought to complete sexual maturity as judged by histological criteria. Such activities in these wild birds must be controlled by factors not permitted by the crowded conditions in these experiments and not by mere histological fitness for breeding (Bissonnette, 1933a, 1933b). Cole (1933), using Mourning Doves, was the first to secure mating and viable eggs in winter with a bird of limited breeding season. These doves, however, breed in captivity normally. Since Cole's experiments, several others have induced birds to breed out of their normal season with good fertility and hatchability. Birds used were the Bob-white (Brill, 1934; Bissonnette and Csech, 1936c), turkeys (Scott and Payne, 1937, cited in Bissonnette, 1936c), pheasants (Martin, 1935; Bissonnette and Csech, 1936a, 1936b, 1937; Clark, Leonard, and Bump, 1936, 1937), ducks (Benoit, 1934, 1935f), Ruffed Grouse (Clark, Leonard, and Bump, 1936, 1937), canaries (unpublished data from several sources), and doubtless many others. Guinea fowls fail to respond to increasing light given in this manner (Scott and Payne, 1937). These birds, like guinea pigs which also fail to respond to similar treatment, are natives of the tropics where the factor of changes in relative length of day and night is small and, probably, the animals did not evolve in such a way as to use this factor as a releasing stimulus to induce or accelerate sexual activity at a season most favorable for survival of the young (Young and his students, cited from Bissonnette, 1936c). Neither do all animals of the temperate zones (spermophile ground squirrel, Moore, etc., cited from Bissonnette, 1936c; and African weaver birds, Witschi, 1935, which retain their original African cycles in spite of removal to Iowa).

In male Starlings, a maximum effect and consistent results were obtained by giving large and immediate increases in daily periods of light rather than by gradually increasing periods, even in autumn when periods of daylight were decreasing. This was not so consistent with females. In ferrets this was reversed and males required gradually increasing periods throughout or they underwent regression of the germ-cells while interstitial cells and accessory sex-organs responded completely (Bissonnette, 1932b, *et seq.*). Success in inducing pheasants, bob-white, raccoons and ferrets, of both sexes, to become fertile and potent at the same time and to beget living young was attained by gradually increasing daily periods of light in autumn and winter (Bissonnette, 1936d; Bissonnette and Csech, 1936a, 1936b, 1936c, 1937).

Rowan also obtained his greatest success with juneos in this way. With male Starlings, filtered red light of 1.7 foot-eandles luminous intensity, acting for six hours eaeh night from the start, after nine and a half hours of daylight, gradually decreasing with the season, in a basement room, induced complete spermatogenesis in twenty-three days in December and January. Other eombinations ineluding red light did it in eighteen days (Bissonnette, 1931a, 1931b, 1932a, 1936e). Seott and Payne (1937), however, found that if the additional light is given during the daylight hours as increased intensity and not after nightfall, it had no stimulating effeet on sexual aetivity in turkeys.

Normally testis regression in Starlings oeeurs before June 8 or 15; no birds killed on or after those dates had remained in eomplete spermatogenesis (Bissonnette, 1930b). But daily periods of daylight still increase slowly till June 21, both in duration and intensity. Prolonged experimental studies, even with most potent sehedules of lighting, showed that birds invariably passed the elimax of aetivity after a time and underwent regression. This was due to "throwing out of gear" or development of refraetoriness at some part of the sexual meehanism. Maximum size and aetivity of testes eould not be maintained beyond a certain period which varied inversely with the effectiveness of the stimulus used for activation and bore some relation to the length of the other phases of the indueed sexual eycle. Animals brought quiekly into maximum aetivity remained completely aetive for a shorter time than those more slowly aetivated (Bissonnette, 1936e). This also oeeurs with male and female ferrets. Long eontinued injeetions of gonadotropic anterior pituitary hormones and "pregnancy urine" show this same sort of failure to maintain aetivity of sex-glands and seeondary sexual eharaeters in rabbits, rats, and monkeys (Bissonnette, 1936c, for eitations). This has led some to believe that reaetions against foreign proteins are eoneerned. But in these refraetory reaetions in Starlings and ferrets with photic stimulation there ean be no foreign protein to reaet against, because the animal's own glands produee the hormone against the effectiveness of whieh refraetoriness oceurs. Nothing foreign is introdueed into the system and no natural hormonie balanee is disturbed.

Rapid development of this refraetoriness is probably at the bottom of reeurrent short sexual eyeles with or without ovulation intervening, and rapid reeovery leads to repeated eyeles in polyoestrous animals. Quick aetivation followed by quick regressive phases with prompt reeovery of aetivity, or slower eycles, in different speeies will account for differenees in length of oestrous eyeles from the five-day

cycle of the mouse to the longer ones of other animals like ferrets and rabbits. The relative length of these cycles may also be subject to environmental interference by various types of stimuli, and may be suppressed temporarily for varying periods by such agents. Some such factor operative in birds is capable of limiting the clutch of eggs laid. It is in some way dependent on the number of eggs in the nest; but how it acts is far from clear.

In December and January, 1931-32, an attempt was made to determine whether the light affected the Starlings through the head. Light-tight hoods were placed upon half the birds in a cage while added exposures to light were made. But all the birds in the cage died from the necessary handling of the birds to put on and take off the hoods, and nothing came of it. From similar experiments with ferrets, however, using hoods with and without eyeholes, it was evident that for them the eyes were the receptors for sexual photic stimulation (Bissonnette, 1936d). Benoit (1934, *et seq.*) has shown that for the duck the eyes are the normal receptors; with eyes removed, the exposed ends of the optic nerves may act as receptors; even the hypophysis itself may be stimulated directly by light to induce sexual activation; but only when thyroids and hypophysis are present. He also found that the red end of the spectrum was effective but not the blue-green regions. Ivanov (1934), however, concludes that in sparrows even denuded skin may act as receptor for this reaction. Martin, Buchner, and Inkso (1933) found that if combs were removed from cockerels their wattles and testes enlarged considerably. So the reception of sexually stimulating light was increased.

The first account of use of night lights to induce autumn and winter laying with poultry dates back to a Spanish book of 1802. Waldorf in 1905 was first to use it in this country (Lippincott and Card, 1934). The response is evident in ten to twelve days. But fowl may be bred to high winter production without night lights and the poorer layers are the most improved by increased light (Whetham, 1933; Kennard and Chamberlin, 1931).

Warren and Scott (1935, 1936) and Scott and Warren (1935) have shown that, among the factors influencing ovulation rate in the hen, light is an important one.

Miyazaki (1934) showed that the mejiro, a green bird of Japan, can be brought into sexual activity and caused to sing its mating song at least three times a year instead of once by night-lighting or "yogai" as it is called. Reduction of daily periods of light leads to molting.

Petty (Brill, 1934), in Oklahoma, indueed the Bob-white quail to lay from January 1 in one year and December 3 in another by inereased lighting and controlled temperature and humidity; and one hen laid 167 eggs before stopping. He also induced them to "group mate" with two eoeks and seven hens, with fertility just as high as with pairs. Fertility and hatehability were good and growth better than normal. Bissonnette and Csech (1936a, 1936e) independently indueed Bob-white to lay outdoors from Mareh 22 instead of May 19, in Hartford, Conneetieut, with fair fertility and some hateh, without eontrol of temperature or humidity.

Martin (1935), with eontinuous light from 5:00 P. M. to 6:00 A. M. and feeding for egg-produetion, from Deeember 5, induced laying beginning January 1. Cold weather did not hamper egg-produetion. No eggs were fertile before three weeks of laying but after that fertility was high, espeeially after days began to be warmer in late winter.

Clark, Leonard, and Bump (1936, 1937) found that pheasants, quail, and ruffed grouse all responded to inereased illumination in winter by enlargement and activation of the gonads, but failed to eontinue long enough to seeure laying. Bissonnette and Cseeh (1936a, 1936b, 1937) induced Ring-neeked Pheasants to lay fertile eggs beginning on January 15 by gradually inereasing their periods of daily illumination from Deeember 16, and indueed three hens to lay an average of 105+ eggs eaeh before June 29. The hens, but not the eoek, were apparently exhausted by this aetivity and after eeasing to lay they all died soon after return to the normal daylight eonditions. In another experiment five hens and a eoek hatehed on May 7 were subjeeted to inereasing night-lighting from 151 days of age, Oetober 5. One hen began to lay at 185 days of age on November 8. Ten of the eleven eggs she laid were set and gave 50 per eent fertility and 30 per eent hateh on Christmas day. In nature these birds would not have laid till controls did at April 4 and 5, or about 332 days of age. All these birds were in pens smaller in dimensions than those of eontrols. So their freedom to exereise was eurtailed though it was doubtless prolonged eaeh day. In some later experiments in whieh similar periods of lighting were given but two pens were subjeeted to greater disturbanee from the publie and from observation generally than another pen plaeed between them, the least disturbed or least exereised pen was the one to lay most eonsistently and prolifieally. Greater exereise and disturbanee did not lead to earlier or greater sexual activity (unpublished data).

Sparrows, recently tested by Keck (1932, 1934), Ivanov (1934), Kirschbaum and Ringcon (1936) and Riley (1936), show sexual photoperiodicity. They also show evidence of refractoriness to stimulation in early autumn just after the breeding season, which is not shown by young birds of the season's broods. Witschi and Riley take this to minimize the effect of light as a factor in modifying sexual cycles. But it would seem better to regard it as a reaction against maximum activity which causes lowered susceptibility to photic stimulation. It also indicates that young sparrows in their first year would come into breeding in autumn but for the retarding influence of shortening days. Ivanov's finding that denuded skin as well as eyes may act as receptor in sparrows has not been confirmed by others. Ringoen and Kirschbaum (1937) found that covering the eyes of sparrows prevents even seven hours of added light from inducing spermatogenesis in November when controls were completely activated.

Recent work on mammals and birds indicate that sexually photoperiodic animals, as well as others, have inherent cycles of the anterior pituitary and of gonads, etc., dependent on pituitary activity, which, in the absence of effective environmental factors to modify and synchronize them with the seasons for optimum reproductive success, control the reproductive and other rhythmic activity. Phases of these cycles may be accelerated, initiated in periods of normal quiescence, retarded, or delayed by one or even many environmental variables, of which changes in daily duration, intensity, and wave-length of light and changes in types and constituents of food are two.

The peculiar sexual behavior of migratory birds will be discussed below along with other phases of migration phenomena.

Migration

This form of photoperiodicity has been ably reviewed by Rowan (1926, 1931), Wetmore (1932), Kendeigh (1934), and Thomson (1936) and some additional facts in relation to transequatorial migrants have been brought out by Marshall (1932, 1936, 1937) particularly in his Croonian Lecture and the supplement which followed it. These relate to the special types of sexual photoperiodicity of birds whose migration across the equator and failure to breed in their winter range have been such stumbling blocks to those formulating theories as to its cause and its general relation to more common forms of migration. It is difficult to discuss migration except in correlation with sexual photoperiodicity, because Rowan's work has shown that the two phenomena are closely correlated, in some birds at least. One might well add that tendency to form summer and autumn flocks is

also related to these phenomena. Therefore it is impossible to avoid some overlapping of the following upon the preceding topic.

Riddle, Smith, and Benedict (1932) suggested that the thyroids of migratory birds fail to respond to onset of cold weather by increasing activity while those of non-migratory ones do. Migratory birds have higher metabolic rates than do non-migrants. Kendeigh (1934) believes that spring migrations correspond secondarily with the prevalent temperature of the season; when spring temperatures average higher than usual migration is earlier, and later when temperatures average lower. This is difficult to separate from brighter days due to less overcast skies.

Sharpey-Schafer (1907), as quoted above, points out the need for a regularly recurring environmental stimulus to condition migration such as regular increase and decrease of length of day in spring and autumn. But he felt sure sex-gland fluctuations are not its fundamental internal cause, because in spring migrants these glands are but little larger than in autumn. With this Eifrig (1924) agreed.

Rowan (1925-37), however, in a series of very ingenius experiments with juncos and crows, was led to the conclusion that, for these species, the change in length of day in autumn causes the regression of the gonads which brings on the southward migration or perhaps more properly the restlessness which leads to migration. He concluded that increase in activity of these glands in spring induced by increasing daily exposure to light causes the spring restlessness leading to migration northward (Wagner, 1930). His experiments with crows are suggestive rather than conclusive, at least in regard to northward migration. His conclusion that the birds migrate southward when their sex-glands are either regressing or just regressed and northward when they are becoming larger and more active is supported by Wagner's (1930) finding that caged migrants show pronounced activity at night only at the spring and autumn periods of migration. Rowan's results indicate that temperature is not a major factor in the induction of sexual activity or its suppression, to which he attributes migrations, though Kendeigh (1934) appears still to consider temperature changes a major cause of migrations. Rowan is supported on the temperature question by Bissonnette (1930-1933) and Bissonnette and Wadlund (1931-1933) with Starlings, Cole (1933) with Mourning Doves, Miyazaki (1934) with Mejiros, Petty (Brill, 1934) with Bobwhites, Martin (1935) with pheasants, Clark, Leonard, and Bump (1936, 1937) with pheasants, Bob-white, and grouse. Bissonnette and

Csech (1936-7) with pheasants and Bob-white, Benoit (1934-6) with ducks, and Scott and Payne (1937) with turkeys.

Moreau (1931) and Bissonnette (1932c, 1933, 1936c) have suggested that change in type or scarcity of food may act as a limiting factor though not as an activator, when it becomes inadequate to support reproductive activity. Witschi (1935) denies this, without reservation of any kind, on the basis of the fact that his African weaver birds retained their breeding cycles on a constant food ration for three years in Iowa City. But they were evidently on an adequate diet all that time. That they did not change their cycles does not prove that even their cycles can not be modified by changes in feeding régimes just as Bissonnette's Starlings on inadequate diets were prevented from responding completely to sexual activation by very stimulating exposures to even red light, to which, on adequate and varied diets, they are most responsive. Witschi's birds responded sexually to the inherent cycle of the anterior pituitary without modification by changes in light cycles. Scott and Payne (1937) had already found that the guinea fowl, a native of the tropics, is not sexually responsive to added lighting out of its normal breeding season (Bissonnette, 1936c). Blinded ferrets also show failure to respond to increasing daily exposures to light (Bissonnette, 1937) but show an inherent cycle of sexual activity and quiescence, which, however, cease to be correlated normally with the seasons, as they are with intact eyes. This mammal has a seasonal sexual cycle, like the Starling, conditioned and modified by seasonal changes in length of day. This conditioning is removed by cutting the optic nerves and the animals behave like Witschi's weaver birds do naturally. It is evident, therefore, that in some birds and mammals the inherent cycle of the sexual apparatus is more fixed than in others and less susceptible to environmental interference or less responsive to different environmental factors of which change in length of day and change in food are merely two (Bissonnette, 1935, 1936c). As Bissonnette has pointed out, these cycles are conditioned by various factors in addition to the internal rhythm, depending on the evolutionary and environmental history of the animals concerned.

Rowan (1929, 1936) concludes from his experiments that the migration in autumn is due to shortening days acting not as reduced photic stimulation but as reduced periods of exercise or bodily activity inducing shrinking and decreasing activity of the sex-glands; the spring one to increasing daily periods of exercise, not increasing photic stimulation, inducing enlargement and activation of the sex-glands. With this phase of his theory of migration and sexual photoperiodicity

Bissonnette and his co-workers and Benoit (1934-6) and some others are not in agreement. Nor is it certain that the sex-glands are necessary to the migration cycle. That the anterior pituitary is a necessary part of the mechanism is more probable in the light of recent research and of Rowan's experiments on crows. The probability of an inherent cycle of high and low sexual activity resulting from a similar cycle of activity of the anterior pituitary can not be overlooked in view of the regression of sexual activity in Starlings before June 15 in nature (Bissonnette, 1931, *et seq.*) while days increase in length till June 21 and in luminous intensity till later in the summer. Similar regression also occurs in Starlings, ferrets, fowl, ducks, raccoons, and other birds and mammals under experimental lighting schedules, and also under continued injections of gonadotropic hormones from the anterior pituitary and pregnancy urine (Bissonnette, 1936c).

For birds that do not migrate into the tropics or across the equator, Rowan's hypothesis with the above reservations seems to fit the cases better than any combination of factors including temperature and food yet suggested. Considerable evidence is accumulating, however, that sexual cycles, in birds, mammals, and some other animals, and, probably, migration cycles in birds depend on inherent rhythms of the anterior pituitary more or less fixed in the absence of, or without responsiveness to, external, usually stimulating, factors like light cycles (Bissonnette, 1930-37; Hill and Parkes, 1933, 1934; and others). In many animals, in nature with normal exteroreceptors, these cycles are synchronized with the seasons by response to external factors, of which light cycles may be only one, depending on species, length of incubation or gestation period, and/or the degree and rate of change in the effective intensity of the external factor (Bissonnette, 1935, 1936c; Witschi, 1935; and others). For example, while increasing light activates or accelerates sexual activity in Starlings and ferrets, the sex-glands of Starlings on normal light cycles go into regression before the maximum length or brightness of day in June, and both Starlings and ferrets go over into sexual regression after a time even in spite of experimentally lengthening days and can not be maintained in continuous maximum activity by increasing duration and intensity of light. They become refractory to this type of stimulation and for a time incapable or much less capable of a second stimulation or require much greater degree of stimulus than before the refractory condition sets in or longer time to be activated again. Riley (1936) has shown that this is also true for sparrows. Their susceptibility to stimulation then

increases again and, in the absence of increasing light as a stimulator, the pituitary may again become active, though at a slower rate and later in time than with light or other stimulating factor to accelerate its action (Bissonnette, 1937). Bissonnette's experiments with Starlings and Benoit's (1934-1936c) with ducks indicate that it is light *qua light* and not increased waking periods or exercise that is the major factor directly concerned. Both find that not only is increasing length of day a factor but also increased intensity and larger amounts of the longer-waved rays near the red end of the spectrum. The shorter-waved blue and green are ineffective to stimulate Starlings or ducks; but, with ferrets, all the visible and a little of the very near ultra-violet are apparently equally effective to induce sexual activity (Marshall and Bowden, 1934-1936). This points to species differences in this matter. As pointed out above, Scott and Payne (1937) have shown that for turkeys the light must be of additional duration and not merely added during the day as increased intensity of illumination, possibly because given in that way it is not enough of a relative increase to induce increased response. Marshall and Bowden have shown that if the intensity times the time of additional lighting is kept constant the resulting acceleration of sexual activity in the ferret is approximately constant. If the additional duration is zero, perhaps that would account for Scott's results since additional duration is reduced to zero and the product is therefore also zero.

Kendeigh (1934) has shown that direct endocrinal stimulus is important in migration and he believes the hormones from the gonads, varying as part of the reproductive cycle are most important. Keck (1932, 1934) and Witschi (1935, 1936) have shown that sexual changes in birds are dependent upon pituitary hormones. Benoit (1937) finds that the thyroid is involved as well as the pituitary. Castration lowers metabolic rate as does decrease of thyroid activity (Mitchell, Card, and Haines, 1927; Aude, 1927). Wachs (1926) believes that the physiological rhythms concerned are independent of or related only in time to environmental changes. Length of day or change of intensity of light can have little causal relation to the return of trans-equatorial migrants. Species differ in regularity and types of migration. We agree with Kendeigh that climate includes factors of major importance in controlling migration, distribution, abundance, and behavior responses in many birds. We would add that of these factors changes in duration, intensity, and even wave-length of light with the seasons and the development of refractoriness to the activating factors are of paramount importance, for many species.

Thomson (1936) points out the "inter-migrations" which are superimposed upon the primary or great migrations of many birds. These may even be reverse migrations. They occur in response to adverse weather conditions among weak migrants and do not occur among strong migrants which will succumb to bad weather without retreat. "Abmigration" in ducks is a northward migration in spring by birds that have remained over winter in their original breeding areas. These, with exaggerated migrations by some birds, may lead to invasion of new territory in some seasons. They may also be mere food expeditions and not migrations in response to the normal migration-inducing stimulus. They may depend upon fluctuations in food supply like the invasions of New England by snowy owls about every four years which correspond to the years of maximum population of arctic foxes. These movements are not usually directly north and south. Migrations from more to less arid regions in the tropics, even across the equator, may be of this sort. In Africa, some species are found both north and south of the equator and breed in opposite seasons in the two localities. Some breed in the north of their range and some nearly related species in the south part of their range. One species crosses the equator and breeds in the south and so can feed on winged termites almost throughout the year. This is related to changes in humidity.

The order in which the two sexes and ages reach the summer territories varies with different species. In some, males precede, mixed groups next, and females alone last. In some the first are all young, and old males are last; in some the young come first, then mixed old and young (Starling); in others old birds only, then mixed old and young, and only old birds again last. Rowan showed that adults precede young birds in autumn among juncos, females first followed by flocks of males; the reverse is true in spring. Among golden plover, young birds take a different route and a different time from the old birds. These cases show differences in reaction of physiologically different members of the same species and also sex differences.

Van Oordt (1928, 1931) showed that birds failing to complete spring migration usually have winter or intermediate plumage and inactive sex-glands, which may be due to vagaries of the anterior pituitary. Gotz (1929) found that, if there is an autumn molt, migration follows it immediately; that delayed breeding is followed by delayed molt and migration; that passerine birds with two molts per year are usually migrants. Others see less correlation of molt and migration, since individuals in some species differ from others in relation

of molt to migration. Some spring migrants are even losing body feathers while migrating. Both molt and migration are probably related to the rhythm of the pituitary sometimes in different ways, even depending on the previous experienees of the individual bird. Segregation of speeies is often shown in large migrating mixed floeks. Few sing on the northward spring flight; none in the autumn flight. Particular communities of some speeies take different routes habitually and this may lead to extermination of some groups with survival of others. Different routes are often taken by the same birds in spring and autumn. The origins of migration and of these speeifie and individual differenees is beyond the seope of this paper.

Native born Starlings in England do not migrate (Wynne-Edwards, 1929); neither did these birds for some time after introduetion into Ameriea. But of late they are beginning to do so. Migration ean not be a learned habit because in some speeies the young preeede their parents and in some they follow. Thomson (1936) believes that two faetors are aeting as stimuli to migration; physiologieal eyelic ehanges in the bird and seasonal extrinsie faetors in their environment. He points out that reversed migration in Rowan's Crows oeeurred in only a few birds but that they followed the direetion usually taken by Crows in their normal migrations. Castration did not inhibit these migrations. He thinks Rowan may be overstating it when he eoneludes that the southward migration is independent of the gonads, though it is probably so for young birds of the year. He fails to eonsider the eomplete results of Bissonnette's work in its bearing on Rowan's eonelusions and apparently knows nothing of Benoit's studies on the duek, cited above, and their support of Bissonnette's findings.

Thomson points out, as we did above, that both Rowan's and Kendeigh's theories of migration require modifieations to suit transequatorial and other types of migration mentioned above. He agrees with Moreau (1931) that periodieity differs with different speeies of migrant; that daylight ehanges apply only to migrations of birds from temperate regions and only in autumn to transequatorial migrants from temperate zones whose spring migration is governed by an internal rhythm whieh over-rides external faetors; that in birds eonfined to the tropies some other faetor or faetors must operate. He says the "periodieity is essentially the same in all eases, but it may beeome linked with different faetors in the environment aeeording to eireumstances. The inter-related reproduetive and migration eyeles may both be expressions of a periodieity refleeting the influenee of all the external eonditions governing the bird's life; the phases of these eyeles

may be induced by environmental stimuli of different kinds, or may occur to some extent without extrinsic stimulus by virtue of an inherent rhythm. In some such way the hypothesis of a primary stimulus from the reproductive system may be given general application to various categories of migratory birds". According to our hypothesis, which will be stated below, we need only change "reproductive system" to endocrine system of the anterior pituitary and related glands.

Chapman (1928) points out that the last migrants to arrive are in general the first to leave and that corresponding dates of arrival and departure tend to be approximately equidistant on each side of the summer solstice. He feels that the state of the reproductive organs prompts birds to migrate to nesting sites.

Stimmelmayr (1932) suggested that a particular declination angle of the sun in both autumn and spring is the critical factor in each case acting through atmospheric electricity, just as he ascribes orientation for the homing reaction to electric currents not as yet demonstrated. But Besserer and Drost (1935) have shown that, with these possible electric factors excluded by insulation of the cages, the birds still show "migration restlessness".

Thomson (1936) thinks that, for most cases of migration, weather is capable of acting only within narrow limits on birds already stimulated by the primary factor to a state of unrest. For those with "weather movements", however, it may act as more than a secondary stimulus. The autumn departure date is modified by falling temperature and high barometric pressure in conjunction with individual physiological states (Nice, 1933). If approximate date of migration depends on seasonal rhythm of the bird and its environment, and exact day on immediate weather conditions, the precise moment of flight often depends on intensity of light, even to a particular degree of twilight for nocturnal migrants (Drost, 1930, 1931).

As to path of flight on migrations, Stresemann (1935) suggests that the angles of inclination and declination of the earth's terrestrial magnetism at different places acting on statoliths in the birds' ears may act as a stimulus to guide them on flights till the right ones are reached. But, since members even of the same brood may migrate in different paths, there would seem to be no general rule operative in all cases. This may or may not be related to light. We have not enough data to decide (Thomson, 1936).

If one may be at least condoned for attempting to put forward as a working hypothesis a suggestion as to the interaction of intrinsic and extrinsic factors in bringing about migratory flights and failure to

breed in the winter range, the following may be of some interest and stimulation to further study of sexual and migratory photoperiodicity.

Recent research on the physiology of the hormones of the anterior pituitary, gonads, and thyroids indicate that there is, in many animals at least, an inherent rhythm of activity of the pituitary of varying duration of cycle and of phases of that cycle. The gonads, accessory sexual apparatus, and behavior are subject to control by the pituitary and thyroid as shown above. This rhythm is in some animals capable of stimulation, inhibition, or retardation by extrinsic factors of which changes in daily periods of light and in food are two. If so, or if not, the sex-glands and pituitary reach a maximum phase of activity but can not be maintained beyond a time which varies with the species and the rate at which they have been caused to come to this maximum. The whole complex of endocrine action on which the sexual cycles depend goes over into regression of varying rate and degree and a refractoriness of varying duration results. These are the facts.

The sexual and migration cycles are correlated with those of plumage and the pituitary-thyroid complex. If the progress of regression of pituitary and gonads during the refractory phase, which develops with or without extrinsic inhibition, or even in spite of stimulation by increasing days or other lighting changes, is slow and of considerable duration and if flocking and southward migrations of many birds are dependent on it, the southward flights may take the birds to or beyond the equator. Rate of flight may also help to determine the distance flown southward. If in young birds of the year shortening days induce an autumn regression of the pituitary when activation would otherwise occur, their first southward flight will be accounted for. If the refractory period of this endocrine system is prolonged after southward flight stops and before the recovery phase of the cycle begins, also more or less spontaneously, or the birds become responsive to longer days, failure to breed in the southern or winter range results. Detention in that range, however, should be followed by a breeding cycle there. That this does occur with European storks in captivity in Lima, Peru, has been pointed out by Murphy (1925, 1936) and Marshall (1937).

On recovery of the pituitary, begun even with days not increasing, or when not completely inhibited by a steep enough falling gradient of day-length or other factor to which the birds respond, the birds would be stimulated by pituitary activity to the reverse reaction and fly northward or toward their summer range before or while their sex-glands begin progressive changes which culminate, or reach such a

point as to induce migration to stop, and mating, nesting and incubation to occur, at a time and place depending on the species and perhaps on their original birthplace and region of early acclimation (Cole, 1933). These last functions are conditioned by hormones from the anterior pituitary (Riddle and his co-workers).

This return to activity of the pituitary and sex-glands may occur in some animals even in spite of great reduction of effective day-length as indicated by experiments on ferrets, mammals whose sexual cycles are partly controllable by changes in daily lighting just as are those of juncos, crows, starlings, canaries, doves, mejiros, ducks, etc. (Hill and Parkes, 1933, 1934; Bissonnette, 1936c, 1937; Benoit, 1934-6).

Prolonged refractory periods following maximal activity with or without environmental stimulation by light or other factors, would supply the necessary delay to prevent even trans-equatorial migrants from breeding in their southern range. Recovery of the activity phases of the pituitary cycle, even without environmental stimulation at first, will account for the start northward and the reactivation of the sexual apparatus, in various degrees of correlation with each other, depending on the evolutionary history of the species.

This would give a single theory to account for the behavior of all true migrants, whether controlled by seasonal changes in illumination or not. But much testing, both in general and in detail must be done before this theory can be more than a working hypothesis. That it is reasonably easy to test, both experimentally and by observation of birds and their movements in nature, is beyond question.

That the primary agent to modify the cycle is change of periods of exercise is improbable in view of Bissonnette's and Benoit's studies. Also, the long-continued flight southward, coming in some birds at night after feeding by day, would induce reactivation of the gonads if increased exercise were the major factor inducing northward migration and sexual activity, if the refractory period were not too pronounced to be overborne by it. In fact Rowan's castrated Crows migrated southward in the autumn condition (Rowan, 1932). This would suggest that the cause is more fundamental than the reactions of the gonads. One thinks of the anterior pituitary as the more fundamental agent.

Cole (1933) suggested that different geographical groups of some species may vary in their response to light;hence their distribution; though light is not the only factor operating (Bissonnette, 1932, '33, '35, '36; Davis, 1933; Lock, 1933; Linsdale, 1933; Witschi, 1935). Variations in their refractory periods and in the time at which they

reach mating and nesting phases of recovery would account for their place of taking up these activities and for their summer distribution. This may be related to their birthplaces and early conditioning during their first summer. Bissonnette (1935, 1936c) suggested this probable control of migration by the anterior pituitary, and Allard (1928) suggested that length of day is the probable environmental factor most concerned in setting off migration urge, but that it could apply only to birds subject to lengthening days in spring in their southern range and also during their northward flight.

It is likely that different species are conditioned by different factors in their environment, some already known, others not yet determined; and the same species may be responsive to more than one factor. Enough importance has not hitherto been given to the occurrence of the refractory state or phase after varying periods of maximum activity of the endocrine systems. These develop in spite of increasing intensity and duration of the normal extrinsic stimulus. The degree and kind of response differs in different species. The inherent rhythms are perhaps more dependent on this regularly recurring refractoriness with temporary regression than upon the occurrence of recurring stimulation. Recovery may be, and probably is, spontaneous in the absence of conditioning by external factors or when animals are not inhibited by decreasing amounts of stimulation. The frequently repeated cycles of polyoestrous animals including birds may well be determined by the quicker arrival at the refractory phase followed by quick recovery without great susceptibility to stimulation or inhibition by external factors or changes in them. This may be the determining factor in birds that have two or more broods per year in contrast to those that have but one. It may also in different degree be responsible for the different times at which different species and even different groups of the same species begin their flights in migration. Age and sex differences may furnish the physiological differences in condition which cause one bird to react at one time, another at another. It would also account for the different times at which birds arrive in the spring.

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THE MOCKINGBIRD IN WESTERN SOUTH DAKOTA

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The arrival of Mockingbirds at our grove in May, 1936, brought to us the pleasant expectancy of a number of days of unusual entertainment, and the recollection of visitations of other years, but no more than a promise of the eventful season of observation and enjoyment that was to be ours.

In our twenty-six summers on the plains, Mockingbirds (it is the western form, *Mimus polyglottos leucopterus*, with the larger white wing patches, which comes to this southwest corner of South Dakota) had been rare. The first was noted perhaps twenty years ago, unmistakably, for we had known the Mockingbirds of Arkansas and Illinois. He stopped for a morning's rest and inspection of the relatively new homesteads and young trees. The tally of those that had been seen prior to 1936 was no more than seven, including two pairs in different seasons. One pair had remained for thirteen days.

On the morning of May 2 bold and ringing notes were heard, and the new visitor was eagerly sought out, for to be able to see and to

watch the performance of a brilliant and distinguished singer is no small part of one's satisfaction in hearing his recital. This bird proved to be delightfully friendly and fearless, coming now and again to the trees nearest the house, occasionally using as a stage an adjacent shed, or the house chimney. His excellent repertoire included calls of the Bluebird, Bluejay, Meadowlark, Catbird, Robin and, somewhat rarely, those of the Goldfinch, Grackle, and Shrike, and his imitation of the common, noisy small talk of the English Sparrow was nearly perfect. As with others of his kind the greater part of his song was made up of elements we could not distinguish, though several phrases, we felt, from their frequency, must have been gleaned from his sometime neighbors with which we were unfamiliar. Then, too, it seems probable that some songs are disguised by the Mocker's own vivid and intense nature or by his vocal restrictions.

One of our earlier friends, I recall, had spent much time practicing a certain *prair-e-chick, prair-e-chick*, hesitating and prolonging the first syllable, slurring the second, accenting and staccatoing the last. His production never seemed to quite satisfy him. Instead of his usual rapid changes he would often sit quiet a moment or two before going on, or returning for another try at *prair-e-chick, prair-e-chick*. Another bird by practice or superior endowment had become a past master at Bluejay imitation. He would give the jay's explorational or arrival call of *jay, jay, jay!* and follow it immediately with a repetition that gave the effect of a sociable fellow amid numerous friends in the upper branches of red oaks at a little distance; and as often would continue with a *jay, jay, jay!* that you would say came from deep woods two hundred yards away, if you had not observed the actual enunciation; all this practically on the open prairie, for our trees, even today, are relatively small—there are no red oaks on the dry, high plains—and without changing his post.

It was not until the tenth day that we got sight of a second bird, which we were sure had been about from the beginning. Now we checked the days carefully, hopeful that the previous fateful record of thirteen would be exceeded. It was. The delightful concerts were continued, at dawning, the morning long, at high noon, often throughout the afternoon, well into the night; not so much through the night, it seemed, as with the birds of Illinois; near the house he sang, here and there through the grove, much of the time in a neighboring grove, that of my parents, similar in extent, four or five acres, and separated by a bit of meadow and a road.

As the days advanced well into late May we began to wish fervidly that the season might not be too unkind, that the supplies of water, seeds, insects, whatever else might come in the line of necessities would prove ample for the summer, so that our birds would not find it obligatory to retreat the eighteen miles to the south across the line into Nebraska, the recorded northern nesting limit of the species.

About this time shrikes began to make themselves much too obvious. The singing, all the habits of the Mockingbirds were continually interrupted. No actual contact battles were witnessed, but the days came to be filled with skirmishings. Neither shrike nor Mockingbird seemed to gain an advantage. The thrilling dark gray and white was pursuer as often as the bullet-like pearl-gray, white, and black. There was, however, this difference: the shrikes were more or less at ease in their usual rôle, while the Mockingbirds impressed one as brave but very much annoyed. By the third or fourth day the leader of the Mockingbirds, too hard pressed, was tiring, and nerve strain had become evident. We were compelled to take a part. Mrs. Barr, as "gunman", went out with the .22 and easily "got" two of the shrikes. The others became wary but within a few days three more were downed, and the one or two that hung about a few days longer gave no trouble. The Mockers accepted the relief promptly, and all was well, as indicated by the floods of song that were poured out again.

It was a week or more after this that Mrs. Barr hurried out with the .22 in answer to a shrike call. It seemed to come from the end tree of a row of silver poplars. The Mockingbird was there upon a high twig, unafraid, giving out an occasional note or two. The shrike could not be sighted. At last, as she was about to turn back to the house, the shrike call came again, at close range, and the Mocker himself was discovered to be the guilty party. This incident would have given fitting denouement to the shrike episode but that, still later, shrikes did appear again. They listened to the Great Mimic's shrike song, slunk away to a low corner of the orchard, sat, bewildered, in a cherry tree for an hour or more. And the final end was that they silently folded their tent and beat it.

In early June a nest was found about six feet from the ground in the crotch of a twiggy lower limb and the trunk of a dead Norway poplar. The tree had been retained for winter windbreak effect and headed back to twelve feet to prevent possible breaking and damage to interplanted pines and ashes. The nest was open to the sun until mid-afternoon but had a secluded location in being beyond the orchard, in the least frequented part of the grove and near to a dense,

tall hedge of Russian olive. It was a large nest, built mainly of rather coarse sticks, and impossible, perhaps, for a novice to distinguish from the nest of a shrike. It was, possibly, a trifle deeper and certainly not so well lined, rather coarse rootlets composing the finish. There were but three eggs, greenish gray, spotted dark brown.

The discovery of the nest was of extreme import, for the authority for the region ("Birds of South Dakota", by William H. Over and Craig S. Thoms) states: "South Dakota is north of the range of the Western Mockers, although they are occasionally seen in the Black Hills or along streams on the adjacent plains", and added this remark, "The Mocking Birds have no equal as singers, and it is hoped that by kind treatment they may become regular summer residents of our state." A second point of interest is that this chosen summer home was not near a stream, but near the height of land between the Cheyenne and the White Rivers, and with no group of native trees that could be termed a grove closer than seven or eight miles, and as much as thirty miles in other directions. Nor is there any other planted grove of equal size, and few of any description within this extensive, naturally treeless area. Attracting these rare visitors was a triumph of wholly man-made environment.

Also of note were the extremes of drought and temperature that characterized the season. From June 1 to September 1 only a few light showers fell, no one of them wetting the ground as much as an inch and a half. Along in July the temperature many times exceeded 112 degrees, a high of 115 being recorded by the nearest official thermometer. Through late July and the month of August all known supplies of water available to the birds within many miles were exhausted. Absence of all water for extended periods is not a new obstacle to Meadowlarks and Horned Larks and a few other less frequent species, which on such occasions do not move out. As at such times no dew falls, it is believed the birds obtain their moisture needs from insects devoured, or from fruit, in the case of those which come to the grove. The Mockingbirds stayed through to September.

On Sunday, June 7, Prof. A. C. McIntosh, of the South Dakota State School of Mines, observed the rather shy mother bird of the nest, and identified the eggs. Prof. McIntosh had known Mockingbirds in Indiana. We were agreed that the western bird differs from the southern chiefly in the darker, less showy tone of the gray color. The book of South Dakota birds notes that the western form is distinguished by a brownish tinge below and larger white wing patches. The individuals we observed here were not soiled white below, as the southern

form is described, neither distinctly brownish-tinged, but gray, a somewhat lighter tone than that of the sides and back, and decidedly lighter at the throat. A faint brownish tinge might fairly be said to pervade all the gray parts of the plumage.

The Great Mimic had been spending more and more time at the neighboring grove, vocalizing much in a certain silver poplar near the house, and convenient to a closely set row of cedars. Mrs. Barr was intrigued as to his particular interest there. From an upstairs window she saw the birds entering a dense, low cedar, and there a nest was found, only five feet from the ground, quite filled with nearly fledged young.

A mystery, somewhere. This was a day or two after Prof. McIntosh's visit. On Friday of the same week I looked again into the first nest, and counted three young, two or three days from the shell. Less than a week later the nest was empty. The nest itself was apparently undisturbed, so the suggestion that a bullsnake had raided it is as good as any. But the male parent of the first nest? Polygamy, as an answer, was hardly satisfying. Doubtless there was a male bird, shy to an extreme, and doubtless it was he that authored the songs we heard a few times at a distance, when the Great Mimic was somewhere near, and loud. Perhaps a young fellow. We do not know that we ever saw him.

The summer grew hotter and the Mimic's family made greater demands; singing became intermittent, finally almost ceased, so that we came to ask one another whether the Mockingbirds had been seen during the day. But when his brood left the nest there was glorious singing. A day, two days, and then . . . There must have been a curtain lecture, perhaps a series. The old boy got right back to business. Friend wife had not come to Dakota for a pleasant vacation, there was work to be done, a mark to set. And good work was done. It is of record that but one of that brood met ill fate, from a cat. Further, on July 12, in the very silver poplar that had witnessed so many of the Great Mimic's public successes, and about fifty feet from the cedar of the second nest, a third nest, about eight feet from the ground, was found, already comfortably full of half-fledged young. Four or five, I should say, not venturing to move the step-ladder close, they were so wide-awake. At this date and later the earlier brood, frequenting the ease and umbrage of the air-conditioned pines, continued to receive a degree of supervision and a part of their food. No wonder there was hardly time for a phrase of song, only for the brief, routine signals of business.

But at that there were the cats to be looked after, particularly Mother's big gray tiger that lived on the steps or about the coal-shed, and prowled here and there with the least possible judgment, and the dog. The cat, if out away from his sleeping quarters, often came in for uncomfortable, cringing moments as the Mimic darted about him, almost touching him. It was part of the ritual, especially in the early forenoon, when the Mimic had captured worm, moth, or grasshopper, to look into the deportment of the cat at the moment. Food in bill, he would perch upon the peak of the coal-house, no more than twenty feet from the kitchen porch steps, and repeat his scolding note until content that all was well. If the enemy was in view, even asleep or otherwise uninterested, the scolding might be kept up for as long as twenty minutes, the food at last delivered to the waiting young. An observing critic might discern in this by-play a temperamental need for stage stuff, especially as the other birds did not find such performance unavoidable. And the threats directed at the dog, even to alighting on his back; it is hard to determine the genuine occasion of that. Unless this dog, retaining a puppy-like fondness of pursuing any small flying thing, even such small prey as grasshoppers, had at some time been caught by the Mimic in an ill-considered act.

Just back of the coal-shed and a line of the quadrangle of evergreens stood a group of mulberries, densely foliaged, stunted trees, and Mockingbirds were often seen there. The group was, perhaps, good hunting ground, or a shelter from the intense sun as were the pines and cedars, or merely a way station to the coal-shed lookout, as seemed likely. Yet when the leaves had fallen in October there was disclosed a used nest of the year, by all the characters a Mockingbird's nest. Can it be that the pair whose first nest was broken up came and nested here successfully?

During the great heat of the summer all living things sought shelter from the sun at every opportunity. The young birds were seldom in evidence. Never more than five birds were observed at one time, with usually an old one or two in the number. On September 2 or 3, four, which I took to be young ones, were playing along a barb-wire fence eight or ten rods to the east from the grove. It was the only time any of them were seen so far from the trees. On the third an old bird was noted once or twice. Early the next morning I may have heard a call note; I listened, but it was not repeated. The season was over.

Smithwick, S. D.

JOHN MAYNARD WHEATON

BY MRS. H. J. TAYLOR

John Maynard Wheaton, valued citizen; trusted and beloved physician; naturalist and pioneer ornithologist; was born in Columbus, Ohio, May 18, 1840. He died of tubereulosis, January 28, 1887, leaving a wife and a son eight years old. He is buried in Green Lawn Cemetery in Columbus, Ohio.* His years, though few, bore rich and lasting fruit.

Sketches of early ornithologists are written not alone for the history of ornithology but also to present in brief and tangible form the most valiant, pieturesque, and outstanding representatives in this field of natural history at a time when birds and butterflies were not in the curriculum, and entomologists and ornithologists were delicious subjects for the eartoonist. Such a eontribution was made to Ohio ornithology by John Maynard Wheaton.

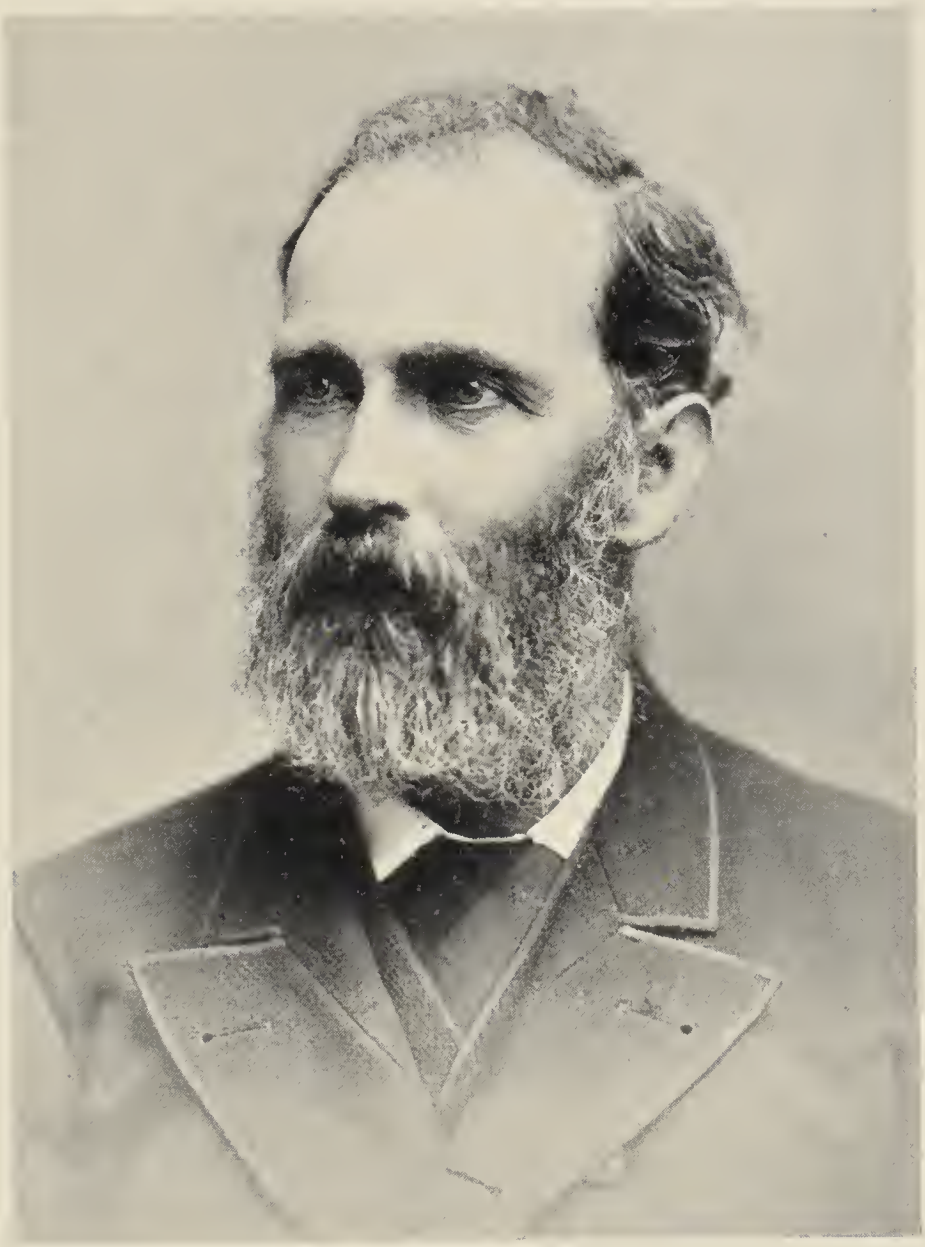
He was edueated in the public schools of Columbus. On completion of the high school eourse in 1857 he entered Denison University, a Baptist school at Granville, Ohio, graduating with a B. A. degree in 1860. The school at Granville was undoubtedly selected because of the devotion of his parents to the Baptist Church and the prominent part his father took in uniting the Welsh and English Baptists in 1835 into the First Baptist Church of Columbus. Dr. Wheaton was a loyal member and supporter of this church throughout his life.

On graduating from Denison University in 1860 he entered the office of Dr. Starling Loving, taking the course offered in the Starling Medical College. The Civil War broke out and immediately upon finishing his eourse Wheaton enlisted as assistant surgeon in the 188th Ohio Volunteer Infantry. At the close of the war he returned to Columbus and began the praetice of medicine.

He fitted up an office in the old family home on Fourth Street where he was born and where his father died. Here, too, his mother died in 1884. He reserved a room for bird cases, another was set aside for butterflies, beetles, snakes, and other natural history objeets.

John Wheaton was a thorough, painstaking student in all he did. In 1867 he was made Professor of Anatomy in Starling Medieal College which position he held until his death. He was a rare teacher greatly beloved by his students. In his time the "Family Physician"

*Data for this sketch were obtained from Mr. Robert J. Wheaton, son of Dr. J. M. Wheaton, and from such persons as had known Dr. Wheaton as physician, friend, or naturalist. Similar information is contained in "An Ohio Ornithologist", by Osman C. Hooper, in The Honey Jar, Columbus, Ohio, Vol. XVII, No. 2, p. 17.



JOHN MAYNARD WHEATON, 1840-1887

was a distinct figure in the community and held an abiding place in the hearts of grateful families. There are more than a few even today who recall him as the beloved doctor of their childhood days. His ability, sincerity, and friendly personality endeared him alike to adults and children. Professor W. H. Siebert (June, 1936) writes: "My grandfather who often went bird hunting with Wheaton would have only Dr. Wheaton to attend his family in sickness. He frequently took me with him to the Doctor's office where I saw his numerous specimens, not only of birds, but butterflies, beetles, snakes, and other objects. He was a spare man above medium height, kindly, considerate, and lovable with a pleasing voice. He was charming and entertaining in conversation. My grandfather thought the Doctor's interest in ornithology was probably due to a tendency to tuberculosis and the necessity for an out-door life." The truth is Wheaton's interest in the woods and living things found there dates from earliest childhood. After the father's death his mother often administered rebukes to her son in written form. A letter dated July 30, 1853, now in the possession of Dr. Wheaton's son, Robert, says: "John, I told you yesterday morning to do some work and you said it was too wet and asked to go into the woods. I gave you leave with the promise that you would return soon and stay in the house in the afternoon and read. You did not come home till three o'clock. Is this the way to obey and comfort your mother? If you do not become a good boy you will not go to heaven and see your father." This is but one of many rebukes given for roaming the woods and meadows. The love and call of tangible, glorious woods; trees topped with birds bursting forth in song; butterflies and bees flying and droning about; unweeded gardens at his feet were inviting realities with which an unknown heaven could not compete. It is well that youth does not take too seriously the concern of elders.

Dr. Loving paid tribute to the skill and confidence he had in his student by calling Dr. Wheaton to attend Mrs. Loving during a long and serious illness. The service rendered was one of love. Dr. Loving expressed his appreciation of this service by presenting Dr. Wheaton with a fine Kentucky riding horse to aid him in his service to others. Until then Dr. Wheaton had made all his calls on foot or street car.

Excellent physician that Dr. Wheaton was, it was as an ornithologist that he obtained lasting fame. It is not easy to understand how a man so conscientious and successful in a profession, also found time for serious scientific work the result of which is of such quality and value that his name stands foremost as a pioneer in Ohio orni-

thology. Splendid work had been done by Professor Jared P. Kirtland (1793-1877), who in 1838 prepared a catalogue of Ohio birds naming 222 species. He was widely known as a naturalist, as a horticulturist, and florist. By profession he was an excellent and beloved physician.

Wheaton's catalogue of Birds of Ohio (Agricultural Report for 1860, published in 1861, pp. 359-380) was prepared with the assistance of Messrs. John Kirkpatrick, R. W. Winslow, and Dr. J. P. Kirtland. In this catalogue of 271 birds the classification of Professor Baird, in Birds of North America, is adopted. Of this catalogue Wheaton says: "In the year 1838 Prof. Kirtland, then State Zoologist and Botanist, prepared a catalogue of Ohio Birds which was considered very nearly complete. Since then . . . new species have been discovered and others added to our fauna. Some which were then rare are now common. Many then common have now retired from our limits or are very rare." He also states that due to the physical features of Ohio the state has a larger proportion of resident birds than the surrounding states. In referring to the game law passed by the Ohio Legislature in 1857 he says: "The quail has become as numerous as ever." The legislature of 1860 wished to extend the law to protect more species. The discussion regarding such extension is enlightening and interesting. I quote the following: "The passenger pigeon needs no protection." "The yellow-hammer or flicker may be included and receive protection though its eatable qualities certainly do not rank very high." "The meadow-lark . . . though not strictly a game bird, is yet quite eatable."

Of Wheaton's "The Food of Birds as Related to Agriculture" (Twenty-ninth Ann. Rep. Ohio State Board of Agric. for 1874, 1875, pp. 561-578) Elliott Coues (Birds of Colorado Valley, 1878, p. 716) says: "This is, in effect, a corrected and completed list of the birds of Ohio, briefly annotated, and with general food-regimen of each family given; being a well conceived essay of much practical utility."

Wheaton's principal and most valued work is a Report on the Birds of Ohio, published in 1882 (Geological Survey of Ohio, Vol. 4, Zoology and Botany, pp. 187-628). This work is reviewed by that peerless critic, Elliott Coues, whose words place upon a writing a stamp that makes it current and unquestionable as to quality. Dr. Coues says: "This long-deferred work reaches us at length in the form of a treatise on the ornithology of the State so extensive and so systematic that the time [six years] its preparation has occupied seems justified if not absolutely required. . . . Dr. Wheaton's report must at once take place at the head of State Faunas, so far as ornithology is con-

cerned. It represents a large amount of original research, extending over nearly a decade. . . . applied to the construction of a systematic treatise which possesses the necessary qualities of a good working handbook of the subject. . . . Ohioans have here . . . a correct history and description of their 300 birds, systematically arranged and classified . . . a work of that useful kind called 'a manual' and bearing the weight of competent authority. Since the death of Dr. Kirtland, we doubt that any one is better entitled to speak of Ohioan birds than Dr. Wheaton, who appears to have himself collected, in the vicinity of Columbus, more than two-thirds of the species he treats,, and to have admitted none that he has not personally identified, except on unimpeachable authority." Quoting directly from Wheaton, Coues continues: "The descriptions of species are almost without exception or alteration from Dr. Elliott Coues' Key to North American Birds. . . . The nomenclature adopted is that of Dr. Coues in his Check List of North American Birds (1874) with such modifications as changes, made since its publication, require. . . . Following the description I give, as briefly as possible, an account of its general and breeding habits, together with such biographical observations as seem to me interesting or valuable . . . making a total of 298 species and varieties. . . . In the appendix I have inserted a list of birds, with the dates of their appearance and disappearance, as observed by me in this vicinity. . . . A list of [101] birds identified by me in my garden in this [Columbus] city." Dr. Coues continues his review: ". . . This volume of some 450 pages is no slight nor uncertain addition to our ornithological literature. It is easily first in its special field, and takes its permanent place among the more comprehensive treatises on North American birds . . . [since] the text is well written, and possesses the attraction of being mostly new and original. . . . Dr. Wheaton is one of the pioneers in Ohio ornithology, his publications upon the subject extending over a period of more than twenty years." (The Bull. Nutt. Ornith. Club, VIII, 1883, 110-112).

It is more than fifty years since The Birds of Ohio was published. A letter from his son, Robert Wheaton (August, 1936), says: "My father's ornithological collection has been in the Ohio State Museum since a year or two after his death. The collection consists entirely of bird skins, there being no mounted specimens among them. What is left of his butterfly collection is in our home. His collection of shells is also in the museum. Not long ago the curator of Natural History in the Ohio State Museum advised me that the Smithsonian Institution in Washington still considers my father's work their standard reference."

E. S. Thomas, Curator of Natural History, Ohio State Museum states [October 6, 1936]: "Dr. J. M. Wheaton collection shows 606 museum skins of birds."

The Wheaton Club of Columbus was organized at the Ohio State University in his honor in 1921. Some interesting contributions to ornithology have come from this organization.

John Maynard Wheaton was one of the founders of the American Ornithologists Union and his death was the first among its active members. He was an occasional contributor to current ornithological literature. Dr. C. Hart Merriam, who knew Wheaton in his profession, in his scientific work, and as a friend, in a letter received in February, 1937, says: "Dr. J. M. Wheaton, of Columbus, Ohio, was not only one of my dearest friends, but an ornithologist of high standing, whose loss was a severe blow to American ornithology. In 1874 when I was in charge of the American Ornithologists' Union's Committee on Bird Migration, Dr. Wheaton served as Superintendent of the Middle-Eastern District, including Ohio. Dr. Wheaton was an unusually competent observer, possessed of a bright eye and a keen brain, a man whose death was a great loss to ornithology as well as to his many patients and other friends."

He lived his entire life in Columbus, Ohio, where he was an esteemed citizen. The death of this beloved physician was deeply mourned by those who called him "our doctor". Friends who had talked and walked with him through woods and meadows, by lakes and streams, keenly felt the loss of his presence. The essence of his life has enriched the science of natural history and in the field of ornithology he lives for his valued contribution.

Writings of J. M. Wheaton

1861. Wheaton, J. M. Bird Notes. Field Notes [Agricultural Newspaper, Columbus, Ohio]. I, 1861, 65.
Note on the distribution of the distribution of the Pileated Woodpecker, Whip-poor-will, Nighthawk, and Shore Lark.

1861. Wheaton, J. M. Rare Birds. Field Notes. I, 1861, 153.
Notes on the capture at Columbus, in May, of *Porzana carolina*, *Rallus virginianus*, *Guiraca ludoviciana*, *Ardetta exilis*, *Gallinula galeata*, and *Chondestes grammaca*. New species, 1.

1861. Wheaton, J. M. Ornithological Inquiries. Field Notes. I, 1861, 152.
Suggestions as to the proper identification of *L. occidentalis*, with interesting notes upon the breeding habits of the Florida Gallinule, and upon *Ardetta exilis*, and *Botaurus lentiginosus*.

1861. Wheaton, J. M. Catalogue of Birds of Ohio. Ohio Agricultural Report for 1860 (1861). Pp. 359-380. Prepared with the assistance of Messrs. John Kirkpatrick, R. K. Winslow, and Dr. J. P. Kirtland.
Two hundred and eighty-five species are given with annotations.

1861. Wheaton, J. M. Catalogue of the Birds of Ohio. Reprinted from the Ohio Agricultural Report for 1860. Pp. 1-21.
A reprint of the preceding title, repaged, and with its addenda distributed in place. Three species are added to the list of probabilities.

1874. Wheaton, J. M. Notes Found in Coues' Birds of the Northwest, 1874, pp. 233-234.
In these notes credited to Dr. Wheaton are annotations on the Olive-backed Thrush, Blue Warbler, Yellow-throated Warbler, Cedar Bird, Brotherly-Love Vireo, Loggerhead Shrike, Song Sparrow, Lark Finch, ,Nighthawk, and Chimney Swift.

1875. Wheaton, J. M. The Food of Birds as Related to Agriculture. Ohio Agricultural Report for 1874 (1875). Pp. 561-578. (September, 1875). Also a reprint, repaged but otherwise unchanged. "This is in effect a corrected and completed list of the birds of Ohio, briefly annotated, and with the general food regimen of each family given; being a well-conceived essay of much practical utility." From Coues, Bibliographical Appendix, Birds of the Colorado Valley, 1878. This edition contains 288 species with six additional varieties.

1877. Wheaton,, J. M. The Ruff and Purple Gallinule in Ohio. Bull. Nutt. Ornith. Club, II, 1877, p. 83.
First authentic record of the Ruff and Purple Gallinule in Ohio.

1879. Wheaton, J. M. Kirtland's Warbler again in Ohio. Bull. Nutt. Ornith. Club, IV, 1879, p. 58.
A male and female *D. kirtlandi* taken at Rockport, Cuyahoga County, Ohio, in 1878.

1879. Wheaton, J. M. Occurrence of Birds Rare to the Vicinity of Columbus, O. Bull. Nutt. Ornith. Club, IV, 1879, p. 62.
Reports the Red Crossbill (in June), Swallow-tailed Kite, Barn Owl, and Pinnated Grouse.

1881. Wheaton, J. M. The Ruff. Cinc. Soc. Nat. Hist., Vol. 4, 1881. p. 341.

1882. Wheaton, J. M. Report on the Birds of Ohio. Report. Geol. Survey, Ohio, Vol. IV, Part I, 1882, pp. 189-628.
This list includes 298 species.

Berkeley, Calif.

WINTER NESTING AND WINTER FOOD OF THE BARN OWL IN SOUTH CAROLINA

BY CLARENCE COTTAM AND A. L. NELSON

The Barn Owl (*Tyto a. pratincola*) is a widely distributed species occurring at least casually in all sections of the United States. It is usually a permanent resident wherever it becomes established, although records indicate that it is partially migratory. The Biological Survey's banding and migration files contain a number of records of individual birds banded in New Jersey and Pennsylvania that were subsequently collected in South Carolina and Georgia. While it is known to be an erratic nester, most nidification records are for the spring months. Several records of fall and winter nests, however, have been published and a number of these are for South Carolina. Audubon in his "Ornithological Biography" (Vol. 2, pp. 404-405) discusses the finding of a nest of three young in October near Charleston, and estimated that the eggs from which the young had been hatched must have been laid by September 15. The young in this instance had been fed throughout their nest life exclusively upon small mammals, principally cotton rats. Arthur T. Wayne, in the *Auk* (Vol. 25, 1908, p. 21) reported finding a pair of these owls nesting in early winter, November 18, 1906, in an old mill on the banks of the Cooper River. The following year on the same site a nesting pair had a clutch of six eggs by September 19. Wayne advanced the theory that the birds may breed in South Carolina in the fall because at this season their natural food supplies are at a maximum. Rhett Chamberlain, (*Auk*, Vol. 28, 1911, p. 112) gives a record of another set of four eggs near Charleston in September. Other State records cover occurrences of nesting in the spring, which is considered the normal breeding season.

As further evidence of the winter nesting habit of Barn Owls an interesting recent record of off-season breeding may be cited from one of the Federal Migratory Bird Refuges. Reference is made to the Cape Romain Refuge located not far from McClellanville, South Carolina. In October, 1936, under the supervision of Refuge Superintendent Andrew H. DuPre, construction work on a 45-foot steel observation tower for this area was begun. The tower site was located in a salt marsh some four miles east of McClellanville and was situated on a mud flat in an almost pure stand of salt-marsh cordgrass (*Spartina alterniflora*) that is usually twice daily covered by high tide. The nearest tree, and in fact the nearest dry land, is approximately two and one-half miles distant. The habitat is one best suited to such birds as

the Clapper Rail, various ducks, and perhaps Seaside Sparrows. Certainly one would not look for a Barn Owl in such a situation.

Late in October when the framework of the tower was erected and the floor about half completed, emergency work on the refuge caused interruption of building operations and prevented completion of the project. When the Superintendent returned with his men to complete the tower a few days later, he discovered that a Barn Owl had taken possession and had begun nesting. To prevent disturbing the bird completion of the tower was delayed. A few subsequent trips by the Superintendent were made and at each visit the owl would leave and alight on the nearby mud flat in the midst of the plant growth—a habit characteristic of Short-eared Owls but so far as the writers are aware, an uncommon trait for Barn Owls. A nearby temporary wharf, not more than sixty yards away, which afforded landing from a channel or "natural", contained several upright poles that might have been used for roosting, yet the bird preferred to alight in the marsh within a hundred yards of the tower.

The nest was placed in the northeast corner of the tower and was a very crude affair consisting of a few feathers from the birds' bodies and by the time incubation was completed, it was well lined and surrounded with broken down pellet debris and bone fragments of its larger prey. Nine eggs completed the clutch. At a visit to the nest on November 17, when Mr. DuPre knew that incubation must be nearing completion, it was found that calamity had befallen the set. Seven of the eggs had hatched and the two remaining were well pipped, yet evidence indicated that the parent bird had not been in attendance for perhaps twenty-four hours. As a consequence, the larger and more vigorous young had crawled out of the nest and had fallen to the stairway or ground and all had starved or frozen to death. The two preceding nights had been unusually cold.

But one adult bird was seen near the nest at a time and it is doubtful that the male assisted in the duties of incubation. Whether the female met death while searching for food or whether the urge of migration became stronger than the parental instinct is not known. At any rate, she failed to return to her brood and was not seen afterwards. It should be pointed out that this is the only owl reported for the refuge during the past three years.

To obtain data on the food secured by the bird in this unusual locality, twenty-one whole pellets were collected and examined in the Food Habits Laboratory of the Biological Survey in Washington, D. C. The results indicate that marsh-frequenting birds were taken in greater

numbers than is usually the ease. Normally this speeies subsists almost entirely upon small rodents.

The following table gives the results of the laboratory pellet analyses:

TABLE 1. Food Remains Found in Twenty-one Nest Pellets of the Barn Owl Colleeted on Cape Romain Migratory Bird Refuge near McClellanville, South Carolina, November 30, 1936.

Pellet No.	Food Items	Pellet No.	Food Items
1	1 rice rat 1 seaside sparrow	10	1 undetermined bird about the size of a clapper rail
2	1 rice rat	11	3 rice rats
3	1 rice rat 1 seaside sparrow	12	1 meadow mouse
4	1 virginia rail 1 rice rat	13	3 rico rats
5	1 meadow mouse 1 seaside sparrow	14	1 meadow mouse 1 rice rat
6	1 seaside sparrow 1 undetermined bird—size of clapper rail	15	1 seaside sparrow
7	1 undetermined bird, probably a rail	16	1 meadow mouse
8	1 rice rat	17	1 meadow mouse
9	2 rice rats	18	2 rice rats
		19	1 meadow mouse
		20	1 rice rat 1 undetermined rodent
		21	1 meadow mouse

If eaeh pellet represents the indigestible residue of a single meal, it will be noted that for the 21 meals, 17 rice rats, 7 meadow miee. 1 undetermined rodent, 3 birds presumably Clapper Rails. 1 Virginia Rail, and 5 Seaside Sparrows were eonsumed. Speeial referenee should be made to the oecurrence of meadow miee (*Microtus pennsylvanicus*) as standard manuals on mammalogy do not reeord this speeies along the coast south of northern North Carolina.

BIOLOGICAL SURVEY,
WASHINGTON, D. C.

HARRIS'S SPARROW IN ITS WINTER RANGE*

BY CHARLES E. HARKINS

This paper presents the results of an investigation of the plumage changes and the behavior of Harris's Sparrow, *Zonotrichia querula* (Nuttall), in its winter range. The study, carried on at Stillwater, Oklahoma, has been a continuation of work done in the same locality during the winter of 1934-35 by Park (1936). Since Stillwater is near the center of the bird's winter range, findings here may be regarded as typical.

Swenk and Stevens (1929), with the aid of several coöperators along the migratory route, thoroughly investigated the general distribution, migration, habitat, food, voice, size, behavior, plumage, and molts of Harris's Sparrow in north central United States. Nice (1931) studied this sparrow in central Oklahoma, her work consisting principally of field observations and a study of four banded birds. The plumage, habitat, song, and behavior were studied. Park (1936) banded birds in the vicinity of Stillwater and studied the behavior of this sparrow in its winter range.

Materials and Methods

The traps used for catching Harris's Sparrow in this vicinity were constructed according to the specifications of Lincoln and Baldwin (1929:18). Two traps, designated A and E, built upon weathered wood frames, were suspended, by wire from branches of trees, three or four feet from the ground. A third trap, C, was placed upon a frame covered by screen wire; which was strewn with dirt, leaves, and sticks in order to represent the ground. The traps were set in places where Harris's Sparrows had been observed in abundance. Trap A at Station A, was set on a tributary of Stillwater Creek about three-fourths mile west of Stillwater in a clump of bushes (Fig. 15). The trap was well sheltered and covered by vines, mostly smilax and wild grape. The second trap (Station C), located on another tributary of Stillwater Creek two and one-eighth miles directly south of Station A, was placed in a thicket containing a few large trees. The third trap (Station E), also on a tributary of Stillwater Creek one mile north and three-fourths mile west of Station A, was well sheltered in a wooded valley with hills to the north and south. Bait consisting of corn, wheat, and smaller grains was spread over the platform inside and outside the traps.

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*Contribution from the Zoological Laboratory of the Oklahoma Agricultural and Mechanical College, prepared under the direction of G. A. Moore.

Field observations began on October 1, 1935, and continued, with frequent visits, until the first arrivals were seen at Station A on October 22 at 5:45 P. M. Accordingly on October 23 a trap was set. On October 24, a trap was placed at Station C and on November 10, another trap was set at E. The one placed at Station E was new and it was feared that it might frighten the birds, but apparently this did not occur because the first eleven Harris's Sparrows were banded here.

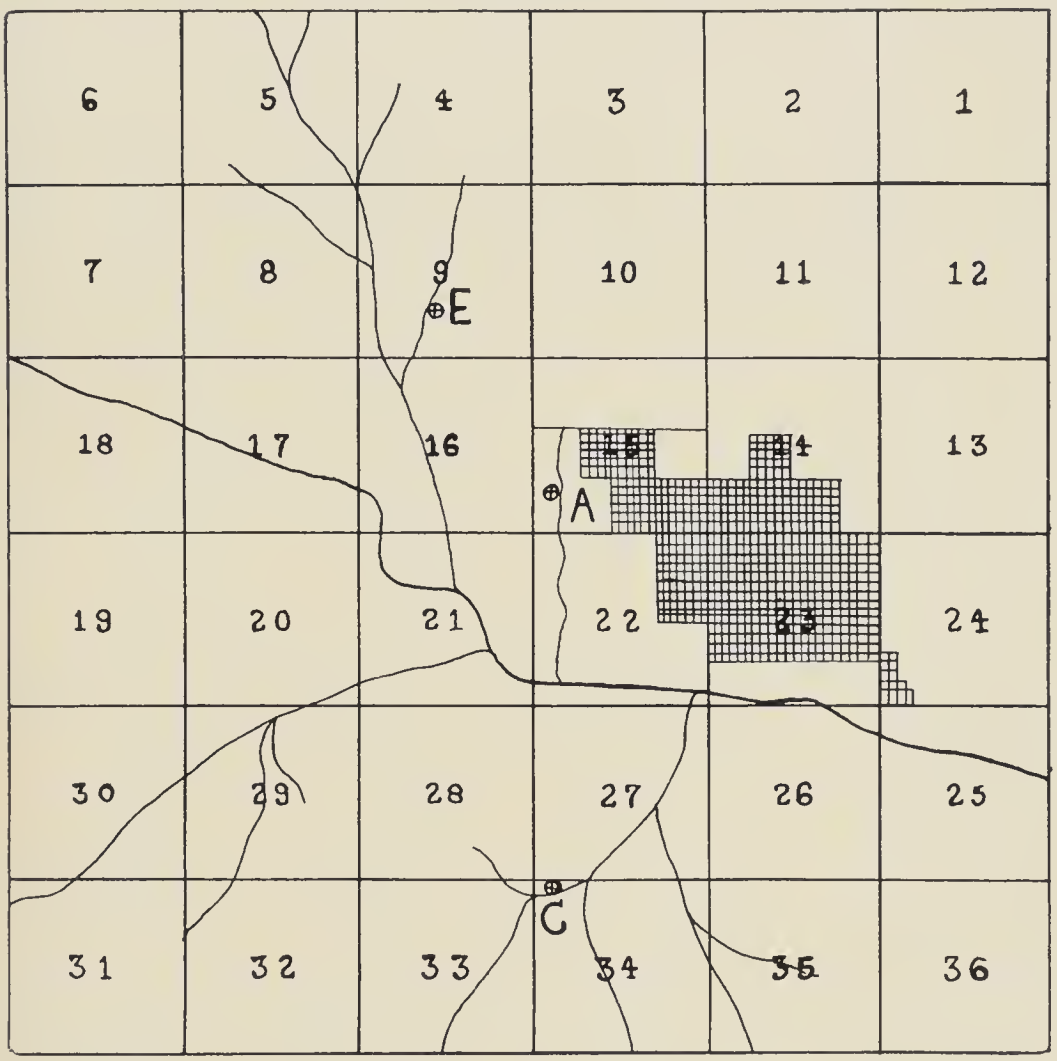

FIG. 15. Map of the region in the vicinity of Stillwater, showing the location of the traps referred to in this paper.

The visits to the traps were made daily a little before nightfall. Care was taken in approaching the traps and in handling the birds to avoid frightening them unduly. Pictures were taken with an Eastman Kodak (116 Brownie), with portrait attachment, at a distance of two feet six inches. Split-ring bands, size 1A, were furnished by the Bureau of Biological Survey, U. S. D. A. These birds were held during banding according to instructions given by Lincoln and Baldwin (1929:90).

Results

The largest numbers were caught in November and April, while February had the fewest. Doubtless the birds were traveling southward in Novcmber and returning to their summer range in April. February, March, and the first few days of April yiclded very few new birds. Low temperatures and rainy weather account for the spring return being delaycd until the middle and latter part of April when more clement wcather prevailcd. Deeember, being mild, ran high in "returns"; only twelve new sparrows were eaught but thirty-cight different individuals returned. January yielded a small number of new birds and a deerease in the number of returns. February showed a dceline in new birds and returns. March gained slightly in new birds and greatly in returns. April showed a wave of migration higher than any of the other months. Harris's Sparrows banded during the season 1935-36 were as follows:

	Adult	Immature
November	17	13
December	6	6
January	10	6
February	1	4
March	9	2
April	18	3
Total	61	34

The limited data eolleeted indieate that Harris's Sparrow follows the same migratory route every year sinee five birds banded by Park in 1934-35 returned in 1935-36 to their original banding station. No. 169108 arrived at Station A on November 20, 1934, and apparently stayed in that loeality until Deeember 7, 1934, sinee it was eaught seven times during that period. On November 21, 1935, this same bird arrived at Station A with no ehange in plumage. No. 169107, caught at Station A on November 20, 1934, returned once between that date and December 8, 1934, and rcturned again to Station A a year later, on December 9, 1935, and again on January 20, 1936. No. 169386, caught at Station A on April 6, 1935, rcturned to the same place on December 9, 1935. No. 169254, caught at Station C on March 5, 1935, returned to that station on January 25, 1936. No. 169170, banded at Station C on February 16, 1935, returned six times that year and again on January 29, 1936.

It is evident that small groups may remain intact for considerable time and follow the same route in the spring as in the fall. Thirteen groups of two birds eaeh returned more than two timcs. Six groups of more than two birds each rcturned more than two times.

The length of time that the birds remain in a locality, in the winter range, varies. Judging from the number of times caught, some may stay for only a short time, while others with the "trap habit", remain for a longer period. No. 169338, caught on November 20, 1935, returned occasionally throughout the winter and spring, excluding January, until April 23. It was caught fifteen times. From November 21 until December 8, 1935, No. 169343 was caught seven times, and returned again on February 19, 1936. No. 169349 stayed approximately one month, from November 21 to December 18, 1935, and was caught five times. The average time for each in a particular locality is about ten days and the extremes are about one day and three months.

A few interesting observations follow: No. 169330, caught at Station A, and released in Stillwater on November 18, 1935, returned in a few days. This same bird, evidently with the "trap habit", when again released in town returned to the trap in two days. No. 169338 was habitually returning to Station E and having been caught eleven times was released at Station A on March 9 and returned to Station E on March 12. No. 169349 had been caught four times at Station A and when liberated December 17, 1935, returned immediately to the trap and started eating grain. It was carried to Station E and released, as further test, but the next day the bird was in the trap at Station A. It is interesting to note that birds caught at one station and freed at another were never caught at the latter. In fact, they either returned to the station where originally caught or disappeared. Since traps C and E were within a radius of two miles of Station A, and no bird was caught at more than one trap, the stopping places of each bird must be well localized. They do not appear to roam extensively while in a particular locality.

Immature birds, upon their arrival in the fall, were somewhat variable in coloration. The crowns were often black centrally with margins of gray or mingled black and white. The checks were gray-buff, the postauricular spots varied from light brown to brown, the chins and throats were white somewhat mottled with black, while the breasts were mottled black and white.

The adults in the fall had black crowns (sometimes varied by lateral margins of a few white and buffy feathers), gray-buff cheeks, and brown postauricular spots. The black of the throats and chins varied in intensity and the chests, though much blacker than in immature birds, were mottled. These markings remained, as typical, until the spring molt, first signs of which were observed March 12, 1936. During the next two weeks signs of molting became more and more notice-

able, and birds that remained away from the trap for several days returned changed. The birds did not all molt at one time for No. 106323, caught March 12, 16, and 17 did not start until March 20. Likewise No. 169334, first caught on November 19, 1935, and later on March 1 and 16, showed no signs of molting until again caught on March 28. No. 169338 (adult) not molting on March 1 and April 16, when caught on April 22 was molting, for the cheeks had changed from buffy to a solid gray and the black was more extensive and intense. No. 169357 had not molted when caught on February 19, but on March 14, change was evident. No. 169375 (adult) first caught December 16, 1935, when caught again March 16, 1936, had already undergone a partial molt changing the crown from black with gray bars to solid black to the nape. The chin was already black, the neck and upper breast had turned to solid glossy black while the cheeks were still brownish gray. This bird was not caught again.

Pictures taken before and after molting show the changed appearance of the chin, throat, and chest. No. 106320, taken on March 6, 1936, had not started to molt. The crown was barred black, white, and brown, with black dominant; cheeks gray-buff; postauricular spots light brown; chin black; throat black and white; chest black with brown and white spots. On April 22, 1936, this bird returned and had changed to the typical black hood, gray cheeks, and dark brown postauricular spots.

As a contrast, No. 169338 arrived at Station E on November 20, 1935, and constantly returned every few days. It was plainly an adult but had one white spot in the center of the crown. The cheeks were gray-buff, the postauricular spots brown, the chin black, the throat black with white laterally, and the chest mottled black and white. Taken again on April 6, it showed no great change, but on April 22 there was a distinct change in the markings. The white crown spot was gone and the bird had donned its black hood.

No. 106323 first taken on March 12, 1936, at Station A, consistently returned and on March 20 was molting. At the time the first picture was taken the crown was barred black, gray, and buff. The cheek was grayish-buff and the postauricular spot brown. The chin had just a streak of black beneath the beak which extended in a fine line on each side of the white throat. The chest was mottled black and white. On March 31, the throat was blacker and the cheek was becoming somewhat gray. April 2 the crown was black in the center and laterally barred black, gray, and buff. The checks, chin, and postauricular spots had not changed; the chin was black, and the throat had

a black central stripe reaching from the chin to the chest. On each side of the throat, the feathers were white. This bird had been classified as immature.

An adult bird, No. 169357, arrived at Station E on November 27, 1935. The crown was black in front and barred posteriad with black and gray. The cheek was gray-buff; postauricular spot brown; chin, throat, and chest mottled black and white. On March 14, the bird had its black hood and the cheeks and postauricular spots were unchanged.

No. 106310 arrived at Station C on January 27, 1936. The chin, throat, and chest were mottled black and gray; the crown was brownish-gray, the cheek grayish-buff, and the postauricular spot brown. On April 6, it returned to the same station with crown, cheek, and postauricular spot unchanged, the chin and throat black, and the chest mottled black and gray.

Many birds were caught for the first time after the molting period was over. In fact, all birds caught after April 17, 1936, except the immature individuals, had black hoods, gray cheeks, dark brown postauricular spots, and mottled black and white chests.

Nice (1931) states that about one-tenth to one-twentieth of the birds have the black hoods in the autumn but all assume it by late April. In this trapping locality, the autumn records show that 63 per cent in 1934 and 40 per cent in 1935 of the birds trapped were immature (no black hood). Not all of the birds had assumed the black hood in late April, since in April, 1935, only 54 per cent had black hoods and in April, 1936, 82 per cent. (See table).

Although Harris's Sparrows did not seem to be extremely frightened by the operator opening the traps, they did appear to be frightened when the traps were visited by some disturbants. On January 22, 1936, when the trap was visited at Station E, no Harris's Sparrows were caught but a number of them were noticed in the bushes. Near the trap approximately fifty boys were playing ball, taking pictures of the trap, and tramping down the bushes. No more birds were caught here until February 19.

March 20, 1936, a large cat was found at Station A and the trap had been somewhat battered. There were two Harris's Sparrows in the inner chamber, frightened but otherwise unharmed. No birds returned to this trap until March 31.

On April 1, 1936, a squirrel was taken from the trap at Station E. Blood, feathers, and hair were in the inner chamber. Although the trap was thoroughly cleaned no birds returned until April 17.

The presence of such disturbants must leave a marked impression at the trap. The cat and squirrel may have frightened the birds away and, by their tampering with the traps and feed, may have induced fear. On April 28, 1936, No. 106332 was killed and eaten by an unknown animal in the trap at Station E. Before this time many birds had been caught here but no more were seen or taken at this trap after that date.

Conclusions

1. Harris's Sparrows, in their migration, follow the same route year after year. In following this route, they stop at certain points for food, and linger for from one to thirty days (average ten). Banded returns indicate that the birds stop at the same places in the spring as in the fall.

2. Harris's Sparrows enter the traps often in groups of two or three and these groups often return to the traps together.

3. The molting period begins about the middle of March and continues until the middle of April. The molt is accompanied by a change in plumage typical to the age of the individual bird. The outstanding changes occur in the regions of the crown, cheeks, postauricular spots, chin, throat, and chest. The adult changes were: Cheeks gray-buff to a uniform gray or slate gray; postauricular spots light brown to dark brown; crown, chin, and throat to a uniform black hood. The immature birds remained the same in the cheeks and postauricular spots but darkened somewhat in the other parts mentioned. As a whole, in the spring, the immature Harris's Sparrow is about 50 per cent darker on the crown, chin, throat, and chest than in the fall.

4. Harris's Sparrow may be frightened away from a given locality for a period of several days by some unusual commotion.

5. Harris's Sparrow shows a marked homing instinct. While stopping in a particular locality, they do not roam far from that vicinity.

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EDITORIAL

The excellent *Quarterly Review of Biology* runs a very excellent book review department, which we read very carefully and regularly. We have often enjoyed the devastating appraisal of some book—and sometimes deprecated it. The current number carries an anonymous review (they are all anonymous, for that matter) of some bird book (which we have neither seen nor heard of previously). And the only thing about the review which caught our attention was the reviewer's impatience with verse. We must make the matter clear with the following quotation: "To the distress of the reviewer the author frequently deserts prose for verse. This is so often true of books of this type that we, as hard-boiled cynics, are tempted to suggest that some bright young person prepare a doctorate on the stimulus given poetry by ornithology (or *vice versa*)."

This at once forced us to recall that our leading article in this issue starts off with a verse. But, we reflected that Dr. Bissonnette's learned researches and contributions to experimental ornithology would protect him from any suspicion of languid sentimentality. It then happened that on the same day we opened the current issue of *Science* (Sept. 3, 1937) and found the leading article to be by Sir Edward B. Poulton, of the University of Oxford, and president of the British Association for the Advancement of Science, and which article contained two verse quotations. Then, without a change of date, we turned the pages of the same September *Quarterly Review*, and found the paper on the seventeen year cicada by the veteran and distinguished Professor E. A. Andrews, of Johns Hopkins University, on the first page of which and on the last page of which short verses are interpolated.

We are thus guided to the conclusion that a slight addiction to verse is not incompatible with scientific standing, even though it may be indicative of some familiarity with poetical literature and some time spent browsing therein—and hence away from the grindstone of science.

And as long as we are so close to the subject we may as well say that we have never felt very great admiration for anonymous reviews or writings of any kind—especially those with sarcastic and walloping inclinations. We can't help wondering how much of it is braggadocio, and how much punishment the bully could take before the tears would come.

GENERAL NOTES

Conducted by O. A. Stevens

Lapland Longspurs in Kentucky.—I have observed hundreds of Lapland Longspurs this winter (1936-1937) in Hopkins and McCracken Counties, Kentucky. One was collected.—Raymond J. Fleetwood, *Paducah, Ky.*

The Starling in Clay County, South Dakota.—Reports of the Starling in southeastern South Dakota are as yet rare; therefore, the writer would like to add a record for Clay County. On March 28, 1937, I saw a pair of Starlings on the western edge of the town of Vermillion, and it is probable that the birds will breed in that vicinity.—Wm. Youngworth, *Sioux City, Iowa.*

Yellow Rail in Ohio.—On April 18, 1937, the writer flushed a Yellow Rail (*Coturnicops noveboracensis*) in a wet, grassy field near Cleveland, Ohio. The chicken-like bill and yellow underparts were noted as the bird descended into the grass a few yards beyond the spot where it was first flushed. On being approached the bird took flight again, displaying the characteristic white wing patches. It flew about thirty yards and dropped into a blackberry patch. So far as I know, this is the second record for this rare species in the Cleveland region.—Ralph O'Reilly, Jr., *Cleveland Heights, Ohio.*

Gull Records for Lake Erie.—More than the usual number of gulls remained along the shores of Lake Erie during the past winter (1936-37). Here in Cleveland a few Bonaparte's Gulls were noted among the hundreds of Herring Gulls and Ring-billed Gulls. At Ashtabula harbor a Glaucous Gull was seen on December 27 by a party including the writer. The bird appeared to be a second-year bird, as it had not yet acquired the spotless plumage and yellow bill of the adult. At the same place on January 30 an adult Iceland Gull was noted as it flew by at a distance of only about thirty yards. At Presque Isle, Erie, Pennsylvnia, on February 20 and 21, a Great Black-backed Gull was seen in the bay. At the same place we saw a flock of twenty-one Common Redpolls. Both species were observed in good light at short range.—M. B. Skaggs, *Cleveland, Ohio.*

Pine Siskins in Western Maryland.—On July 1, 1937, a number of Pine Siskins (*Spinus pinus pinus*), some of them young birds of the season, were noted in Swallow Falls State Forest, along the Youghiogheny River in Garrett County, Maryland. The birds were feeding and calling in hemlock trees, and it seems reasonable to suppose that they may have bred locally. Individuals of this species were again noted on July 3 by Mr. M. Graham Netting, of the Carnegie Museum, Pittsburgh. The forest here is of nearly pure virgin Canada hemlock (*Tsuga canadensis*), and many Canada, Black-throated Blue, Blackburnian, Magnolia, and Black-throated Green Warblers, Juncos, Red-breasted Nuthatches, and Mountain Vireos nest locally. Siskins are rarely observed in summer on the Allegheny tableland, a region embracing parts of Pennsylvania, Maryland, and West Virginia.—Maurice Brooks, *West Virginia University, Morgantown, W. Va.*

Unusual Sparrow Records from Arizona.—A single Swamp Sparrow (*Melospiza georgiana*) was seen by the writer on December 19, 1936, at Tuba City, on the western side of the Navajo Indian Reservation in Arizona. It was closely observed as it perched in a small willow; its characteristic note helped to identify

it. But one other Arizona record exists, that of a specimen taken December 22, 1915, near Tucson by Howell (*Condor*, 18, 1916, p. 213).

On February 19, 1937, a Harris's Sparrow (*Zonotrichia querula*) was observed at Moenave, a few miles west of Tuba City, in company with a great number of Gambel's Sparrows (*Zonotrichia leucophrys gambeli*). The bird was judged to be an immature male. It also is the second record of its species for the state, the other being on March 15, 1913, at Sacaton by Gilman (*Auk*, 31, 1914, p. 403). It might be pointed out that both previous records are for the southern part of the state.

Song Sparrows (*Melospiza melodia* subsp. *fallax?*) were common at Moenave and Tuba City during the winter months, leaving during the early part of March. There are no previous Song Sparrow records for the northern part of the state, aside from one seen by the writer on September 15, 1936, at Teec-Nos-Pas in the very northeastern corner of Arizona, also on the Navajo Reservation.—Gale Monson, *Gallup, N. M.*

The Carolina Wren in Wisconsin.—On March 17, 1937, a group from the Game Management Division visited the E. H. Fabrice Farms in southeastern Wisconsin, Lafayette Township, Walworth County. The main farm, which is one of the wild life demonstration and experimental areas under direction of the University, has 160 acres of unpastured and undisturbed woodlot.

A number of birds were seen, but the outstanding record, worthy of note, was the Carolina Wren (*Thryothorus l. ludovicianus*). This bird was heard by the entire group of eight persons, including professor Aldo Leopold and Leonard W. Wing, and seen by Harry Anderson and Arthur Hawkins, of the Game Management Division, and Richard H. Pough, of the National Association of Audubon Societies. The bird was found in an oak-maple woods bordering Sugar Creek. Several small spring flows and hillside bogs are in the vicinity in which the wren was seen. During the week of April 25-30, 1937, I saw the wren on numerous occasions, and had it under observation with binoculars.

In the spring of 1936 I saw a Carolina Wren at the same locality on two occasions, April 26 and May 10; both times I heard the song. Kumlien and Hollister in "The Birds of Wisconsin" (1903) considered the species a "rare straggler to Wisconsin". Roberts (1934) states: "It is spreading northward and has reached southern Minnesota in limited numbers."—Douglas E. Wade, *Game Management Division, University of Wisconsin, Madison, Wis.*

Some Interesting Killdeers.—In May, 1935, the spring meeting of the Indiana Academy of Science was held at Mt. Vernon, Indiana, on the Ohio River. One of the members, Glenn A. Black, an enterprising archaeologist, with others on May 12, visited some of the pre-historic Indian locations of the vicinity. At a village site some three miles east of Mt. Vernon they found a burial up-turned by the plow. The smaller bones had been rearranged to form a nest. It contained three eggs of a Killdeer as shown in the accompanying photograph. (Fig. 16). I have enjoyed the picture which was presented to me by Mr. Black and desire to share it with other bird students because of its unusual character.

In this connection I wish to speak of an experience of my own. Some two years before the above find, also in May, I found among some brick bats and other such material that had been hauled to fill a low place in the barnyard of my farm near Kokomo, Indiana, four Killdeer eggs. Notwithstanding the fact that

horses, cows, sheep, and hogs had free run over that yard, the birds hatched all their eggs and presumably the young escaped from the animals of the barnyard.—Amos W. Butler. *Indianapolis, Ind.*

Wayne's Clapper Rail Carries Its Young.—In view of the recent discussion in the Wilson Bulletin concerning the habit of birds to carry the young, the writer presents the following case. Many observers have reported an adult carrying young between the legs. It has been reported of the American Woodcock, European Woodcock, Spotted Sandpiper, and Eastern Willet. Gayle Pickwell has written of a Killdeer's nest that was on a shed fifty feet above the ground, and

Fig. 16. Photograph of the Killdeer's nest referred to in Dr. Butler's note.

that the young were found on the ground near the shed while still but feeble walkers. In what manner the old ones had transferred the young was not observed. All these accounts may be found in Bent's Life Histories, in the two volumes devoted to the shore birds. The account of the Eastern Willet is quoted from Wayne's Birds of South Carolina, where he told of finding a nest which contained one newly hatched bird and three eggs ready to hatch. He stayed nearby until all were hatched, and the parent bird carried the young off to some distance, *one by one* until all were removed. Certainly this seems like purposeful action.

Outside the shore bird group Bent quotes an account by Verdi Burtch of a Virginia Rail carrying a young bird back to the nest in her bill. E. Burnham Chamberlain, Curator of the Science Department of the Charleston Museum, has given permission to write down a hitherto unpublished account of Wayne's Clapper

Rail carrying young. It seems that he, with several others, was at Procher's Bluff, South Carolina, during a time of high tide. As they were watching young rails drifting by on the usual drift trash, he noticed an adult rail swimming with something in its bill. Through the binoculars he could see that the bird was carrying a young chick in such a manner that its head was under water. As he watched she stopped, shifted the burden so the young would not drown, swam to the raft of drift, dumped the chick onto it, and clambered up herself.

When one considers the reputation of the observers, the fact that the behavior has been seen in several species, and the number of times it has been reported, it is hard to escape the conclusion that this is a well developed and *purposeful* method of removing the very young bird from a zone of danger. Yet, with the knowledge that the intelligence in the shore bird group is not on a very high plane, I wish someone might furnish a better explanation of the phenomenon and its origin. That it exists we can not well doubt, nor can we well believe it accidental when repeated time after time.—Ivan R. Tomkins, *U. S. Dredge Welatka, Savannah, Ga.*

Melanism in the American Rough-legged Hawk.—The winter of 1936-37 in southeastern South Dakota was one of unusually deep snow. Highways were blocked for days and the prairies were covered early with a blanket of snow that ever increased in depth as the season advanced. The American Rough-legged Hawk (*Buteo lagopus s. johannis*) was abundant, probably forced south in more than usual numbers by the deep snow and severe blizzards which likely made it difficult to procure sufficient food in its northern range.

As the roads were cleared of snow after each new storm, large flocks of Horned Larks (*Otocoris alpestris* subsp.), Lapland Longspurs (*Calcarius lapponicus*), and Ring-necked Pheasants (*Phasianus colchicus torquatus*) were attracted to the graveled highways. Many of these birds were killed each day by the passing cars and furnished a continual banquet for the Crows (*Corvus brachyrhynchos*), in which they were quite frequently joined by the Rough-legged Hawks.

I spent five days a week all winter long traveling this territory and I doubt if a single day passed that I did not see at least one Rough-legged Hawk. Usually I saw many each day and I was especially interested in their great variety of plumage, which ranges from the pure black that give the "Rough-leg" the name of "Black Hawk" throughout the middlewest, to birds of such light plumage that they might easily be mistaken for the Ferruginous Rough-leg (*Buteo regalis*) by the incautious observer. Melanism in the American Rough-legged Hawk is so common as to excite little interest under ordinary circumstances and I had given this phase no more than ordinary attention until an incident occurred which brought it to my notice more forcefully.

On January 29, 1937, in McCook County, south of Montrose, South Dakota, while driving along the highway I noticed two large hawks some distance ahead of me. One of them was perched on a telephone pole and the other had lit in the snow near by. I was able to drive within twenty yards of them and take out my glasses before they took wing. They were identical, no single feature of either size or plumage differed in any respect. Both hawks were black except the under surface of the distal third of each wing. They took wing and flew across the road in front of me, turned and came back low and almost directly overhead. Their markings were unusual even for the Rough-leg and the fact that they were

alike was, to me, very extraordinary. I made a sketch of the under-surface of this hawk, which is shown in Figure 17A. I had been keeping a list, as was my custom, but had not been keeping the melanistic individuals separate from the regular type, except in one instance. On January 11, 1937, two miles southeast of Kaylor, S. D., I saw my first completely black hawk. This bird was not the glossy black of the crow but was of a dull black or very dark brown. It was entirely without light markings of any kind. It was unsuspicious and allowed me to approach to within a short distance. It was an American Rough-legged Hawk, without question.

I now started keeping a record of this phase and in the short series I was able to make, found that about one bird in five differed in some degree from the normal plumage. I am considering as normal the plumage shown by Walter A. Weber on page 330, Volume I, of "The Birds of Minnesota", by Dr. Thomas S. Roberts. This plumage is shown in Figure 17D.

In the sketches shown here I have copied the outline from Weber and filled in the dark and light areas from the drawings in my notebook made at the time of observation.

The bird shown in Figure 17B was seen on February 4, 1937, two miles north of Alexandria, South Dakota; that of Figure 17C was seen on the same date one quarter mile west of Stanley Corner in McCook County, South Dakota.

Aside from those that are shown here, birds were seen in almost every intermediate degree of light and dark coloring.

The fact that the two hawks seen on January 29 were alike makes me wonder if the dark and light phases might not be inherited. I would be at a loss to know how to explain these identically marked dark hawks unless they were from the same brood.—Bruce F. Stiles, *Sioux City, Iowa.*

The Herring Gull Colony at Bridge Lake, British Columbia.—A description of the most southerly nesting so far located in British Columbia of the Herring Gull (*Larus argentatus smithsonianus*) was published by me in the Condor (XXXVII, July, 1935, pp. 214-215). When this colony was next visited two years later, on June 24, 1935, it was observed that the number of birds had increased from thirty-four adults in 1933 to thirty-eight adults in 1935. This had happened in spite of the fact that less nesting accommodation was available, owing to a rise in the lake levels which had reduced the island's area by one-third.

There were seventeen nests composed chiefly of twigs and moss—one contained a few green poplar leaves, several pieces of green grass, and a twig of Douglas fir with green leaves attached. Ten nests contained eggs (four singles, three of three, and three of two); five contained eggs and downy young (in two cases two eggs and one young; in three cases one egg and one young); two nests were empty.

The stomachs of two downy young contained larvae of a predaceous diving beetle (*Dytiscus* sp.) as the chief item. In one case thirty, in the other eight had been eaten. A few of these larvae, which remained sufficiently whole to be measured, were one and a half to two inches long, and the remainder, represented chiefly by jaws, were thought to be approximately the same size. Unidentified fish remains, beetle fragments, and vegetable debris, including a *Polygonum* seed, were minor items totaling 5 per cent of the contents in each case. The stomach of a third specimen held fragments of several small Salmonidae, 95 per cent,

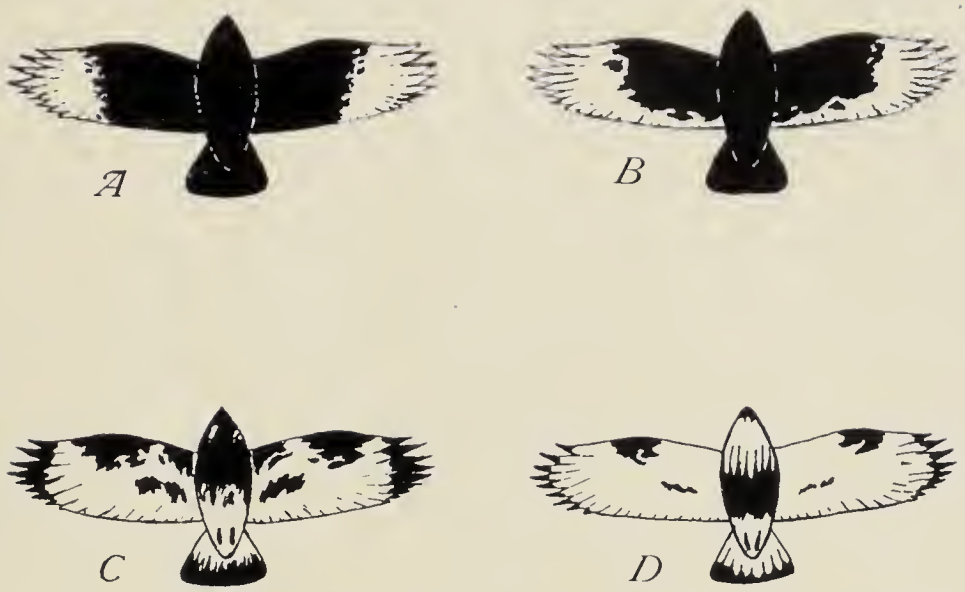

FIG. 17. Diagrams showing the under-surface color patterns of the American Rough-legged Hawks as discussed on the opposite page. A, individual seen on January 29, 1937, in McCook County, S. D. B, individual seen on February 4, 1937, in Hanson County, S. D. C, individual seen on February 4, 1937, in McCook County, S. D. D, normal color pattern as shown by Walter Weber's figure in Robert's "The Birds of Minnesota".

FIG. 18. Photograph showing the Herring Gull colony at Bridge Lake, B. C., mentioned in Mr. Munro's note.

and *Dytiscus* larvae, 5 per cent; a fourth contained parts of a minnow, probably *Richardsonius balteatus*. Two of the four downy young examined had been found dead in the nest. In every case the stomach was well filled.—J. A. Munro, *Okanagan Landing, B. C.*

Bird Records from the Allegany State Park.—Two papers have been published on the summer birds of the Allegany State Park, in southwestern New York state, by Mr. Aretas A. Saunders.* His notes on the plumage, nesting, feeding habits, and songs are very interesting reading, betray a tireless eye and ear, and add much knowledge applicable to the same species in other regions.

No one, however, has heretofore recorded the bird life found here in the spring, fall, and winter seasons. It has been my pleasure and privilege to spend three full years in this, the largest of the New York State parks, most of this time in the field. During this time a number of species, twenty-six to be exact, have been seen and are recorded in this paper, for the first time.

The spring is a beautiful and interesting season here. It is at this time that water fowl and shore birds are found in their greatest numbers and variety on and around our two artificial lakes. The largest of these lakes is 120 acres. It is evident from a study of my arrival statistics that there are about five times as many water fowl and shore birds here in the spring as there are in the fall. An interesting fact about the park is that there are no natural lakes or ponds within its borders. This is said to be due to the lack of glacial action in this particular area; in fact the park lies in the only area in the entire state which escaped direct glaciation. The margins of our lakes are almost entirely devoid, as yet, of suitable food plants for water and shore birds. In time, no doubt, the marginal flora will assume a more favorable aspect as desirable plants gain a foothold. Members of the Civilian Conservation Corps, stationed in the park, have performed a real piece of conservation work by gathering thousands of food plants outside the park and planting them in and around the larger of the two local lakes.

Water fowl visit the park as early as March 27, because the ice seldom breaks up and leaves the lakes before the first or second week in April. On this date in 1934, six Hooded Mergansers (*Lophodytes cucullatus*) dropped from a wintry sky. These were followed on the 29th by four scaups (*Nyroca* sp.). On the 30th came the Buffle-heads (*Charitonetta albeola*).

Of course, the above three species visited us more than once during the same season, a fact which applies to most of the other species mentioned in this paper. Ten or fifteen days is about the longest period of time that any species of water fowl remained with us, some species staying but a few hours or a day.

April seems to be the best month to see numbers of water fowl on our lakes. Almost every day brings new arrivals. The following species were seen during this month: Whistling Swan (*Cygnus columbianus*), American Merganser (*Mergus merganser americanus*), Red-breasted Merganser (*Mergus serrator*), Horned Grebe (*Colymbus auritus*), Pied-billed Grebe (*Podilymbus podiceps podiceps*), Bonaparte's Gull (*Larus philadelphia*), Common Loon (*Gavia immer*), Baldpate (*Mareca americana*), Old-squaw (*Clangula hyemalis*), American Golden-eye

*Saunders, Aretas A., The Summer Birds of the Allegany State Park. Roosevelt Wild Life Bulletin, I, No. 3, pp. 235-354, 1923.
Saunders, Aretas A., Additional Notes on the Summer Birds of Allegany State Park. Roosevelt Wild Life Bulletin, III, No. 3, pp. 476-497, 1926.

(*Glaucionetta clangula americana*), Blue-winged Teal (*Querquedula discors*), Greater Yellow-legs (*Totanus melanoleucus*), and the Herring Gull (*Larus argentatus smithsonianus*).

The month of May furnished two records for our list, namely, the Canvasback (*Nyroca vallisneria*) and the Florida Gallinule (*Gallinula chloropus cachinnans*). The latter was sighted in a marsh on the easternmost boundary of the park. The Solitary Sandpiper (*Tringa solitaria solitaria*) was seen in June by Mr. H. Albert Hochbaum.

Some attempt was made to approximate the number of individuals of each species. Totaling of two year count, we find that 273 American Mergansers were seen there. They were by far the most numerous. The Bonaparte's Gulls were next most numerous, followed by the Pied-billed Grebes, the Canada Geese, and the Old-squaws.

Some years ago a pair of Whistling Swans were liberated on Red House Lake and proved to be a wonderful attraction. They remained for several years and then returned no more. In the spring of 1935, however, one swan was seen and it is quite likely that this is one of the pair liberated here previously.

The following partial list will give some indication of the first apperance of some of our songbirds, as compiled from my 1934 records. In this list will be noted three new records for the park, namely, the Ruby-crowned Kinglet, the Myrtle Warbler, and the Fox Sparrow.

March 5—Robin
March 19—Field Sparrow, Meadowlark
March 22—Song Sparrow, Blue Bird
March 30—Baltimore Oriole
April 9—Phoebe
April 12—Flicker
April 17—Chipping Sparrow, Fox Sparrow, House Wren
May 5—Black-throated Blue Warbler
May 6—Barn Swallow
May 8—Chimney Swift, Chestnut-sided Warbler, Towhee
May 10—Black and White Warbler, Purple Finch
May 15—Rose-breasted Grosbeak, Magnolia Warbler
May 18—Kingbird, Indigo Bunting, Red-eyed Vireo

Two unusually large groups of birds were observed during the spring migrations of 1935. On April 12 about 200 Robins were seen feeding on the lawn of the Administration Building. On May 6 hundreds of Barn Swallows were observed feeding over Red House Lake.

Although frosts frequently occur here in the latter part of May, this fact does not seem to defer the arrival of the birds. It was with some misgivings that I consented to guide forty-three members of the Cleveland Bird Club on an early morning walk in the latter part of April, 1935. Much to my surprise, we noted the following thirty-seven species of birds: Common Loon, Horned Grebe, Little Green Heron, Baldpate, Blue-winged Teal, Scaup Duck, Sparrow Hawk, Ruffed Grouse, Spotted Sandpiper, Greater Yellow-legs, Mourning Dove, Kingfisher, Flicker, Hairy Woodpecker, Phoebe, Barn Swallow, Blue Jay, Crow, Chickadee, White-breasted Nuthatch, Robin, Bluebird, Ruby-crowned Kinglet, Starling, Black and White Warbler, Myrtle Warbler, Black-throated Warbler, Meadowlark, Cowbird, Bronzed Grackle, Goldfinch, Towhee, Savannah Sparrow, Slate-colored Junco, Chipping Sparrow, Field Sparrow, and Song Sparrow.

The following winter residents were observed during February, 1935: Belted Kingfisher, Downy Woodpecker, Crow, Chickadee, and White-breasted Nuthatch.

The Ruddy Duck (*Erismatura jamaicensis*), Canada Goose (*Branta canadensis*), Laughing Gull (*Larus atricilla*), and the Common Tern (*Sterna hirundo hirundo*) were sighted in the fall of 1935.

Summary of new bird records for the Allegany State Park: Common Loon, Horned Grebe, Pied-billed Grebe, Whistling Swan, Canada Goose, Baldpate, Blue-winged Teal, Canvas-back, Scaup, American Golden-eye, Buffle-head, Old-squaw, Ruddy Duck, Hooded Merganser, American Merganser, Red-breasted Merganser, Florida Gallinule, Solitary Sandpiper, Greater Yellow-legs, Herring Gull, Bonaparte's Gull, Common Tern, Ruby-crowned Kinglet, Myrtle Warbler, and Fox Sparrow.

I wish to acknowledge the kind assistance given me in the preparation of this paper by Mr. Aretas A. Saunders and Dr. Herbert Friedmann.—Irving William Knobloch, *Allegany State Park, Red House, N. Y.*

Snowy Egrets at Pymatuning Lake, Pennsylvania.—A few days of my vacation were spent at Linesville, Pennsylvania, on the north shore of Pymatuning Lake. There on August 23 I observed about one hundred American Egrets (*Casmerodius albus egretta*) at various points along the Upper Lake. These birds were wary and it was difficult to approach them before they flushed. Among them were several smaller birds of more deliberate and less watchful nature. They permitted a fairly close approach, and as they took wing I could see clearly the yellow toes which indicated them to be Snowy Egrets (*Egretta thula thula*). Two individuals were observed closely enough to make the identification sure. Again on August 25 at the same place I saw about fifty American Egrets and at least one Snowy.

Since a question had been raised as to the authenticity of certain previous sight records of the Snowy Egret in western Pennsylvania, and more especially because the Carnegie Museum had no locally collected specimen, I was advised to return to Linesville and secure one. On September 13—a cold, rainy day—I succeeded in obtaining two Snowy Egrets; both were young males, still showing evidences of molt. American Egrets were still fairly numerous on that date.—Reinhold L. Fricke, *Carnegie Museum, Pittsburgh, Pa.*

The Pileated Woodpecker in Clayton County, Iowa.—In the evening of October 11, 1936, I heard an unusual call, looked up quickly, and about forty feet away, flew a Pileated Woodpecker (*Ceophloeus pileatus abieticola*). He was much larger than our other woodpeckers, with a longer neck and brilliant red crest. He flew with their characteristic undulating motion.

On December 19 I saw him working at the base of an oak tree about sixty feet from the cottage. Again on January 12 he was working on a limb near the top of a tall tree. He bored a hole, then put his bill in, took something out very daintily and ate it.

It was January 29 before I saw him again. He was working on the low limb of a hard maple tree about fifty feet from the cottage. At first he kept on the far side but soon he came out where I got a splendid view of him with my glasses. He spent about ten minutes examining this dead limb. He would tap several times, then it was Stop! Look! Listen!, turning his head first to one side,

then to the other. Deciding there was nothing worth working for, he flew to the other side of the cottage, alighting on an oak tree, and then I saw that his mate was busy at the base where I had seen one the other day.

As far as I know, this is the first time the pair was ever seen together here. The one flew from the tree but the other worked at the decayed base for over half an hour after I first saw it. This gave me plenty to time for its study.

It was working with its back toward me and did not appear to be watching in this direction but was not going to let anything slip up on the other side of the tree. It would take two or three strokes with its bill, then its head would bob around the left side of the tree, and then around the right. Its long neck made this possible without moving its body.

One stroke of its powerful bill, a twist of its head, and a chip flew off. It worked steadily until it had bored quite a hole, then it reached in very carefully and seemed to have found something to eat. It started another place but that was on the live part of the tree so it worked only a little while, then flew away.

I saw the pair again on the hard maple tree. One stayed only a few minutes. The other worked a while, then flew to a nearer tree, and then moved to one about twenty-five feet from me.

They are the most interesting birds I have ever seen, and the most striking in appearance. The body is a dull grayish black, the face is a clear white with a dark streak through the eye, extending a little back. A black streak runs down the back and the front of the neck, and the high crest is a brilliant red. The powerful bill seemed to be partly white. Their attitude was alive and alert, and not timid or afraid, just peppy.—M. Ellen Thornburgh, *McGregor, Iowa.*

Some New and Unusual Bird Records from Utah.[1]—Since 1926 the Department of Zoology and Entomology at Brigham Young University has been attempting to build up a representative collection of Utah birds. This collection now (1937) numbers nearly 1800 study skins and about 200 mounted specimens representing over 250 species and subspecies of the State. A large part of this collection has been obtained through the direct efforts of staff members of the institution, but a considerable number of valuable specimens were obtained from other sources. In 1931 the University obtained about 350 mounted bird specimens from the Latter-Day-Saints Museum of Salt Lake City. Many of these, however, were from localities other than Utah. In the same year fifty mounted specimens of Utah birds were obtained from Mr. R. G. Bee of Provo, and since that time Mr. John Hutchings of Lehi, Utah, has contributed a number of interesting mounted birds including beautiful specimens of the Wood Ibis and the Sandhill Crane.

In the spring of 1937 a series of about 200 study skins of Washington County birds was contributed to the collection by Dr. D. E. Beck and Floyd Atkin of the Dixie Junior College at Saint George, Utah.

During the accumulation of the collection, particularly within the past few years, a number of species and subspecies apparently new to the State, or at least of sufficient rarity to be of interest, have been brought to light. It is the object in this paper to place these occurrences on record and to make some comments as to the distribution of some of the forms within the State.

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[1]Contribution No. 73 from the Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

The writer is indebted to Drs. Clarence Cottam and H. C. Oberholser, of the U. S. Biological Survey, for the identification of some of the doubtful specimens.

Lesser Loon. *Gavia immer elasson.* This subspecies appears to visit Utah in both autumn and spring but as far as I know does not breed within the State. An adult female was collected at the mouth of Provo River, Utah Lake, June 27, 1935, by D. E. Beck. The writer obtained the head and foot only of a specimen shot by a hunter on Utah Lake, October 30, 1932, which on the basis of available measurements seems to be of this subspecies. Still another specimen was collected at Veyo, Washington County, October 27, 1933. As far as I am aware this is the first published record of the Lesser Loon for Utah.

American Egret. *Casmerodius albus egretta.* A mature male specimen was captured alive at St. George, Washington County, by Dr. D. E. Beck and brought to the laboratory at Brigham Young University where it was kept alive for some time during the spring of 1934. It was finally killed and mounted and is now in the display collection of the University. This egret has been formerly recorded from the Bear River Marshes, North End of Great Salt Lake by Bent (U. S. Nat. Mus. Bull. 1935, p. 133, 1926) and by Allee (Scientific Monthly, December, 1926, p. 488). Henshaw (Annals New York Lyceum of Nat. Hist., 11, p. 12, 1874) records it from Beaver, Beaver County, and Provo, Utah County. This bird has apparently always been rather uncommon in the State and is probably less common at the present time than formerly.

Wood Ibis. *Mycteria americana.* A mature specimen was obtained at Lehi, Utah County, during the summer of 1935 by Mr. John Hutchings. It was mounted by him and presented to the Brigham Young University. This species has been recorded from Rush Lake by Henshaw (Report of Expl. and Sur. West of 100th Mer., 5: p. 462, 1875), and from Utah by Ridgway (Manual of N. A. Birds, Philadelphia, J. B. Lippincott Co., p. 125, 1900).

Black-bellied Plover .*Squatarola squatarola.* While undoubtedly a regular migrant visitor to the State, this species does not appear to have been often recorded in State lists. The only published record that I have noted is that of Bent (U. S. Nat. Mus. Bull. 146, p. 168, 1929) from Provo, Utah County, May 11. The writer has been small flocks of this plover at Utah Lake on three occasions. Twelve birds were seen at Provo Bay on May 13, 1933, and a second flock of about the same number was noted flying over the lake on May 20 of the same year. On May 9, 1936, a flock of six birds was seen at Provo Bay and one male was collected from the group. Mr. Reed Fautin, a competent observer, reports having seen about fourteen plovers at the mouth of Provo River, May 5, 1937.

Red Phalarope. *Phalaropus fulicarius.* Two specimens were collected by H. D. Wilkin at St. George, Washington County, October 14 and 15, 1934. The specimens are in typical autumnal plumage and their broad bills at once distinguish them from Wilson's Phalarope and the Northern Phalarope which also occur in Utah. To my knowledge, this is the first published record of this species for the State.

Flammulated Screech Owl. *Otus flammeolus.* One specimen was taken from Pine Valley Mountain, Washington County, October 20, 1935, by Floyd Atkin. Another adult female specimen was taken by the writer and Mr. James Bee at Mule Flat, Mt. Timpanogos, Utah County, July 3, 1937. The last mentioned specimen was removed from her nest which contained two downy white young that we judged to be about ten days old. The nest was in a large aspen tree in what was

apparently an old woodpeeker hole and was situated about twenty-four feet from the ground. The bird allowed us to pluck her from the nest and offered little resistance when in hand. Aside from snapping the beak she showed no inclination to fight. The situation was interesting, furthermore, in that there were several nests of the Violet-green and Tree Swallows as well as one Purple Martin nest in the same tree. While this owl undoubtedly is generally distributed throughout the State in suitable habitats, I have not seen it recorded in any of the lists.

Northwestern Horned Owl. *Bubo virginianus lagophonus.* A specimen was collected near St. George, Washington County, October 22, 1933, undoubtedly a migrant individual. I have not noted any previously published record of this subspecies for the State. The status and distribution of the breeding horned owls of Utah are not as yet positively established from our collections. Considerable collecting during the breeding season should be done throughout the State. The Montana Horned Owl (*B. v. occidentalis*) has been established as the breeding subspecies of the Wasatch Mountains east of Provo. Mr. James Bee and the writer obtained a set of partially incubated eggs in South Fork, Provo Canyon, March 21, 1936, and took the female as she left the nest. The nesting site was in a cottonwood tree about fifty feet from the ground. On the same day a set of three eggs, advanced in incubation to the formation of small bones, was taken about one mile west of Charleston, Wasatch County. The nest in this case was also located in a cottonwood tree about fifty or sixty feet from the ground. We have noted that this subspecies also often nests in cliffs along the sides of canyons. The Western Horned Owl (*B. v. pallescens*) is undoubtedly the breeding bird of the southern part of the State, but the exact extent of its range is not evidest from our collections.

Western Nighthawk. *Chordeiles minor henryi.* An adult female was obtained at 10-Mile Spring, south of Escalante, Garfield County, June 22, 1936, by D. E. Beck. Oberholser in his monograph of the genus *Chordeiles* (U. S. Nat. Mus. Bull. 86, pp. 65-70, 1914) does not record this subspecies for Utah, but in his map (ibid., pl. 3) indicates its presence in the extreme southwestern corner of the State. A series of five specimens from the La Sal Mountains, Grand and San Juan Counties, taken by the writer in July, 1934, appear on the basis of Oberholser's descriptions and comparisons, to be intergrades between *C. m. henryi* and *C. m. howelli.* Such an intergradation would be expected on the basis of Oberholser's map of distribution. The establishment of the breeding range of these two subspecies as well as that of *C. m. hesperis* of the western part of the state will require considerable more collecting.

Alaska Hermit Thrush. *Hylocichla guttata guttata.* A specimen was taken on Pine Valley Mountain, Washington County, October 12, 1935, by D. E. Beck. While this subspecies undoubtedly migrates regularly through the State in autumn, this is the first specimen to come into our collection. It was reported by Ridgway (Bull. Essex Inst., 5: p. 170, 1873) as occurring in the Wasatch Mountains in autumn.—C. Lynn Hayward, *Brigham Young University, Provo, Utah.*

Neighborly Wood Thrushes and Other Birds.—The summer of 1936 was marked by the most prolonged heat and drought on record. This had its influence on the feeding habits of the late nesting birds. A pair of Wood Thrushes (*Hylocichla mustelina*) always nest in the yard and are very shy. On July 15 the second brood left the nest. The two young were just able to fly a short distance.

The next morning one of the parents and one of the young were missing. The other parent visited the bird bath of a neighbor and she thought she would try throwing out sime cracker crumbs and bread crumbs. The bread crumbs were rejected but the cracker crumbs were thrown closer and closer to the edge of the porch until we could have reached and touched the parent. She would appease her own hunger and then hop off with a mouth full for the young which always remained at the edge of the yard. The youngsters insisted upon being fed until full grown.

Another bird deprived of food was the Eastern Wood Pewee (*Myiochanes virens*). The parent, in an effort to procure food which was abundant around the foundations of houses, would dash at its prey, often striking a person in its mad flight. The five young of one family perched for the greater part of the day on an apple tree limb about four feet from the ground and were very tame. They, too, insisted upon being fed until grown.

The winter of 1935-1936 here in contrast with other sections of the State, had about three times as many Carolina Wrens (*Thryothorus ludovicianus*) as usual and these all remained for the summer of 1936, raising two large broods each, but in mid-November most of them departed.

During the winter of 1936-1937 the Eastern Mockingbird (*Mimus polyglottos*) and White-throated Sparrow (*Zonotrichia albicollis*) were seen frequently.

The Sharp-shinned Hawk (*Accipiter velox*) has been unusually plentiful here this winter.—Katie M. Roads, *Hillsboro, Ohio.*

Records from Southeastern Missouri—Bennitt's "Check-list of the Birds of Missouri" (Univ. Mo. Studies VII, No. 3, 1933) recorded a number of species and subspecies whose status in Missouri was in doubt. During the summer of 1934 an attempt was made to determine the status of some of them by collecting in the lowland counties of southeastern Missouri. Dr. Harry C. Oberholser has kindly identified the specimens whose names are starred (*). All the birds collected are now in the museum of the University of Missouri.

*Southern Downy Woodpecker. *Dryobates pubescens pubescens. First Missouri record.* Previously reported from points close to Missouri in Kentucky, Tennessee, and Arkansas. There are four specimens from Dunklin County: two females (Cardwell, June 13; Campbell, June 20) and two males (Campbell, June 27).

*Southern Crow. *Corvus brachyrhynchos paulus. First Missouri record.* Previously reported in western Tennessee. A female was taken at Puxico, June 24, and two males at Campbell, June 20 and 27.

*Southern Robin. *Turdus migratorius achrusterus. First Missouri record.* Previously reported from points close to Missouri in Illinois, Tennessee, Arkansas, and Kansas. Two males were taken (White Oak, June 20, and Campbell, June 27), and two females (Kennett, June 21 and 27).

*Maryland Yellow-throat. *Geothlypis trichas trichas. First Missouri specimens.* According to the geographic range of the subspecies of *G. trichas* as outlined in the 1931 A. O. U. Check-List (p. 296), there should be no breeding yellow-throats in Missouri at all. The Northern Yellow-throat (*G. t. brachidactyla*), however, is a common breeder in most of the state, and *trichas* was included in Bennitt's "Check-list" (p. 56) on the basis of rather scant evidence. The presence

of *trichas* in summer in southeastern Missouri was established by two males taken at Cardwell, June 15 and July 5.

*Florida Blue Jay. *Cyanocitta cristata florincola.* First reported from southeastern Missouri in Bennitt's "Check-list" (p. 45) on the basis of three specimens. Six more were collected in Dunklin County during June, 1934, establishing this as the summer-resident race in that region.

*White-breasted Nuthatch. *Sitta carolinensis carolinensis.* Three specimens were taken in Dunklin County during June and July, 1934. In view of the fact that a specimen of the Florida race, *S. c. atkinsi*, from Howell County is now in the National Museum collection, and that Dr. Oberholser has referred two specimens from Central Missouri to this subspecies (Bennitt, 1933, 46), it appears that both races occur in southeastern Missouri.

*Migrant Shrike. *Lanius ludovicianus migrans.* Eight specimens were taken in Dunklin County in June, 1934. Although the Loggerhead Shrike (*L. l. ludovicianus*) has been recorded at points near Missouri in southern Illinois, Kentucky, and Tennessee, *migrans* appears to be the summer-resident shrike of southeastern Missouri.

*Western Parula Warbler. *Compsothlypis americana ramalinae.* Although this race is not now recognized by the A. O. U. Committee and typical specimens of the northern subspecies, *C. a. pusilla*, have been taken elsewhere in Missouri, it is worth recording that four birds taken in Dunklin County during June and July were all referred by Dr. Oberholser to *ramalinae*.

Southern Meadowlark. *Sturnella magna argutula.* Five males were taken in Dunklin County in June, establishing this as the summer-resident meadowlark of the southeastern Missouri lowlands. The only previous specimen from there was one taken by Howell in New Madrid County in 1910 (*Auk*, Vol. 27).

Painted Bunting. *Passerina ciris.* Reported from southern and western Missouri by Bennitt (1933, 60). This species was seen several times during June and July in Dunklin and Stoddard Counties, thus extending its known range in Missouri.—James W. Cunningham, *Southwest High School. Kansas City, Mo.*

ORNITHOLOGICAL LITERATURE

Studies in the Life History of the Song Sparrow. I. A Population Study of the Song Sparrow. By Margaret Morse Nice. Trans. Linn. Soc. N. Y., IV, April, 1937. Pp. i-vi+1-247. Pls. I-III. Charts I-XVIII. Maps 1-14. Tables I-XXXIII. Price, $1.50.

This is Volume I of a monograph based on eight years (1928-1936) of intensive study of *Melospiza melodia*, mostly on an area of about forty acres of Olentangy River flood plain adjacent to the author's former home at Columbus, Ohio. Its scope ranges from statistical presentation of breeding data to critical evaluation of population theory and includes significant discussions of such phases of life history as migration, territorialism, and ecological relationships. Volume II, it is indicated, will be devoted more to details of Song Sparrow behavior, with special regard to activities associated with reproduction.

The principal research technique used was that of field observation, supplemented by color banding. Little experimentation, and no collecting, was done, as it was desired to determine as accurately as possible "What actually happens in a population of wild birds."

One is impressed by the tremendous amount of data that Mrs. Nice has somehow found time to gather, practically through her own efforts alone. As might be expected of a person of her linguistic accomplishments, she has drawn from European, as well as American, ornithological literature. Of the non-English references in the 14-page bibliography, those having German and Dutch titles seem to have been most freely cited.

The subject matter, for all of its bulk and intrinsic complexity, has been clearly handled. Mrs. Nice has expressed the hope that the Song Sparrow work might stimulate further study, and it should do just that. The chapter summaries and the eight pages of index should contribute to this end, but the chief strength of the writing, in my estimation, lies in its essential simplicity of diction, its solidity of background, the trends of thought it reveals, and the questions it raises. Not only has it been the author's evident intention to supply interested readers with the basic facts and up-to-date interpretation of those facts, but she has called attention to a great many of the important hiatuses that still exist in our knowledge of the life history and ecology of vertebrates.—Paul L. Errington.

Observations on the Birds of West Virginia. By Alexander Wetmore. Proceedings of the United States National Museum, Vol. 84, No. 3021. Washington, 1937. Pp. 401-441.

To those who are somewhat familiar with the State's avifauna Dr. Wetmore's paper will hold fewer surprises than to those who have not recognized West Virginia as an outstanding meeting place for many bird species and races. For local students, however, its value is apparent when one finds here listed the first race ever described whose type locality is in West Virginia; no less than nine races recorded from the State for the first time; and the first recorded specimens of at least one species. The present list treats 142 species and races.

Dr. Wetmore directed the Smithsonian Institution's investigation of West Virginia birds during the spring, summer, and autumn of 1936. The party's itinerary was so planned that nearly all major faunal divisions of the State were visited, the work extending from the Ohio River region in the southwestern portion of the

state, up through the rugged hills that lie west of the Allegheny ridges, and eastward to some of the highest mountain areas. Additional data at hand were used, and the specimens already in the National Museum were taken into account. No collections are recorded from that portion of the state which lies in the Shenandoah Valley, nor was any work done in the interesting region comprising parts of Preston, Grant, Mineral, and Tucker Counties which we have come to call the "Allegheny Tableland".

Most surprising, perhaps, of Dr. Wetmore's findings is that Ruffed Grouse in West Virginia are referable to the Canada race, *Bonasa umbellus togata*. This seems to hold true also for the grouse of western Pennsylvania, Virginia, Tennessee, and northern Georgia. In view of the range given for *B. u. umbellus*, the typical form might well be looked for in the extreme eastern part of the state.

Other races recorded from West Virginia for the first time are Southern Crow (*C. b. paulus*), Ohio House Wren (*T. a. baldwini*), Southern Winter Wren (*N. h. pullus*), Southern Robin (*T. m. achrusterus*), Northern Yellow-throat (*G. t. brachidactyla*), Giant Red-wing (*A. p. arctolegus*), Labrador Savannah Sparrow (*P. s. labradorius*), and Mississippi Song Sparrow (*M. m. euphonia*). Illuminating data on the recently described Southern Creeper (*C. f. nigrescens*) and the Northern Carolina Chickadee (*P. c. extimus*) are also included. Specimens of Lapland Longspur were taken, this bird having been known to the state previously only through a sight record.

Concerning the Mississippi Song Sparrow, Dr. Wetmore has determined that the type specimen of the previously named *M. m. beata* Bangs is really a specimen of the Dakota Song Sparrow (*M. m. juddi* Bishop). This leaves *beata* Bangs as a synonym for *juddi*, so *beata* is replaced by *euphonia* Wetmore, the type locality of the race being Cranberry Glades, Pocahontas County, West Virginia.

Eastern bird students will find interest in Dr. Wetmore's belief that the Golden Eagle may still nest in West Virginia. There is a seemingly remarkable coincidence in the collection by the Smithsonian group of another Swainson's Warbler, a previous specimen having been taken by P. C. Bibbee in Monongalia County (Bulletin 258, West Va. Agr. Exp. Station, p. 34).

All breeding birds of the species in West Virginia are considered by Dr. Wetmore to be Cairn's race (*D. c. cairnsi*) of the Black-throated Blue Warbler. The present writer ventures the opinion that individuals of the typical form, *D. c. caerulescens* will be found breeding in the Allegheny Tableland territory in extreme northern West Virginia.

It might be noted that in giving Wardensville, Hardy County, as the northern known limit in West Virginia for Black Vultures, Dr. Wetmore overlooks W. H. Ball's record for Harper's Ferry (*Auk*, XLVIII, Oct., 1931, p. 599). In speaking of the Eastern Purple Finch this paper represents observations on the species made at Cranberry Glades, Pocahontas County, as a considerable southern extension of its summer range. Rev. E. A. Brooks has recorded (List of Birds Found in West Virginia, Bulletin No. 12, W. Va. State Board of Agr., Charleston, W. Va., 1909) the species in summer from The Pines, Randolph County, and from Pocahontas County, near Osceola. He also quotes Thaddeus Surber's record of the summer occurrence of the species in Greenbrier County, farther south than the Cranberry Glades area. Maurice Brooks has noted previously the summer occurrence of the birds at Cranberry Glades (Wilson Bulletin, XLII, Dec., 1930, p.

249). Throughout Dr. Wetmore's paper Kate's Mountain, where considerable collecting was done, is consistently misspelled.

When it is possible to record from an eastern state nine races of birds previously unknown, or only recently known, from the area, further emphasis is given to the need of extensive field work in West Virginia. Dr. Wetmore's collections, taken together with the excellent work on West Virginia avifauna being carried on by Dr. George M. Sutton, Karl Haller, and others, will make the work of the compiler much easier, and will add richness to the next check-list of West Virginia birds.—Maurice Brooks.

A Survey of the Resident Game and Furbearers of Missouri. By Rudolf Bennitt, Ph. D., and Werner O. Nagel, A. M. Univ. Mo. Studies, XII, No. 2, April, 1937. Pp. 1-215. 8 figs. 10 maps. Price, $1.25.

The authors of this survey have produced a report which may serve as a model for similar work in other states. The plan of the work includes some general statements as an introduction, followed by chapter discussions of selected game birds, game mammals, furbearers, and predators. Approximately half of the report is devoted to game birds. The species included are the Bob-white, Ruffed Grouse, Prairie Chicken, Ring-necked Pheasant, Wild Turkey, Mourning Dove, and a few others merely mentioned.

The Ruffed Grouse population in Missouri is reported to consist of about 100 birds. The population of Prairie Chickens is estimated at about 5,000 (as contrasted with 12,500 in 1907). The southern half of the state is credited with a population of 3,585 Wild Turkeys, which, on the whole, is decreasing. Missouri is one of the states which counts the Mourning Dove a game bird. This again brings to our mind the question of how a game bird is defined. Is it defined by its edibility? Is it defined by its abundance? Is it defined by the skill required in shooting it? Or is it merely a traditional term without exact meaning, except in a legal sense? In some not very clear way the term "game" bird is associated with the idea of sport. And, similarly, we usually think of sport as a test of skill and prowess. The estimated population of Mourning Doves in the State of Missouri in the fall of 1934 is 3,000,000. Subtracting 30 per cent for loss by predators, weather, etc. (as was done in the quail estimate, which may or may not be justified in this case) we would have a spring population of 2,100,000 birds to compare with the estimate of 1,065,000 Bob-whites for the spring of 1935. These figures would indicate about twice as many Mourning Doves as quail in Missouri. This puts the Mourning Dove in a worse position than we had supposed it to be. The Bob-white, with a higher reproductive capacity than the Mourning Dove, is barely holding a stationary population in Missouri. What can be expected of the Mourning Dove, with a lower reproductive capacity, granting two or three broods per season, and a much longer open season? The authors' comment on this is, "that any amount of dove shooting likely to occur in Missouri for the next few years will not endanger the breeding reserve". Of course, during Missouri's open season they have not only their own birds, but those from the northern states as well; unless their breeding population moves southward, in which case the hunted population would all be northern. To work out this problem one would need the full facts of migration. It seems clear enough that while any state may properly regulate its own resident game, the problem of migratory species can only be solved by considering its entire range.

The pages of this report which deal with mammals are as complete and thoughtful as those on birds. The entire case of the proper handling of our wild life is helped by just such contributions as the one under discussion. This is a fact-finding paper, and as such is entitled to serious consideration by interested students in any state. The last five years will no doubt mark the beginning of a renaissance in wild life management in this country, and work of the kind here reviewed will stand as a landmark in its history.—T. C. S.

Handbuch der Deutschen Vogelkunde. Volume I: Passeres. By Gunther Niethammer. Pp. i-xxiv+1-474. Figs. 69 and Col. Pl. I. Published by the Academische Verlagsgesellschaft M. B. H. Leipzig, 1937. Price, 15 RM.

As the title indicates this is a handbook of German ornithology, the present, first, volume dealing wholly with the passerine birds. While it is written in the German language, the English alphabet is used, thus facilitating translation for us. A few more than two hundred forms are treated, each under the subheads: description; field marks, including song; general distribution; distribution in Germany; migrations; habitat; breeding habits; food; parasites. The Europeans have given much more attention to parasites than Americans have done, and consequently a good list of various parasites can be given for practically every bird species treated. The paragraph on breeding habits (fortflanzung) is very fully presented, including the facts concerning the nest, eggs, care of the brood, incubation period, and nestling period. We have enjoyed going through this volume not only for the information gained by comparison of the nomenclature and other descriptions with our own, but we have found it a most profitable exercise in strengthening our reading ability in the German language. And for the same reasons we believe that many an American ornithologist would find this work a very useful addition to his library.—T. C. S.

Birds Collected by the Childs Frick Expedition to Ethiopia and Kenya Colony. By Herbert Friedmann. U. S. Nat. Mus. Bull. 153, Pt. 2, Passeres. xii + 506 pp., 14 pl. (1 col.), 30 figs. Washington, 1937. Price, 70 cents.

By our unofficial count this work treats of 295 species and 58 additional subspecies. Part 1, published in 1930, contained about the same, making a total of 613 forms. It is based primarily upon some 5,200 specimens collected by the late Dr. E. A. Mearns. The treatment consists chiefly of discussions of the status of the forms examined with new details of plumage, etc. The general reader will find frequent notes on habits. Common names are mentioned for many of the birds but they are not placed in the headings, except for families, nor indexed. It is always interesting to examine an account of a distant region. In this second part of the report, the weaver-birds are the most numerous family with fifty-eight nominal species. The warblers (Sylviidae), thrushes, and shrikes are next in order, with subspecies decidedly most numerous in the warblers. In the weaver-birds we find four species of *Passer*, of which *P. griseus swainsoni* in Ethiopia "takes the place of *P. domesticus* in a general way". The text figures are mostly distributional maps and the plates mostly photos of habitats. A brief discussion (pp. 3-15) of faunal areas is included. The author states that a report on the birds of the Roosevelt African expedition is in manuscript.—O. A. S.

Concord River. Selections from the Journals of William Brewster. Edited by Smith O. Dexter. Pp. i-x+1-259. Harvard University Press, Cambridge, Mass. 1937. Price, $3.50.

Concord River is a companion for October Farm, which was published last year. The notes in Concord River begin with 1879 and extend to 1918, though the bulk of those selected were written in the 90's. This is a larger book than October Farm, and it seems to us that it contains more bird material; though we do not find it any more interesting. Concord River in enhanced, however, by having a detailed map of the October Farm region. Many of the bird notes scattered in this diary have quotation value, such as, for instance, the whisper song of the Brown Thrasher (p. 37), the flight songs of the Flicker and the Pine Warbler (p. 196), the eating of petals of apple blossoms by the Cedar Waxwing (p. 188), and many others. Brewster also witnessed the very extraordinary incident of a male Downy Woodpecker attacking and killing a female Downy. On several occasions, Brewster relates, he saw a hawk or a shrike capture its prey, and was so vexed that he was tempted to shoot the predator on the spot, but refrained. The illustrations are for those who like that kind.—T. C. S.

Flight Speed of Birds. By May Thatcher Cooke. Circ. 428 U. S. Dept. Agric., May, 1937. Pp. 1-13. Price, 5 cents.

A useful brief discussion of bird flight as affected by body weight, shape of wings, and wind currents, together with a very full list of birds with determined flight speed. A good bibliography of eighty-six titles is also given.—T. C. S.

Fluctuations in Numbers of Ruffed Grouse Bonasa umbellus (Linne) with Special Reference to Ontario. By C. H. Douglas Clarke. Univ. Toronto Biol. Studies No. 41. Univ. Toronto Press, 1936. Pp. 1-118.

A paper which discusses especially population numbers, life history, cycles, parasites and diseases in the Ruffed Grouse species.—T. C. S.

Vertebrate Animals of Point Lobos Reserve, 1934-35. By Joseph Grinnell and Jean M. Linsdale. Pub. 481 Carnegie Inst. of Washington. Washington, 1936. Pp. i-vi+1-159. Pls. 1-39. Fig. 1.

The Point Lobos Reserve is a state park located near the middle of the California coast line. The body of this report includes annotated lists of amphibians (five in number), reptiles (five in number), birds (147), and mammals (19), which were found in the park during the period of study. In their listing of species the authors use the binomial nomenclature, since no specimens were collected upon which to base subspecific determination. The authors advocate the administration of this park in such a way as to preserve its natural conditions intact, and a strong plea is made for this policy.—T. C. S.

Natural Hybridization and Genetics of Flickers (Colaptes). By Alan Deakin. Amer. Nat., LXX, Nov.-Dec., 1936, pp. 585-590.

A study of the genetics based on two families. We have long wished to know something about the chromosome count in such closely related forms as the flickers, and especially in the hybrids.—T. C. S.

The *Chat* is a new mimeographed periodical issued by the North Carolina Bird Club, and published at Raleigh, N. C., at $1.00 per year. The editor is John H. Grey, Jr., 1719 Park Drive. In the March number (I, No. 1, 1937) one writer tells of having seen a Ruby-crowned Kinglet with a *yellow* crown patch instead of a ruby-colored one. This variation in color may be a local strain, since very little has been written about such a color variation in the general literature. The April number (I, No. 2) has an important article by C. S. Brimley on "Additions, Corrections to North Carolina Birds" as developed since the "Birds of North Carolina" was published in 1918. There is also a report of the nesting in North Carolina of the Prairie Horned Lark. The May-June number (I, Nos. 3-4) prints an article by Editor Grey on birds to be seen on the Atlantic Ocean. This number also reports 101 charter members of the newly organized society. The July-August number (I, Nos. 5-6) presents an article by Dr. T. Gilbert Pearson reviewing the present status of bird protection in South and Central American countries. Another writer records the decrease in numbers of Purple Martins, and believes the cause to be the use of a poisonous spray used by the Brazilian coffee growers. Another paper on the breeding habits of the Least Tern reports many eggs on the North Carolina coast as early as May 18.

The *Nebraska Bird Review* for April (1937, V, No. 2) carries a suggestive article by Prof. O. A. Stevens on bird banding, and also a very complete biography of the late Professor Lawrence Bruner, with a portrait and list of published works. The July number (1937, No. 3) presents another instalment of Professor Swenk's history of Nebraska ornithology. This instalment deals with the several small expeditions up the Missouri River which followed the one by Lewis and Clark. Previous instalments covered fossil birds (April, 1933), aboriginal man and bird life (October, 1934), early Spanish explorations (April, 1935), the Lewis and Clark expedition (July, 1935).

The *Redstart* for April (1937, IV, No. 7) presents an article by Dr. George M. Sutton on available problems in West Virginia ornithology, which may be of interest to others also. We note with appreciation the very nice compliment from the editor of the *Redstart*. In the May number Mr. Maurice G. Brooks calls attention to a list of about seventeen species of birds which might be found nesting in Preston County. Such suggestions promote ornithology by stimulating those who have the opportunity to investigate.

News from the Bird Banders for August (XII, No. 3, 1937) lists the banders who participated in the work of the W. B. B. A. for 1936. It shows that 37,951 birds were banded by 122 banders. This issue reproduces a comment from the Wilson Bulletin, evidently with approval.

The *Inland Bird Banding News* for June (1937, IX, No. 2) gives a historical account of the campaign of gull banding in the Great Lakes region. M. J. Magee reports having banded 28,424 birds (3,141 of which were Evening Grosbeaks) during the fifteen years (to May 28, 1937) of his banding activities.

The *Game Research News Letter* for August, 1936, issued at Madison, Wisconsin, carries a supplement which gives very full information concerning the game management training work as offered at the University of Wisconsin under Professor Aldo Leopold. The August, 1937, number introduces the four leading

graduate students of the department, stating their present employment; and also enumerates six of the research projects now being worked on.

The *Chickadee* for December, 1936 (VI, No. 1) contains a composite list of the birds found in Worcester County during the year 1936.

The *Prothonotary* for June, 1937 (III, No. 6) includes a composite one-day list of 184 species of birds. There is also an eye-witness account of the way young Wood Ducks leave the nest. In this case, at least, the young birds tumbled out of the nest and fell to the ground without any assistance from the parents. The July number is devoted mainly to nesting records. The August number is devoted to brief records.

The *Migrant* for June, 1936, reports two colonies of Cliff Swallows in Tennessee. One colony is on the Cumberland River at Dover. The nests were cemented to the concrete wall of a dam. Later nests were added below the older ons. One nest had a bottle-neck entrance which "hung down for more than a foot". Another colony was found on the Tennessee River thirteen miles below (north of) Savannah, Tenn. These nests were attached to a natural rock cliff. The authors suggest that these colonies are the "most southerly breeding sites of this species at the present time". Mr. Weakly continues the topic in the September *Migrant* and reports several other small colonies along the Cumberland River in Tennessee and Kentucky; and also along the Tennessee River, one of these being in northern Alabama. Two of the mud nests were occupied by snakes, each one of which contained an adult swallow. The December number (VII, No. 4) has an article by Mr. Coffey on the Chimney Swift migration at Memphis, which describes another banding project on a large scale. In the number for June (VIII, No. 2) Mr. Ganier records a list of sixty-nine species of birds for the Pickett Forest, wilderness area in the northeastern part of the state.

The *Cardinal* for July (IV, No. 6, 1937) contains a paper on the breeding birds of unglaciated Ohio, by Lawrence E. Hicks, and notes from West Virginia, by Maurice G. Brooks, as well as many short notes and reviews.

The *Raven* for April-May (1937, VIII, Nos. 4-5) contains a report of the Seventh Annual Meeting of the Virginia Society of Ornithology. and an intimate account of the flight song of the Woodcock. The June number (VIII, No. 6) has for its leading article a description, by Dr. J. J. Murray, of the birds found on Cobb's Island on a June visit.

The *Journal of Minnesota Ornithology* is published by the T. S. Roberts Ornithology Club as an annual. The number for April, 1937 (I, No. 2), contains an article by Cyril J. Rosenberger summarizing noteworthy discoveries of birds during 1936. A Magpie invasion is described by J. P. Jensen. There is also a short paper reporting the Whooping Crane near Wolsey, S. D., on July 30. 1936.

The *Flicker* is published quarterly by the Minnesota Bird Club. Beginning with the March number for 1937 (IX, No. 1) it appears in printed form, with an attractive cover design. This number gives a ten-year list of winter birds in Minnesota as compiled from the literature by E. D. Swedenborg. The May number (IX, No. 2) contains a list of the summer birds of Cook County, also by Mr. Swedenborg. The *Flicker* is edited by George N. Rysgaard.

The *Wildlife Review* for July (No. 9, 1937) contains just a hundred abstracts of papers dealing with wildlife, and classified under the usual headings.

The *Bird Calendar of the Cleveland Bird Club* for April and May (July, 1937) gives a list of unusual birds observed locally during the spring; and also a list of spring arrival dates.

"Cleveland's Nature Trails" is the title of a booklet prepared by Dr. Arthur B. Williams and published by the *Cleveland Press*. These pages give a descriptive account of a number of natural history aspects of the Cleveland area, for example, the park areas, birds, trees, woodland flowers, mammals, plant growth, etc. Besides being of local interest, this booklet is very suggestive to other communities which might wish to plan something of a similar kind. A copy may be had by sending ten cents to the Cleveland Press, Public Service Bureau, Cleveland, Ohio.

The *Bulletin of the Schools* of the University of the State of New York uses one issue each year as a Bird Day number, and this year it was the March number. In it we find twenty pages of popular reading matter on bird life, including a paper on the movements of birds by Dr. Dayton Stoner.

The Outdoor Nature Club, of Houston, Texas, has issued a 4-page spring (1937) Bulletin. Further information concerning it may be secured by writing Mr. Chas. B. Boone, 2524 Cragmont St., Houston, Texas.

"Fuertes and Audubon, a Comparison of the work and personalities of two of the World's Greatest Bird Artists" is the title of an article by Dr. Frank M. Chapman in *Natural History* for March, 1937, a reprint of which was kindly sent us by the author.

Donald J. Boror has prepared a mimeographed report on the migration dates for the birds of central Ohio, issued in March, 1937.

The *Bluebird* is the new name for the News Letter of the Audubon Society of Missouri, beginning in February of this year. The February number (IV, No. 2, 1937) has a good article on the winter food of birds. In the March number (IV, No. 3) a writer tells of a House Wren's nest built on the rear axle of an automobile. When the car was used the nest and mother bird went along, being twice gone all day. The five eggs were successfully hatched. In the June number (IV, No. 6) the Editor offers some comments on the growing use of poisoned bait for the destruction of certain animals which come under human ban. The question is raised whether these burrowing rodents may not perform some beneficial service in soil development. Mankind has made some costly blunders in draining away the surface waters and loosening the top soil—all due to haste and ignorance. It may later be discovered that much of the poisoning work is in the same category. This periodical has been running a good deal of discussion on the extent to which birds eat butterflies. Other discussion considers the good and bad points of the English Sparrow, and of the grackle and bluejay (mostly bad points in these two cases). In the August number (IV, No. 8) Mr. G. E. Moore advocates the inclusion of introduced wild species in our daily lists.

INDEX FOR VOLUME XLIX, 1937

Compiled by Chas. J. Spiker

Numbers in *italics* indicate pages on which the species is the subject of a major article or field note.

TO OUR CONTRIBUTORS

Our members are urged to submit articles for publication in the BULLETIN. Short items are desired for the department of General Notes, as well as longer articles pertaining to life-history, migration, ecology, behavior, song, economic ornithology, field equipment, methods, etc. Local faunal lists are desired, but limited space makes slower publication inevitable. In preparing such lists for publication in the BULLETIN follow our existing style, and use the nomenclature of the fourth edition of the A. O. U. Check-List.

THE MANUSCRIPT. The manuscript, or copy, should be prepared with due regard for literary style, correct spelling and punctuation. We recommend the *Manual of Style*, of the University of Chicago Press, as a guide in the preparation of manuscripts. Use paper of good quality and of letter size (8½x11). Avoid the use of thin paper. Write on one side only, and leave wide margins, using *double spacing* and a reasonably fresh, black ribbon. The title should be carefully constructed so as to indicate most clearly the nature of the subject matter, keeping in mind the requirements of the index. Where the paper deals with a single species of bird it is advisable to include the scientific name of the species in the introductory paragraph. If the author will mark at the top of the first page the number of words in the paper, a little of the Editor's time will be saved.

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