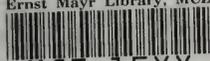


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THE WILSON BULLETIN

A Quarterly Magazine
of
Ornithology

Edited by
JOSSELYN VAN TYNE

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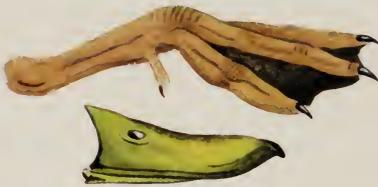
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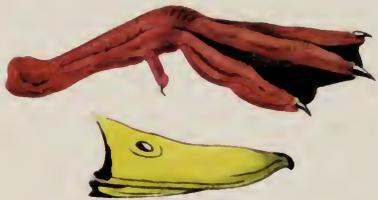
♂ JUVENILE (FLIGHTLESS) ♀



♂ JUVENILE (IN JUVENILE PLUMAGE) ♀



♂ JUVENILE (IN FIRST WINTER PLUMAGE) ♀



♂ ADULT (IN WINTER PLUMAGE) ♀



♂ ADULT (IN ECLIPSE PLUMAGE) ♀

T. M. Short

BLACK DUCK
(*Anas rubripes*)

THE WILSON BULLETIN

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Vol. 55

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No. 1

CORRELATION OF BILL AND FOOT COLORING WITH AGE AND SEASON IN THE BLACK DUCK

BY TERENCE M. SHORTT

SPORTSMEN and ornithologists have long been familiar with two distinct types of coloration in the bill and feet of the Black Duck (*Anas rubripes*), and many have published their interpretations (Brewster 1902, 1909, 1910; Townsend 1905, 1912; Dwight 1909; Phillips 1920; Bent 1923; *et al.*). Some believed that the differences were due to age and to seasonal changes; others that the variants represented two geographic races. In the present A.O.U. Check-List the latter interpretation is accepted.

The greatest difficulty in ascertaining the significance of this color variation has been in making an exact age determination for individual birds. Young birds, once they had moulted from the juvenile to the first winter (or nuptial) plumage, were not distinguishable from older birds. This difficulty was overcome by Gower (1939), who found that the bursa of Fabricius was an age indicator. This sac-like organ is attached to the dorsal side of the large intestine and opens into the cloacal chamber near the anus. It is believed not to be present in adult birds except in the ostriches, but is present in all juveniles. Apparently

PLATE 1. BILL AND FOOT COLORING OF THE BLACK DUCK

DOWNY: ♂ June 6, 1942, Kabiskaubakau River, Ontario (west coast of James Bay). The sexes appear to be essentially alike.

JUVENILE (FLIGHTLESS): ♂ July 15, 1942, Fort Albany, Ontario (west coast of James Bay). Much down still adhering to back and rump.
♀ July 9, 1931. Laird, Algoma District, Ontario. Much down still adhering to back and rump.

JUVENILE (IN JUVENILE PLUMAGE): ♂ July 23, 1942, Big Piskwanish, Ontario (west coast of James Bay). Fully feathered and flying.
♀ September 17, 1941, Rice Lake, Ontario.

JUVENILE (IN FIRST WINTER PLUMAGE): ♂ December 1, 1941, Long Point, Lake Erie, Ontario.
♀ December 1, 1941, Long Point, Lake Erie, Ontario.

ADULT (IN WINTER PLUMAGE): ♂ November 30, 1941, Long Point, Lake Erie, Ontario.
♀ December 1, 1941, Long Point, Lake Erie, Ontario.

ADULT (IN ECLIPSE PLUMAGE): ♂ July 19, 1942, Nettichi River, Ontario, (west coast of James Bay).
♀ July 16, 1942, Nettichi River, Ontario, (west coast of James Bay).

(Note reversion to juvenile coloration.)

It should be remembered that there is considerable individual variation in the bill and foot coloring of this species. The illustration does not show these variations but rather is an attempt to portray the typical sequence of color change. The types of coloration shown are those most frequent in the series of freshly killed birds available for examination.

this sac, after complete development, is gradually absorbed and has disappeared entirely by the time a bird is sexually mature. In surface-feeding ducks the bursa appears to reach the height of development when the bird is approximately four months old, that is, in September or October. It is evident in all juveniles through November and December, is usually still discernible in February, sometimes in early March.

Hochbaum (1942) subsequently studied and further simplified age and sex determination by cloacal examination. Particularly useful is the comparison of the short, rudimentary penis of the juvenile male and the large, sheathed organ of the adult. The oviduct of the juvenile female is occluded; that of the adult shows as a conspicuous slit in the left cloacal wall.

Pirnie (see Kortright, 1942: 170) made a careful study of the Black Duck and came to the conclusion that the variations in color of the unfeathered parts were due to sex and age. He pointed out that the coloration of the bill and feet was duller when adults were in the eclipse plumage than when they were in winter or nuptial plumage.

In the light of the information contained in the papers mentioned above, 38 Black Ducks taken in various places in Ontario have been critically examined. The colors of the unfeathered parts were carefully noted in relation to age, sex and seasonal variation of plumage.

Twenty-seven of these birds were in winter (or nuptial) plumage, having been taken in late November. By cloacal examination 16 were determined as males and 11 as females. Of the males four lacked any trace of the bursa and possessed the large sheathed penis of the adult. The remaining 12 had the bursa well developed (measuring 20 mm to 28 mm in length), and the copulatory organ of each was inconspicuous and rudimentary. These were obviously birds of the year which had just attained their first winter plumage. There was no trace of the more streaked juvenile plumage, and the only outward manifestation of immaturity was the presence of two juvenile tail feathers in each of two birds taken on November 30, 1941. These tail feathers were readily identified as of the juvenile plumage by the blunt tips of the shafts, which protruded some distance beyond the distal barbs, as described by Witherby (1924:270).

The bill coloration of the adult males was from Wax Yellow¹ to Lemon Chrome, faintly tinged with Olive at the base and on the terminal portion. The feet were red, ranging from Coral-Red to near Scarlet-Red. The other group, comprising the first winter males, showed bills varying in color from Light Yellowish Olive to Greenish Yellow and feet of Tawny to Apricot Orange.

In four of the 11 females examined the oviduct was visible and open, and the bursa had been absorbed, indicating maturity. The other

¹ Capitalized color names are from Robert Ridgway's "Color Standards and Color Nomenclature." Washington, D. C. 1912.

seven displayed well-developed bursae, approximately the same size as those found in the young males. The oviduct opening was not visible. Here again there was a difference in the colors of the unfeathered parts, though there was more variation, and the birds were not so readily separated into two groups. All of the bills were spotted and blotched with dusky and exhibited a gradual range from Deep Olive to Ochraceous-Orange. The feet varied from dusky Olive-Brown to Jasper Red. The four adults, however, were those with the reddest feet and most brightly colored bills.

It will be noted that the bill and foot colors of the adult and juvenile birds agree entirely with the respective characteristics attributed to the supposed races, *Anas r. rubripes* and *A. r. tristis*.

Further evidence tending to refute the existence of the two subspecies was obtained during the summer of 1942. Four adult Black Ducks were collected at Nettichi River on the west coast of James Bay between July 16 and 19. It should be recalled that this area is far to the north in the very heart of the range of the supposed red-legged race, *A. r. rubripes*. The coloration of the unfeathered parts of these birds was noted and sketched immediately after the birds were retrieved. Two were males, the first flightless and with body plumage well advanced in the post-nuptial moult. The second was entirely in eclipse body plumage but possessed new flight feathers and was capable of flight. The age of each bird was checked by the cloacal method, and the mature penis and complete absence of the bursa were noted in both. These birds showed a remarkable reversion to the bill and foot coloring of the juvenile male. Their bills were Grape Green in color, somewhat dusky along the ridge of the culmen. The feet in the flightless one were Cinnamon, in the full-winged one Pinkish Cinnamon.

The two females, both birds with broods of young, were in the post-nuptial moult, with wings and body feathers faded and worn and some new eclipse feathers showing on the sides and breast. The coloring of bill and foot in these birds bore a decided resemblance to the juvenile female. The bills were from Court Gray at the tip to Tea Green at the base, with a saddle of Dark Grayish Olive and a few blackish spots. In one specimen the feet were Cinnamon, in the other Tawny-Olive.

Pirnie has demonstrated that the bright coloration of bill and foot is not renewed until October or November, or in other words coincides with the acquisition of the new winter, or nuptial, plumage.

The facts as presented above appear to leave little doubt that *Anas rubripes tristis* and *A. r. rubripes* are one and the same.

In addition to the specimens mentioned above, I have critically examined seven birds in the streaked juvenile plumage. A juvenile male (July 15) which still possessed much down on the back and rump and was incapable of flight, had an Olive-Brown bill, pinkish at the base of the lower mandible. The feet were Benzo Brown. The bills of four

females of similar age were Dark Olive; the feet were as in the male.

A juvenile male, fully feathered and flying, which was taken on July 23, 1942, at Big Piskwanish, James Bay, had the bill varying from Mineral Gray at the tip to Gnaphalium Green at the base with an area of dusky along the ridge of the culmen. The feet were Pinkish Cinnamon. A juvenile female of the same age had the bill mostly Dark Olive, but Tea Green at the base with some dusky spots.

The downy young of both sexes have the upper mandible and base of the lower, Deep Olive-Gray. The nail and lower mandible are Pinkish Buff. The feet are Chamois to Cream-Buff, variously mottled with Buffy Olive and Olive-Brown.

The Black Ducks which may be seen in the hunter's bag in southern Ontario may be described as follows: In the early part of the season will appear streaked juveniles, with greenish bills and Tawny feet, and moulting adults still in partial eclipse plumage, with bills and feet closely resembling those of the juvenile. Later in the season (late November), the juvenile plumage will have given way to the first winter (or nuptial) plumage, which is practically indistinguishable from the adult winter plumage. In this stage the juvenile may retain the earlier coloring of the unfeathered parts but usually shows a change to a Greenish Yellow bill and Cinnamon feet. The adults at this season have regained the full winter plumage and also the yellow bills and red feet. By spring most of the yearlings have also attained the bright coloration of bill and feet and are indistinguishable from the adult. Some may be somewhat retarded in this respect, but the colors in all are much brighter than in November specimens.

In the course of this study it was thought advisable to check some of the characters which descriptions in the literature commonly ascribe to mature Black Ducks. One statement frequently encountered is that old males have the chin black. Two of the juveniles examined had the black chin, and one adult lacked it, indicating that this marking is not reliable as an age indicator, though it is probably more frequent in adult birds. Another age character is one suggested by Ticehurst (1938), namely that striae are present on the tip of the nail of the bill in young birds but absent in adults. These striae were certainly absent in all adults, but were also absent (or only faintly indicated) in most of the first winter birds, only three having them well-marked. A subsequent examination of skins in the Royal Ontario Museum of Zoology shows this character to be more constant in birds still in the juvenile plumage.

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2 THE SNOWY OWL MIGRATION OF 1941-42

A REPORT OF THE SNOWY OWL COMMITTEE,

PREPARED BY L. L. SNYDER

IN 1938 Charles Elton of the Bureau of Animal Populations, Oxford University, England, suggested that a committee which would gather data and briefly report pronounced migrations of the Snowy Owl (*Nyctea nyctea*) in North America would fill a useful role. The principal objective would be to record the fact of a migration, state its time-period, trace its direction, if possible, and picture its magnitude. Such information would serve as an index to certain conditions in the Canadian Arctic.

This proposal was discussed informally by several ornithologists on the occasion of the annual meeting of the American Ornithologists' Union held in Washington in October, 1938. These individuals, together with other volunteers living in areas likely to be involved by a flight, agreed to act as a committee for this work. A few were already concerned with accumulating data, annually, on populations of certain animals including the Snowy Owl. Others volunteered to obtain specific data whenever a pronounced flight became apparent.

No movement of Snowy Owls, south of the area which can be regarded as the normal wintering range, was evident until the autumn of 1941. At that time members of the Committee began gathering records. Each was concerned with a fairly definite region. Many hundreds of people contributed data through the several members, who here express their appreciation.

When the flight seemed to have spent itself and regional reports were complete, a large blank map was circulated among the members of the Committee. Specific locality records were plotted on this map. Two symbols were used. A small cross marked places where reports indicated that no unusual numbers of Snowy Owls had been observed. In this way it was possible to determine that a major incursion had not taken place during the autumn of 1941 in the central and northern prairie provinces of Canada. Numbers there could be considered usual. The second symbol used on the map was a small circle. This marked specific places where Snowy Owl occurrences had been unusual. If one or two birds had been observed, the circle was left open; if three to ten birds, the circle was half-filled with black; if more than ten, the entire circle was made black.

The provisional map was then used as the basis for a final map (Figure 1) prepared by T. M. Shortt. In order to reduce the map for publication the details of the provisional map were condensed. Three degrees of density are shown by correspondingly shaded areas, and sections where no pronounced flight or increase of winter population was reported are left blank.

Data contributed by Committee members from the several regions concerned the date when first records were made and the period when the flight was clearly obvious. (The Committee has not attempted an exhaustive study of migrating Snowy Owls.) These data are combined as a brief general statement of the 1941-42 flight in the following paragraphs. If the undertaking continues, future reports will not require so lengthy an introductory statement as seemed advisable here.

The Committee will gladly add to its numbers ornithologists who will, in future, undertake to gather information in areas not well covered in our initial attempt. Such areas will probably be shown by our map. The members of the Snowy Owl Committee are listed below:

- B. W. Cartwright, Winnipeg, Manitoba
- A. O. Gross, Brunswick, Maine
- H. F. Lewis, Ottawa, Ontario
- F. C. Lincoln, Washington, D. C.
- O. S. Pettingill, Jr., Northfield, Minnesota
- L. L. Snyder, (Chairman), Toronto, Ontario
- J. D. Soper, Winnipeg, Manitoba
- D. Stoner, Albany, New York
- R. W. Tufts, Wolfville, Nova Scotia
- J. Van Tyne, Ann Arbor, Michigan
- V. C. Wynne-Edwards, Montreal, Quebec

THE 1941-42 MIGRATION

The migration of 1941-42 resulted in concentrations of Snowy Owls in the St. Lawrence valley, along the New England coast, and about the shores of the Great Lakes. The source of this flight was probably Baffin Island, Southampton Island, and the region about the Straits and Hudson Bay portion of Ungava. This view is in harmony with the 1939-40 Snowy Owl population map of Chitty and Chitty (*Jour. Animal Ecol.*, 10: 187) where it is shown that this species increased in these areas. The same map shows that the Snowy Owl had decreased in the western Arctic.

The earliest records were:—one seen on Grand Manan Island, New Brunswick, September 6; one seen at Hawkesbury, Prescott County, in the extreme eastern part of southern Ontario, on September 10. Late September records came from Maine, New York (Long Island), and Minnesota.

The period in which it became obvious that a pronounced flight of Snowy Owls was taking place may be stated for each of the several regions as follows: Province of Quebec, western section, early to mid-October, eastern sections, later; Maritime Provinces, early October; New England states, mid-October; southern Ontario, late October; New York state, mid-November; Michigan, late November; Minnesota,

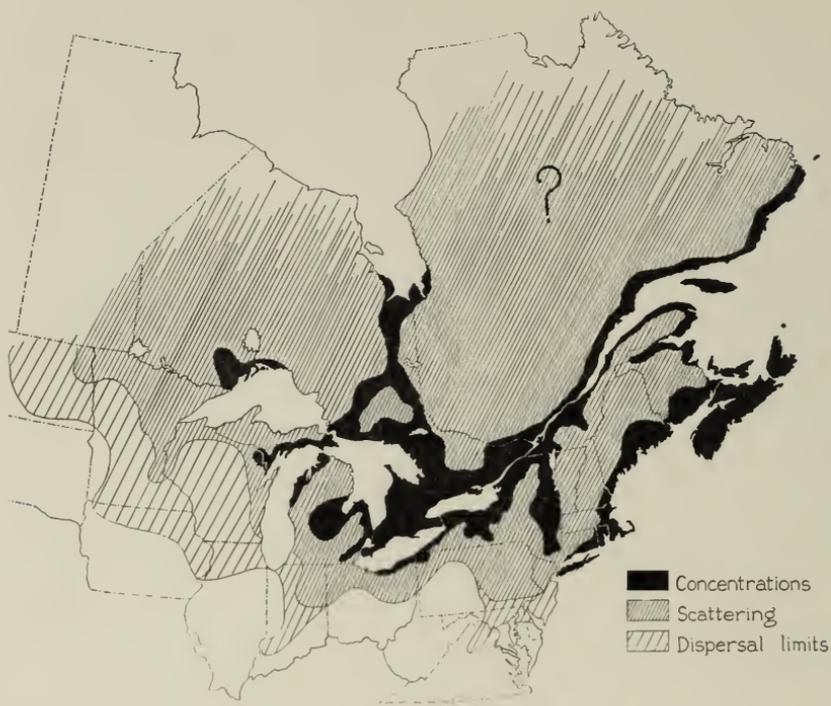


Figure 1. Snowy Owl flight. Scattered occurrences in the Ungava interior have been assumed. We are much indebted to T. M. Shortt for preparing the map.

late October. Maximum numbers were present in these sections two to three weeks later than the periods mentioned.

The line of flight taken by these migrants is suggested by the probable source, by the general topography, and by the time element as stated above. It would seem that the flight, which flowed southward and westward, may have followed, in its initial course, the Labrador coast, the east shore of Hudson and James Bay, and possibly, a smaller trickle, down the west coast of Hudson Bay (see Minnesota timing in relation to the east).

The above, together with the accompanying map, would seem to record the essential features of the 1941-42 flight. Other details can be left for treatment by individual ornithologists.

NESTING HABITS OF THE BLACK-BILLED CUCKOO¹

BY O. RUTH SPENCER

DURING the summers of 1939 and 1941, I carried on studies on the nesting habits of the Black-billed Cuckoo (*Coccyzus erythrophthalmus*) at the University of Michigan Biological Station in Cheboygan County, Michigan. I kept six nests under daily observation, two from the laying of the first egg, and four from the last few days of incubation, through the nestling stage. I supplemented information obtained from these nests with data from five additional nests of the Black-bill and from two nests of the Yellow-billed Cuckoo (*Coccyzus americanus*), which has similar habits (Barrows, 1912: 338; Bent, 1940: 54).

To note details of nestling activities and kinds of food brought into the nesting area by the adults, observations totalling 94 hours were made from canvas blinds three to five feet from the nests; depending upon the nest height, these blinds were placed on the ground or on a tower. A 4x field glass was used. Additional observations, particularly on general habits, were made without a blind.

The information presented in this paper is based, except when otherwise indicated, upon data obtained from the six nests under observation. Table 1 is a summation of these data.

Grateful acknowledgments are made to Dr. Olin Sewall Pettingill, Jr., for guidance given in this study; to Dr. Theodora Nelson and Mrs. Margaret Nice for valuable help and critical reading of the manuscript; and to Dr. H. B. Hungerford for checking my identifications of insects.

NESTS AND NEST BUILDING

The Black-billed Cuckoo generally nests in low trees or bushes (Chapman, 1937: 331), but nest-sites in the Biological Station area varied. The vegetation chosen for nests ranged from clumps of beech saplings (*Fagus grandifolia*) to coniferous trees (*P. strobus* and *Tsuga canadensis*) and tall deciduous trees (*Acer saccharum* and *Populus sp.*), and sites varied in elevation from 19 inches to 20 feet, with an average elevation of 5.9 feet.

The nests were always well concealed by overhanging branches and leaf-clusters. Made of small twigs loosely interwoven, and lined with leaf scraps, pine needles, catkin remains, or empty cocoons, they were comparatively frail platforms, with uniform $\frac{3}{4}$ -inch inside depth and 3- to 3 $\frac{1}{2}$ -inch inside diameter. Apparently the material was gathered largely in the vicinity of the nest, both bulk and lining materials being chosen from those readily available. Two nests, No. 3 and No. 5, were selected for detailed examination of nesting material. The bulk of nest No. 3 gave a total of 65 twigs, 10 varying from 9 to 14 inches in length,

¹Contribution from the University of Michigan Biological Station.

TABLE 1
SIX NESTS OF THE BLACK-BILLED CUCKOO

	Nest 1	Nest 2	Nest 3	Nest 4	Nest 5	Nest 6
Date found:	July 5, 1939	July 22, 1939	July 2, 1941	July 7, 1941	July 16, 1941	July 18, 1941
Habitat:	Wooded area	Open 2nd-growth aspen area	Open wooded area	Hilltop with aspen, beech, and bracken cover	Edge of low woodland thicket	Roadside bordered by aspen, maple, and occasional pines
Nest site:	Lower branch of white pine, 3 ft. from trunk	Angle of lower branch of small aspen	Small beech tree where two main branches crossed	Three-way fork of a sapling in a beech clump	Near top of hemlock, 1½ in. from trunk	Near tip of main branch of sugar-maple, 4-5 in. from trunk
Elevation of nest:	19. in.	19.5 in.	5.5 ft.	2 ft.	5 ft.	70 ft.
Bulk of nest:	Twigs of wild cherry and maple and bracken leaf-stems	Twigs of maple, wild cherry, and aspen	Twigs of beech, bracken stem, and leaf-stalks	Twigs of beech and aspen	Twigs of arbor vitae, aspen, & osier, with dead maple- and aspen-leaves between	Aspen and maple twigs
Lining of nest:	Pine-needles and scraps of dead aspen leaves	Bracken leaf-scrap, moth cocoons, and lichen fragments	Scraps of dead beech & bracken leaves, pine-needles	Bracken leaves, leaf-stalks and aspen-leaf scraps	Small pieces of arbor vitae, scraps of maple leaves, pistillate willow-cattkins, and pine-needles	Bracken, aspen-leaf scraps, pine-needles
Inside diameter:	3.25 in.	3.5 in.	3.75 in.	3.5 in.	3 in.	3.5 in.
Outside diam.:	5.5 in.	6.0 in.	6.5 in.	6.5 in.	7 in.	6.5 in.
Inside depth:	0.75 in.	0.75 in.	0.75 in.	0.75 in.	0.75 in.	0.75 in.
Outside depth:	1.5 in.	4.0 in.	3.0 in.	2.75 in.	3 in.	3 in.
Contents when found:	4 eggs	3 eggs	1 egg	1 egg	2 eggs	3 eggs

30 from 6 to 9 inches, and 25 from 3 to 6 inches. Nest No. 5 gave a total of 76 twigs of more uniform length, 40 varying from 5 to 12 inches, and 36 from 3 to 5 inches. The lining of the first nest was a small handful of dry leaf scraps, and of the second, a considerable mat of dead leaves, pieces of arbor vitae, willow catkins, and pine-needles.

I was not able to make observations during the nest-building period, but there is evidence that nest-building is prolonged into the incubation period. Three times at nest No. 6, an adult brought pine needles as lining material when coming to replace its mate on the nest. Twice the material was carefully worked into the nest.

COURTSHIP FEEDING

During my observations at nest No. 1 on July 12, 1939, the eighth day of incubation, one of the adults (presumably the female) was on a branch above the nest when the other (presumably the male) came into the nest area with a green larva in his bill. Within a few minutes he swallowed the larva and several times gave a loud call. Immediately the female began flirting her wide-spread tail, while making a low mewling sound. This display went on intermittently for fifteen minutes before she flew to the top branch of a nearby aspen. The male remained silent and motionless.

Again, two days later, one of the adults (presumably the male) came into the nest area with a larva in his bill and took the usual guarding position above the nest on a branch of a near-by tree. The female left the nest and alighted on a branch just below. In a few minutes the male hopped down to the same branch, ran down it toward the female and mounted her. However, copulation did not take place. The male immediately flew away with the larva still in his bill, and the female remained motionless. After eight minutes the male returned with another larva and alighted on the same branch with the female, but this time as he ran toward her she flew away. In a short while the male ate the larva he had brought, then remained on the branch ten minutes before moving out of sight. This behavior, though merely inceptive, can presumably be taken as illustrating courtship feeding (Lack, 1940).

EGG LAYING, INCUBATION, AND HATCHING

The Black-billed Cuckoos laid from 2 to 4 eggs, with an average of 3 eggs per nest. The eggs were oval in shape and dull greenish blue in color, and some had a marbled appearance after three or four days' incubation.

The egg-laying interval was variable. The nests were checked daily at approximately 9 A.M. Each new egg was marked and recorded. Nest No. 3, when discovered July 2, contained one egg. A second egg was

laid July 3 and a third July 6. Nest No. 4 contained one egg when found July 7. A second was laid July 8 and a third July 10.

Several authors (e.g. Barrows, 1912: 340; Bent, 1940: 56, 73; and Herrick, 1910: 229-232) state that not infrequently Black-billed and Yellow-billed Cuckoos lay their eggs in each other's nests as well as in the nests of other birds. During my observations I noted only one case of parasitism, finding a Black-bill's egg in a Yellow-bill's nest with two young and two eggs of the Yellow-bill. It was readily distinguished from the other eggs by its deeper color and smaller size.

Incubation began after the laying of the first egg, but was three to four days shorter than the 14-day period given by Burns (1915: 283). In nest No. 3 one egg, laid and marked the morning of July 6, hatched the morning of July 16. In nest No. 4, the egg laid July 8 hatched July 19. The shortest period of sitting was 15 minutes, the longest 115 minutes, with an average period of 90 minutes. The shortest interval the eggs were left uncovered was 5 minutes, the longest 56 minutes, with an average interval of 28 minutes. The eggs were incubated 68 per cent of the time (calculated on the basis of 15 hours' observation, exclusive of the 4-hour period of unusual activity described later).

The sexes were not distinguishable, but I was able to corroborate the statement by Herrick (1910: 195) that both sexes take part in incubating the eggs. Several times a second adult came into the nest area, gave a low call, and took the place of the incubating bird as soon as the latter left the nest. In 17 hours of observation during the incubation period, I observed the second adult take over this duty three times.

During both incubation and brooding, the adult sat very quietly, turning the head from time to time, and moving the eyes more or less continuously. Contrary to the observation made by Herrick (1910: 197), the adults varied their position on the nest, but four birds seemed to have a favorite position, which they assumed more often than others. The birds had also a favorite path to the nest, but it was not invariably used.

Ordinarily the cuckoo remained close on its nest and was not readily flushed during the last few days of incubation. A striking exception to this was noted during an observation period the day before the first egg was hatched. Nest No. 6, containing 3 eggs, was about ten yards from the main road into the Station area. Three times the bird was frightened from the nest—by a low-flying airplane overhead, by a passing group of children, and by a passing truck. With each disturbance the bird flew to a favorite high branch above the nest, which it used as lookout, and then returned to the nest by flying down to the nest branch, and running along it, stopping cautiously and deliberately on the smaller branches on the way. The adult appeared continuously uneasy throughout the four hours of the morning-observation.

As far as I observed, egg-laying and hatching took place during the early morning hours, except in one case, when the younger nestling in nest No. 5 appeared about 3 P.M., July 18. This very exceptional case of afternoon hatching gave me the opportunity to watch hatching procedure. The adult left the nest upon my approach at 2:55 P.M., exposing one nestling and the second egg, whose shell was cracked and slightly parted around its lesser circumference, showing the young bird moving about inside. Within the next five minutes, half of the shell fell away. The young nestling began emitting low cries, and emerged from the remaining half-shell *entirely dry*. The adult, meanwhile, remained on a branch of an adjacent tree and called softly at irregular intervals.

The egg shells were usually disregarded by most of the adults, though they were sometimes pushed about in the nest with the bill. That they were not consistently removed was proved by the fact that many shell scraps were found in the bottom of the nests. However, at nest No. 6, an adult ate the larger pieces of shell. About four hours after the young hatched and after they were fed, the adult stepped over the nest, but before taking the brooding position reached into the nest and devoured what appeared to be small shell scraps. After a short period of brooding, the adult again reached into the nest and brought out the entire smaller half of the shell. It was too large to be taken into the mouth whole, so that it was necessary to crack the shell first between the mandibles. In about two minutes' time the bird had swallowed the entire half.

NESTLING STAGE

The newly hatched Black-billed Cuckoo nestling has a coal-black skin, whose feather tracts are made conspicuous by wiry gray "hairs"—the feather tubes of a vestigial down that never unfolds (Herrick, 1910: 198). The feet and bill are a steel-blue, the commissure very slightly lighter in color. By the third day the down-feather tubes are pushed out on the tips of the juvenal contour-feather tubes, and remain attached to these for four or five days. The feather tubes on the anterior portion of the ventral tract at first develop more slowly than the others, being barely visible until the fourth day, but in their later development they practically parallel those on the dorsal area. By the sixth day the juvenal contour-feather tubes, ranging in length from 17 mm. to 21 mm., give the young nestling the appearance of a porcupine, but on the seventh day the ends of these tubes begin to burst, and the nestling for the first time has a somewhat fluffy plumage. According to Herrick (1910: 206) the opening of the feather tubes (except those on the head and neck, which require longer) is completed in about 12 hours.

The day-old nestlings weighed from 7.5 grams to 9 grams, giving an average for 7 nestlings of 8.5 grams. Weight increased quite uniformly during the first four days, the average daily gain of 9 nestlings

being 4.7 grams; but the increase was more gradual during the remainder of nestling life, the average daily gain of 9 nestlings being 2.8 grams. The average weight of the 9 nestlings on the last day of nest life was 28.5 grams.

FEEDING, CALL NOTES, BROODING OF YOUNG

Feeding began $1\frac{1}{2}$ to 2 hours after hatching. The food consisted almost entirely of insects, 90 per cent of which were in the larval form. The remaining 10 per cent was made up of grasshoppers, small moths, mayflies, and robber flies, with an occasional spider. The larvae of the rosy maple moth (*Anisota rubicunda*) were extremely abundant in the Station area. This abundance probably explains why 81 per cent of the larvae fed to the young cuckoos were of this variety. Herrick (1910: 212) found that smooth larvae made up 44 per cent of the total food of Black-billed Cuckoos, hairy caterpillars 5 per cent, adult lepidoptera 5 per cent, and grasshoppers 27 per cent.

Feeding was done by both sexes. The adult approached the nest by running along the nest branch, and the resulting vibrations excited the food-response in the young: open mouth, stretched neck and flapping wings, accompanied by a sound like the buzzing of bees. As mentioned by Herrick (1910: 214), whenever this food-response was not given by the time the adult stepped on the nest edge, the parent immediately gave a peculiar low mewing sound, and this invariably excited a vigorous response.

The wide-open mouth of the begging young bird displayed a very conspicuous group of snow-white disks of variable size symmetrically arranged on the bright red palate. (Herrick, 1910: 201). Some observers (e.g. Herrick, 1935: 99; Roberts, 1932: 593) believe these disks to be sucking pads used by the young to hold the adult's bill while feeding. However, in 75 feedings, I noticed close contact between the maxilla of the nestling and the bill of the parent only three times. Since the lower or inner edges of the larger disks were decidedly rough, the disks may be an aid in grasping the live food. Another possible function of these disks may be as a food target, since they greatly increase the conspicuousness of the palate.

The food was always carried to the young crosswise in the bill. Occasionally the adult crushed the food before bringing it into the nest area, but more often not until after alighting on the nest edge. Usually the food was thrust far down in the throat. When necessary, additional thrusts were given to hasten the swallowing response. With the younger nestlings the larva was put into the open mouth, then a motionless position was held by both adult and young for many seconds—often for as long as two or three minutes—before swallowing occurred. Herrick (1910: 218) records an instance in which five minutes were required to awaken the swallowing reflex. If the first attempt failed, the larva

was withdrawn, further crushed, and put again into the throat. Occasionally this procedure had to be gone through a third time. With the older nestlings swallowing took place either immediately, or within a few seconds after the food was inserted into their mouths.

Food was generally brought by the adult when coming to take its turn on the nest, the other adult leaving the nest and not returning for a considerable period. A notable exception occurred about 10:30 A.M., July 24, 1941, at nest No. 6, which contained two nestlings. The brooding adult left the nest as the relief adult came up the nest-limb with a grasshopper nymph in its bill, which it fed to the day-old nestling and then ran down the nest limb out of sight. In less than three minutes it was back again with a larva about one inch long and correspondingly thick, which it fed to the same nestling. Just as the larva was inserted into the open mouth, the mate returned and alighted on the nest edge, carrying a well-developed larva of the rosy maple moth. The first adult withdrew the unswallowed larva just fed the nestling, and both parents gave the low food-call. Response was instantaneous, and both adults now tried to feed the younger bird. The first adult succeeded in replacing the same larva, and the mate turned about and placed the larva it was carrying in the wide-open mouth of the older nestling. The swallowing response of both nestlings was retarded because of the size of the larvae, the older one swallowing first. The second adult took the fecal sac and flew away again, leaving the other to assume brooding duties.

Feeding intervals varied considerably. At nest No. 1, containing three young (3-, 5-, 6-day age) intervals ranged from 1.5 minutes to 80 minutes; the average was 18.5 minutes during a 4-hour observation made in the morning. At nest No. 6, with two young (2-day, 3-day age), the feeding intervals varied from 3 minutes to 65 minutes over a five-hour morning-period, and averaged 25 minutes. Herrick (1910: 222) cites two extreme observations. For a 53-hour period at two nests containing six young (ages varying from one to six days), the feeding rate was once every 25 minutes. For an entire day at a nest containing three young (4-, 5-, 6-day), the feeding rate was once every 4 minutes. Herrick explained this high rate by lack of fear, abundant food, favorable weather, and no other young, already fledged, to divert the attentions of the parents.

After feedings on the first five days, fecal sacs were voided and were picked up by the adult. They were either swallowed immediately or carried away. During a four-hour period at nest No. 1 (containing 3 young), when 27 feedings took place, the fecal sacs were carried away after 17 feedings and swallowed after the other 10. On seven occasions after swallowing the sac, the adult settled on the nest, and on the three other occasions it again fed the nestlings several times. It thus appears that at this stage of nest life the manner of fecal disposal is determined

by the adult's next activity: if the bird is disposed to brood or feed again, it swallows the sacs; if not, it carries them away. Herrick (1910: 220) stated that the disposition of the fecal sacs was dependent upon various circumstances in which must be included the hunger of the old bird at the moment.

From the age of 5 days the nestlings backed to the edge of the nest before voiding the fecal sacs. Occasionally the sacs fell to the ground, but more often they fell on the edge of the nest and were picked up by the adult and either swallowed or carried away.

An unusually strong grasping-reflex appeared during the first five hours out of the shell, allowing the bird to cling to the nest. At one-day-old a very rapid opening and closing of the toes was noticed. On succeeding days the toes were opened and closed with greater force.

I noted a very slight shivering of the wings during the food response in all 14 nestlings at one-day-old. This movement became more forceful in the 2-day young. Four 3-day nestlings (nests Nos. 1, 2, and 4) were seen to stretch one wing after the other, sidewise, during prolonged absences of the adult. Grasping at this age was so well-developed that, unless I took great care when removing the young for weighing, the nest was pulled apart. Ten nestlings at 4 days (nests Nos. 1, 2, 3, and 4) stretched the wing on each side downward while extending the corresponding leg. This was done regularly during an adult's absence of an hour and fifteen minutes at nest No. 2, the leg-wing stretching occurring on the average every 8 or 10 minutes, with a maximum interval of 16 minutes.

I saw no evidence of the preening instinct which Herrick (1910: 205) says becomes very active on the sixth day. During the last two days of nestling life (6 and 7 days), with a very few quill tips on dorsal and ventral tracts opened, the young cuckoos were quick to pick at ants or flies on themselves. At no time could this action be mistaken for the combing action as described by Herrick (1910: 205).

During the first two days of nestling life the sound accompanying the feeding response had been similar to the buzzing of a bee. This buzzing gradually gave way to a "bark," a low grating call that took on true cuckoo characteristics about the sixth or seventh day. At the five-day age fear manifested itself in loud, explosive calls, and the young became especially reluctant to be taken from the nest for weighing. Either just before or at the time of removal they voided a brown, sticky excretion, whereas after feeding they invariably voided white fecal sacs.

Accompanying the changes in the grasping-reflex and wing-movements, and in the call of the nestlings, was the development of sight and hearing. The eyes began to open at two days and were wide open for short periods by the third day. At four days the nestling followed moving objects with its eyes, and at five days turned its head from side to

side in an attempt to see moving objects in the nest area. At one day of age the rustling of leaves excited the food response, which indicated an already keen sense of hearing. At five days the breaking of a twig several feet from the nest caused the nestling to turn its head in that direction. Both sight and hearing were well-developed by the six-day age.

At my approach to the nest during brooding the behavior of the adult very closely paralleled that described by Herrick (1910: 197). At first, the adult moved its head to keep me within view, but as I came nearer the nest (within 4 or 5 feet), the head began to rise and continued until the bill pointed to the zenith. Rapid movements of the eyelids and fast breathing movements were very noticeable.

Even though the adult cuckoo was normally a shy, retiring bird it became quite courageous and bold in defending its young. Early in the period of incubation, when flushed from the nest by my approach to within five feet of the nest, the adult flew very quietly to a nearby branch and watched. Toward the end of the incubation period (8 to 9 days) the adult did not leave the nest so readily, but remained motionless until I was within two or three feet of the nest. When it did leave, it was with a mewling sound and perhaps open bill. At the time of hatching, the adult was more reluctant to leave and more vigorous in its calls; it stayed closer to the nest than before—within two or three feet—while uttering kuk-kuks of protest. It continued to behave in this manner for the first three or four days of nestling life. Later, whenever the young emitted the raspy bark commonly made by them when disturbed, the adult became strikingly bold, and a number of times flew directly at my face with wide-open mouth, spread tail, and drooping wings, sometimes clapping the bill loudly. Each attack was usually short, and it quickly decreased in intensity, the adult finally perching on a nearby branch and quietly looking on.

Observations on the attendance of the adult were made for 10-hour periods at 2-day and 5-day ages of nestlings. In each case the data were obtained during ten hours' observation, during which the weather was clear and the temperature mild (78° F and 81° F). The periods of attendance were longest during the middle of the day. The shortest periods were in late afternoon, when feeding activity increased. For the 2-day nestling the maximum attendance period was 120 minutes, the minimum 45 minutes, giving an average of 87.5 minutes. For the 5-day nestling the maximum attendance period was 105 minutes, the minimum 10 minutes, giving an average of 43.3 minutes.

Weather conditions had an evident bearing upon brooding. During the entire life of the nestlings in nest No. 4, the weather was windy and cool (65° F: five-day average); brooding was maintained quite steadily through the first five days. The average length of the brooding period (based on 19 hours of observation) was 80 minutes, and the young

were brooded 54 per cent of the time. In contrast with this, at nest No. 6, when the temperature was quite high (93° F: three day average) with just an occasional breeze, the young were brooded only 26 per cent of the time. The average brooding period (based on 11 hours of observation) was 20 minutes, and the parent would often shade the young from the sun for an equivalent period.

During the approach and duration of a storm, brooding at nest No. 1 was maintained for a two-hour period. The adult apparently sensed the storm's approach, for although the second bird called from a nearby branch, the brooding one did not leave. Three times during the hour preceding the storm the adult used its bill and body in an attempt to push the nestlings deeper into the nest. As the storm broke, the bird noticeably lowered its body, at the same time spreading the wings over the nest edge and lowering the tail. With each additional down-pour the body was pulled more tightly to the nest, tail lowered further, and bill pointed higher. For 45 minutes following the storm the only change the brooding bird made in her position was to lower her head. Herrick (1910: 225) watched a nesting adult during a 1½-hour rain. He noted that it left as soon as the rain was about over. He also noted that the bird raised her body two or three times during the rain to examine the young, whereas the one I observed did not raise the body until shortly before leaving the nest even though it was evident that the nestlings were decidedly restless.

NESTING SUCCESS

During the summer of 1939, when I kept two nests under daily observation, both were brought to successful completion except for a single egg, which did not hatch; but during 1941 only one out of the four nests was entirely successful. In one nest (No. 3), two out of three eggs hatched, the second four days after the first. The younger nestling was found dead at two days of age, hanging on the outer edge of the nest, from which it had probably been crowded. In another nest (No. 4), one of the three eggs was pushed out of the nest and, although I returned it before many hours had passed, it was again missing the next morning with no evidence of it on the ground under the nest. The younger of the two nestlings (three days of age) was also gone the following morning. In a third nest (No. 6), where brooding was in progress during a period of high temperatures (93°-99°), a 15-minute exposure to direct sunlight for purposes of photography killed the two nestlings. (The adults stayed near the nest for several hours afterwards, but deserted before the next day.)

Of the 18 eggs laid in the two seasons, 14 (87.4 per cent) hatched. Ten of the young (71 per cent) left the nest, giving a total for surviving young of 55 per cent from the six nests.

NEST LEAVING

Herrick (1910: 199) says the cuckoo nestling, in proportion to its size, is probably the strongest and most enterprising altricial young on the North American continent. This, in part, explains the shortness of its nest life. Of the ten nestlings known to leave the nest, two left at the age of six days, and eight at seven days.

My single observation of a young bird leaving the nest was made during the summer of 1939 and occurred after I weighed the birds the evening of the seventh day. When I was returning one young to the nest, I noted that the one previously weighed had climbed out on the supporting branch, where it stood erect with upward pointed bill, suggesting the pose characteristic of a bittern. I loosened its grasp with difficulty and put it back into the nest. It immediately ran out again to the end of the nest-branch but, in its haste to escape, lost its balance and, while hanging by its toes, gave loud calls that brought the parent, in a spectacular display of courage, from its watching perch on a nearby tree. The young lost its hold, fell, and, still giving its calls, ran with amazing speed through the bracken (*Pteris*) for several yards before being caught. It was returned to the nest but remained quiet only a short while before repeating the attempt to escape, performing several climbing-feats with skill and speed. Once again the nestling was returned to the nest, but when I left the nest area it was standing in a climbing position on the supporting bracken stem and nest edge. The adult cuckoo, perched just a couple of branches above, was giving a low coaxing call.

SUMMARY -

In northern Michigan the Black-billed Cuckoo was found to nest usually in woodlands but occasionally in more open areas. A total of six nests were observed during the summers of 1939 and 1941.

Nest elevation varied from 19 inches to 20 feet, the average being 5.9 feet.

Possible cases of courtship feeding were observed.

The egg-laying interval varied from one to three days. Both sexes took part in incubating the eggs, one adult apparently assuming the greater responsibility. The incubation period, determined in two cases by marking the eggs, was found to be 10 and 11 days respectively.

Insect larvae made up 90 per cent of the food brought to the nestlings; the remaining 10 per cent consisted of miscellaneous insects.

The Black-billed Cuckoo nestling is exceptionally precocious. The most outstanding reactions displayed upon hatching or shortly thereafter are its grasping-reflex, call-notes, and enthusiastic food-responses.

Observations showed the average attendance-period of the parents to decrease somewhat less than 50 per cent between the 2-day-old and

5-day-old stages of nestling life. During cool windy weather, length of attendance-periods increased.

The young left the nest at the age of 6 or 7 days, with the juvenal-feather tubes just beginning to open.

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GENERAL ZOOLOGY. By Tracy I. Storer. McGraw-Hill Book Co., N.Y. 1943: 6 x 9 in., xii + 798 pp., illus. \$3.75.

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We believe that many ornithologists will return to their special bird problems with renewed enthusiasm and vision after a study of this volume.—J. Van Tyne.

OBSERVATIONS ON THE NESTING OF THE KILLDEER

BY WALTER P. NICKELL

IN the last five years I have recorded a total of 17 nests of the Killdeer (*Charadrius vociferus*) on the Cranbrook Estate in Bloomfield Hills, Michigan. Observations on nine of these nests were cut short by a series of mishaps. In two instances, boys on bicycles rode through the nests, crushing the eggs; football players walked on two nests; the eggs in one nest were very probably overheated by exposure to the sun, for they were located in a dry field, and were left exposed for extended periods during unusually hot weather. Small children took the eggs from one nest, and the remaining nests were also robbed, probably by stray dogs.

During the season of 1942, I was fortunate in discovering eight nests of (presumably) three pairs of these birds within sight of my home, where I was able to observe them two or more times daily. All nests referred to in the following discussion are those observed during the 1942 season.

HABITAT

The nests of all three pairs were found in the athletic fields of Cranbrook School—low, filled in, almost perfectly level fields, kept closely mowed during the Killdeer's nesting season, and bounded on three sides by winding lagoons. Five of the eight nests were located on the white lines of crushed limestone marking the boundaries of the various athletic fields.

NEST

The nests were little more than cavities in the earth or in the crushed rock. No apparent attempt was made to line them (though the power-driven lawn mower threw cut grass over the nests, and this filtered down beneath the eggs after the nests were made). The three nests which were not placed in the crushed rock of marker lines, were located in areas of sparse grass in the clay soil. These nest cavities were an inch to an inch and a half deep at the center, and diameters ranged from five to seven inches.

NESTS OF PAIR ONE

The first of these nests was discovered on April 6 at 9:00 A.M., when the first egg was still warm after deposition. The second egg was laid on April 8 between 11:00 A.M. and 1:00 P.M. Three observations were made between 1:00 P.M., April 8, and the late afternoon of April 9. The nest held only two eggs at the last observation. During the night of the ninth, a heavy snow covered the nest to a measured depth of six inches. On April 10, at 7:00 A.M., and again at noon, I attempted to find the nest, but not even a slight depression was visible in the surface of the snow. Neither of the Killdeer was in evidence in the vicinity. At 4:00 P.M. I found the nest with ease, for in the mean-

time the female had dug down to the eggs and had laid the third egg. Her tracks in the snow showed plainly that she had alighted about 75 yards away and walked directly to the nest site. My own tracks, made previously the same day, circled the nest a few feet away. The Killdeer's tracks indicated that after depositing her third egg, she had left the nest on the opposite side from that of her approach. Somewhat tubular markings at the edge of the excavation were plain evidence that the seven-inch opening to the nest was dug largely with her beak. The



Figure 1. Killdeer nest on April 10 after being cleared of snow by the female.

fourth egg was laid less than 24 hours after the third, between 9:00 A.M. and noon on April 11. Consistent incubation began immediately or shortly afterward, for a bird was near the nest at noon on April 11, and the eggs were warm. At 2:00 P.M. on the same day, the incubating bird left the nest at my approach and ran off a few yards, uttering soft cries, but showed no other signs of distress such as the common "broken-wing" behavior. When I had made my observations and had moved away about a hundred yards, the bird came back quietly and settled upon the eggs, facing directly into a sudden flurry of snow. Observations were made three times daily until 7:30 P.M., April 17, when all eggs had disappeared. During these six days, incubation must have proceeded consistently, since at each observation the eggs were quite warm.

During the 12 days of observation of the first nest, I saw only one

bird at a time, but both were present near the nest site on April 18. At my approach both birds flew about, uttering loud distress cries. Suspecting that they were preparing to nest again soon, I kept the area under close observation. Although both birds were near the original nest site at each visit, I was not able to find the second nest until May 4, when its four eggs had been under incubation for several days. This nest was located on another yard-line, 17 yards from the first. Eight days later a power mower ran across the nest, badly

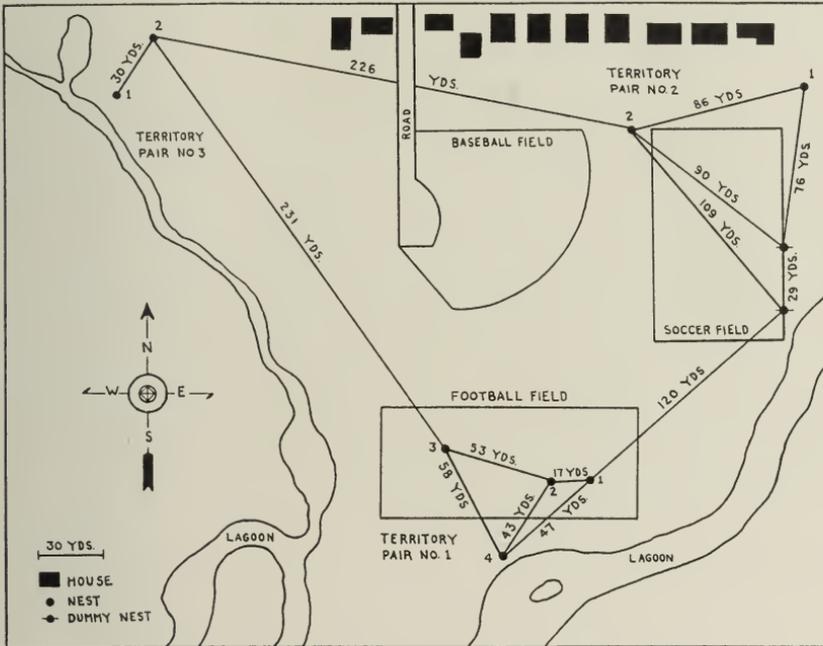


Figure 2. Killdeer nest sites.

cracking two of the eggs and breaking very small holes in the other two. All eggs were allowed to stay in the nest until May 16, when the two badly cracked ones disappeared, probably removed by the parent birds. At 8:00 A.M. on May 20, the young in one of the two remaining eggs could be heard, but had not broken through its shell. No activity inside the other egg was audible. At 6:30 P.M. on May 21, the first egg was pipped in one place. The young could be heard within the shell in the other egg. The first young emerged from its shell at noon on the following day but was quite weak. The second could still be heard. It finally pipped its shell between noon and 5:30 P.M., May 23, when it, as well as the first young, was found dead. The nest was then abandoned, although the adults were seen in the vicinity of the nest site at several subsequent observations.

The third nest, with four eggs, was discovered on June 3, just after the grass mower had crushed its contents. This nest was located on another yard-line, 53 yards from Nest 2. By this time, William Smith, the driver of the grass mower, was watching for a nest, and on June 11 he saw the pair showing great distress at a point near the edge of the football field, where he then found Nest 4. The new nest cavity was in a sparsely sodded spot 58 yards southeast of Nest 3.

The first egg was laid before noon on June 12, the second and third eggs were deposited before noon on June 13 and 14, and the fourth in the afternoon of June 14, some time before 7:00 P.M. Incubation began with the laying of the fourth egg. Daily observations were made through June 26, when I went north for the summer, leaving the final observations to Mr. and Mrs. Felix Bednarz of Birmingham, who were able to make early morning and early evening observations daily. They found three young out of the first laid eggs in the early morning of July 9. The fourth egg hatched during the early morning of July 10. No check was made on the period of parental care, for the parents and young left the immediate vicinity four days after the young hatched.

As will be noted on the accompanying map, the nearest part of the territory of Pair 2 was 120 yards distant, and since only one pair of Killdeer was seen in Territory 1 throughout the season, it is reasonable to assume that all four nests belonged to this pair. Moreover, the only other Killdeer known to be nesting within the boundaries of the Estate were Pairs 2 and 3, and they were occupied with their own family affairs at the time of Pair 1's nesting operations. Gayle Pickwell (1925) believed that one Killdeer he observed laid at least three clutches of eggs from early April to the last of June, and that she may have raised two broods.

NESTS OF PAIR TWO

The first nest of Pair 2 was discovered on May 5, 210 yards north of the first nest of Pair 1. This nest contained five eggs, which hatched in the following order: one young hatched and dry by 9:00 P.M., May 11, two hatched between 1:00 and 8:00 P.M., May 12, and the last two on the early morning of May 14. All of the young were banded, and they left the nest on the early morning of May 15. All were observed feeding with their parents daily, until June 12, when only two were seen. On June 4, I had found, and marked by stakes, three new nest cavities, made in the territory of this pair along the boundary lines of the soccer field. I watched these daily. There was no apparent difference in the cavities to indicate the one to be used. Two were located at distances of 76 and 105 yards south of the first nest of this pair. The other, the one chosen for the second clutch, was 86 yards to the west of the original site. The four eggs were laid as follows: before 8:30 A.M., June 17; before 8:30 A.M., June 19;

before 8:30 A.M., June 21; and in the afternoon of June 22. The two remaining young of this pair were still with their parents in the late afternoon after the fourth egg was laid, but were not seen after that time. These young were able to fly short distances, and I had to chase them down by bicycle in order to check their band numbers. Incubation of the second clutch began either near nightfall or early the next morning after the last egg was laid, for one of the adults was on the nest at 7:00 A.M., June 23, and the eggs were warm. Three eggs (the first laid) hatched before 7:00 A.M., July 16; the fourth egg early the next morning.

PAIR THREE

The third pair of Killdeer was found about 240 yards west of the territory of Pair 2 on May 4, with four young about a week old. These young were banded and observed with their parents until June 7, but were not seen after that time.

On June 17, a nest containing four eggs was found about 30 yards southwest of where the young had been caught and banded on May 4. On June 23 the bird incubating at that time was collected for one of the habitat groups in the Cranbrook Institute of Science. Dissection showed that it was the female. Within twenty minutes another bird, presumably the male, was on the nest, continuing the incubation. The young hatched during July 1, left the nest on July 2, and were under the care of the remaining parent through the last observation on July 13. There is little doubt that this was the second brood of Pair 3, since only one pair of Killdeer was seen at a time in this territory throughout the season.

The difference in behavior of the two incubating birds was notable. The female had been extremely wary and would leave the eggs before the observer came near the nest, running away and calling from a distance. When she was collected, the approach to the nest had to be made from behind thick shrubbery which reached to within 25 yards of the nest location. The "male" was much bolder and invariably remained on the nest until I had approached to within a few feet, when he began circling closely around my feet, spreading his tail and beating the earth with his wings. During this display he uttered loud, piercing, *dee! dee! dee!* calls, interspersed with trilling notes.

DISCUSSION

Bent (1929:207) quotes several published reports on the Killdeer's incubation period. These range from 24 to 28 days. Miles D. Pirnie writes me that he found all four young hatched and away from a nest $23\frac{1}{2}$ days after the last egg was laid. One of these young hatched $22\frac{1}{2}$ days after the last egg was deposited. My own observations show incubation periods ranging from 24 to 26 days. It is possible that the first eggs to hatch in each clutch received some incubation at night

before regular incubation began, although I always found the eggs cold until the last one was laid. A factor which probably contributes to the delay in hatching of the later eggs is the tendency of some parent Killdeers to leave the nest with the first young hatched, allowing the remaining egg or eggs to become chilled. On several occasions, I have found dead young in well-pipped eggs which had been abandoned.

Bent (1929:207) states that both sexes incubate and both take care of the young, and my observations agree. Finally, other observers have reported the Killdeer building incomplete nests near the nest that was actually used.

SUMMARY

At Bloomfield Hills, Michigan, eight nests of three pairs of Killdeer were studied in 1942.

In one nest, the clutch was complete by April 11, an early date for this region. This nest, when it contained only two eggs, was covered overnight with six inches of snow so that the observer was unable to find it, though the Killdeer found it without difficulty, cleared it of snow, and laid the third egg.

There were seven clutches of four eggs, one of five.

Periodicity of egg-laying was found to be variable, not only between females, but in the same individual.

In three nests, incubation began immediately or shortly after the last egg was laid.

The incubation period varied from 24 to 26 days.

When the incubating female was collected at one nest, another bird (presumably the mate) took over the task of incubation.

The period of parental care for two broods was 39 and (about) 42 days.

One female apparently laid four clutches of eggs during the season (April 6 to June 14). The second clutch produced young which died, and the fourth produced young that were perhaps raised successfully.

Two pairs were double brooded.

Three new nests (two unused) were made by one pair before the second nesting.

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A HAWK CENSUS ON TEXAS PANHANDLE HIGHWAYS

BY PHILIP F. ALLAN AND PALMER R. SIME

THE Texas Panhandle offers an almost unparalleled opportunity for the observation of hawks. The broad expanses unobscured by trees or hills, the predominance of clear days with excellent visibility, and the uniformity of landscape combine to make unusual or moving objects conspicuous and the observation of hawks easy.

The Panhandle is that part of Texas north of a line drawn diagonally from Childress County, at the southwest corner of Oklahoma, to Winkler County, at the southeast corner of New Mexico. Most of the Panhandle is made up of treeless short-grass plains of 3,000 to 4,000 feet elevation. It is dissected by intermittent or shallow permanent streams, with wooded banks. Approximately a third of the Panhandle consists of rolling, mid- or tall-grass plains, often covered with sagebrush and oak shinnery. Elevations here are about 1,500 to 2,000 feet. Between the easterly rolling plains and the westerly high plains is an abrupt break, rising sharply. This area is characterized by canyons and buttes, often sparsely covered by grasses, junipers, and deciduous shrubs. Abrupt cap-rock rims lie immediately below the high plains.

Stimulated in part by the sight of large flocks of Swainson's Hawks in migration, the authors, whose regular work required much automobile travel, decided to keep a record of hawks, kites, vultures, and eagles seen en route. The method of observation was essentially that used by Nice (1934) and others; that is, miles traveled and hawks seen were recorded. In contrast to other highway bird observations, these were confined to a comparatively small area, the Texas Panhandle.

The trips were made at random between October, 1938, and January, 1942. A total of 26,768 miles was driven. Most of our trips were separate, but occasionally we traveled together. Although both of us covered most of the Panhandle at one time or another, Allan's observations were made particularly in the northern portion, while Sime's were made in the southern part. A convenient data sheet was used, upon which was recorded the origin and destination of trips, date, speedometer readings, miles traveled, and number of hawks of each species seen. It was found impracticable for one man to record the exact location of each observation, the habitat type, and other information while traveling, so early efforts to obtain these data were abandoned.

After some trials in analyzing the data, we decided to group the records into quarters of the year. These seem to be more comparable than individual months. Beginning with November, 1938, the data were grouped to cover 13 consecutive quarters. The three months of fall migration—August, September, and October—were placed to-

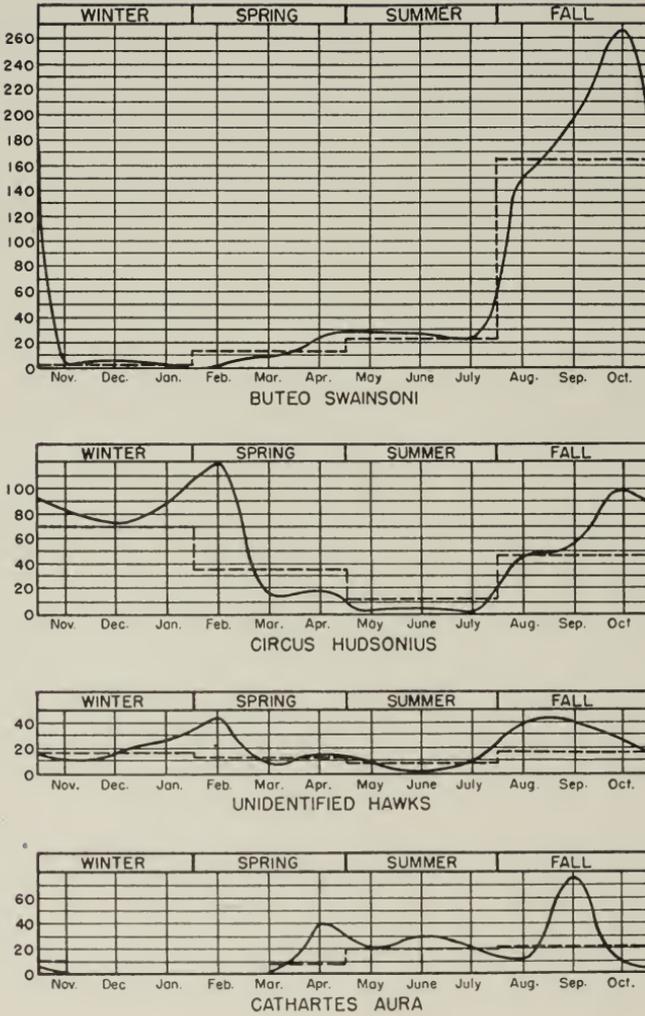


Figure 1. Population trend, based on the rate per thousand miles traveled. The solid line represents the monthly average; the broken line the seasonal average.

gether. Thus November, December, and January are "winter"; February, March, and April are "spring"; and May, June, and July are "summer." Although the data are somewhat meager for some months, we believe that annual population trends are fairly well indicated in Figures 1 and 2.

The individuals of each species were totaled by quarters, and the relative abundance of each was determined (Table 6). The number of miles of travel per hawk of each species was calculated, and converted to the number of each species seen per 1,000 miles of travel. The results of these calculations appear in Tables 2 to 5 inclusive. (In the tables, the data are arranged under "seasons" as defined above.)

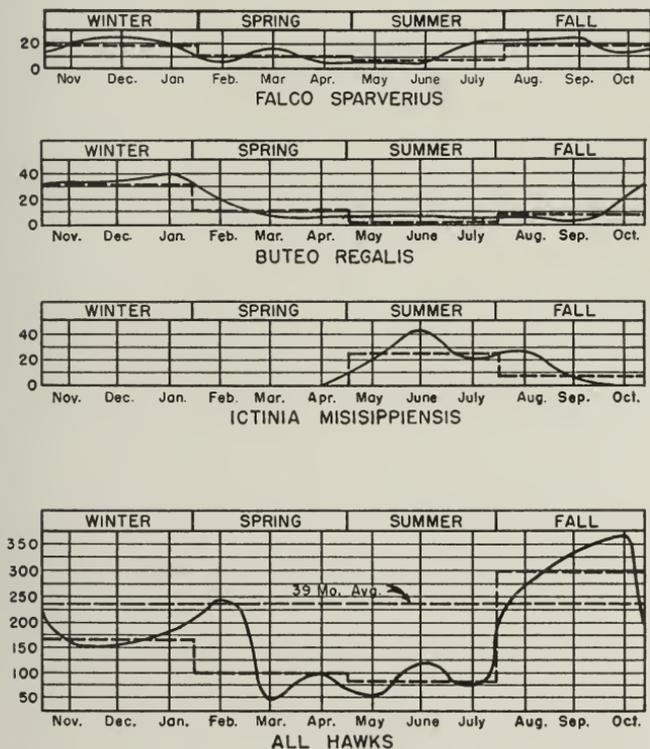


Figure 2. Population trend, based on the rate per thousand miles traveled. The solid line represents the monthly average; the broken line the seasonal average.

It is interesting to compare our data on hawks (Table 1) with those of Mrs. Nice. The figures on vultures for the Texas portion of her trip are remarkably close to ours of 1939 and 1941. There is, however, considerable difference in hawk figures. Our observations show that the summer months are relatively poor for obtaining records. It is difficult to see hawks unless they are in flight, and during the heat of the day they are likely to be resting in the shade.

TABLE 1
COMPARISON OF HAWK POPULATIONS RECORDED BY NICE (1933)
AND ALLAN AND SIME (1939-1941)

June- July	Miles	Hawks		Vultures		Birds		Location	Authority
		No.	Miles Per	No.	Miles Per	No.	Miles Per		
1933	6,349	50	127.0	70	90.7	120	52.9	Ohio-Ariz.*	Nice
1933	557	7	79.6	16	34.8	23	24.2	Texas**	Nice
1939	1,470	115	12.8	41	35.9	156	9.4	Tex. Pan- handle	Allan and Sime
1940	200	8	25.0	4	50.0	12	16.7	Tex. Pan- handle	Allan and Sime
1941	566	31	18.3	16	35.3	47	12.0	Tex. Pan- handle	Allan and Sime

*Round-trip part of travels.

**Texas part of travels.

While there was some concentration of hawks along highways, we were unable to detect how much the perching sites and carrion to be found there attracted them. Much of the travel was done on ranch roads, and there seemed to be as many hawks along them as there were along major highways.

Fifteen species were observed. It is probable that at least three more species occur at times in the Texas Panhandle. J. O. Stevenson (1942) records the Harris Hawk (*Parabuteo unicinctus harrisi*) from Palo Duro Canyon, and Florence M. Bailey (1928) attributes to Ligon a record 50 miles northeast of Carlsbad, New Mexico, which is 25 to 30 miles west of Gaines or Yoakum counties, Texas. The Black Vulture (*Coragyps atratus*) occurs not far south of the Panhandle. Pigeon Hawks (*Falco columbarius*) may occur as stragglers or uncommon migrants, but we have not positively recognized them. E. T. Seton (correspondence) informs us that a female of Richardson's Pigeon Hawk was taken by him on the Perico Ranch in Union County, New Mexico, which is 25 to 30 miles west of Dallam County, Texas.

Cathartes aura. Turkey Vulture (Figure 1).—Earliest spring record: April 1, 1941. Latest fall record: October 15, 1940. On April 19, 1939, 43 were seen in 80 miles, or 1 per 1.9 miles. (Hereafter, the ratio of miles traveled to birds seen is expressed numerically, thus: 1.9:1.) During April, 1940, 20 were seen in 237 miles (11.8:1). On September 25, 1939, 132 Turkey Vultures were seen in 183 miles (1.4:1). During the month of September, 1939, 189 Turkey Vultures were seen in 2,535 miles of travel (13.4:1). Our data show migration peaks in April and September (Figure 1). In the Texas Panhandle this bird was found principally in canyons and wooded river bottoms.

Ictinia mississippiensis. Mississippi Kite (Figure 2).—Earliest summer record: May 4, 1939. Latest fall record: September 25, 1939. The largest number for

one day was recorded on May 28, 1939: 23 seen in 79 miles (3.4:1). The high day in fall was August 30, 1939: 23 in 307 miles (13.3:1). High month was May, 1940: 29 seen in 585 miles (20.1:1). High fall month was August, 1939: 36 seen in 1,470 miles (40.9:1). The Mississippi Kite seemed to be principally confined to wooded bottomlands. It was common in the northeastern Panhandle and ranged at least as far west as Potter County. Bent (1937) indicates its occurrence at Tascosa (Oldham County), west of Potter County.

Accipiter velox. Sharp-shinned Hawk.—This bird was scarcer than the Cooper's Hawk. Only 8 were seen. Like the preceding species, it frequents the heavily wooded bottoms. Paul Russell found it in summer in Palo Duro Canyon, according to J. O. Stevenson.

Accipiter cooperi. Cooper's Hawk.—This was one of the rarer hawks, but it is rather shy and frequents the more heavily wooded valleys; hence it may have escaped our notice. It seems to be only a transient here.

Only 14 were seen. The habits of this and the preceding species are so different from those of the other species treated in this paper that our figures can give no real indication of relative numbers.

Buteo borealis. Red-tailed Hawk.—The Red-tail, primarily a winter bird in the Texas Panhandle, is relatively uncommon, but by no means rare. J. O. Stevenson informed us that Redtails have been observed in Palo Duro Canyon in summer by Russell. It is a bird of wooded rangeland, particularly of canyons and river bottoms. Earliest fall date: August 1, 1939. Latest in summer: May 9, 1941. Highs in single day observations were January 12, 1939: 4 seen in 57 miles (14.2:1); and October 23, 1939: 6 seen in 85 miles (14.2:1). High month was October, 1938: 5 seen in 150 miles (30.0:1). January, 1939, however, is probably a fairer sample: during this month 9 were seen in 673 miles (74.8:1).

Buteo swainsoni. Swainson's Hawk (Figure 1).—The huge flocks of migrating Swainson's Hawks have been described many times. To a certain extent this migration disrupted our data, for in September and October, 1939, we observed 1,961 of these hawks—a record we never again approached. In random travels it is possible to miss large concentrations of hawks, as we apparently did in 1940 and 1941, for large flocks were reported to us during those years. There is some reason to believe that 1939 was unusual, for it was a year of very dry weather and an abundance of grasshoppers.

When not migrating, flocks of Swainson's Hawks frequent the egg-laying beds of grasshoppers, sometimes in flocks of a thousand or more.

In migration, the flocks are a loose group of flapping, wheeling, and soaring birds, moving from ground level to the limits of visibility. Sometimes the horizontal movement is relatively slow, while at other times the flock moves rapidly. On one occasion following a raw, rainy day, 641 hawks were counted in about an hour's time. On this day, October 9, 1939, the weather was clear and cool, with a strong northwest wind.

The Swainson's Hawk is a common summer resident in the Panhandle, nesting nearly everywhere that there are a few cottonwood trees. Earliest record for arrival: March 28, 1941. Latest one seen: December 7, 1938. Our high one-day record for spring is April 19, 1939: 30 seen in 80 miles (2.7:1). The high spring month was May, 1939. In 1,131 miles of travel we saw 58 (19.5:1). Our high day for fall was October 9, 1939: 641 seen in 35 miles (.05:1). On August 30, 1939, we saw 214 in 307 miles (1.4:1); on September 17, 1939, our record was 155 hawks in 165 miles (1.1:1). On September 27, 1939, 397 passed over Amarillo, Texas, but these do not appear in our statistical data, since they were not observed in the course of our travels. On September 26, 114 were seen in a 70-mile trip (.6:1). September and October, 1939, were the high fall months. During September we recorded 1,224 Swainson's Hawks in 2,535 miles of travel (2.1:1); and during October we recorded 737 in 1,381 miles (1.9:1). In August, 1941, 573 miles were traveled and 62 hawks seen (9.2:1).

Swainson's Hawks were abundant in all types of habitats, but were predominant on rangeland. They often were perched on telegraph wires, a habit unusual in large birds. Among the foods are cottontails and jackrabbits killed by automobiles. A young Swainson's Hawk was seen on one occasion to make a very awkward and unsuccessful stoop at a Horned Lark (*Octocoris alpestris*).

Buteo lagopus. American Rough-legged Hawk.—This uncommon hawk is a winter resident only. Earliest winter record: November 2, 1938. Latest record in spring: April 21, 1939. This seems to be an unusually late date, and the bird may have been weak or injured. The April 1, 1941, date is more likely normal. American Rough-legs were so scarce that mileage records are hardly significant. The high month was February, 1940, when 7 were seen in 372 miles of travel (53.1:1). In December, 1938, we saw 14 in 1,144 miles of travel (81.7:1), and in February, 1939, we recorded 7 in 846 miles (120.8:1).

Because this species is slow and unafraid, many are killed by hunters, who find them easy targets along highways.

Buteo regalis. Ferruginous Rough-legged Hawk (Figure 2).—This is a year round resident of the Panhandle. Some of the nests are huge. The accumulations of nesting materials of many seasons evidently account for their size. One large nest in Moore County was located in a hackberry (*Celtis sp.*). This nest was about 4 feet in diameter and nearly 3 feet thick and supported the weight of a man. In 1939, three young Rough-legs were raised here, but in 1940 and 1941, the nest was occupied by Great Horned Owls (*Bubo virginianus*). Interestingly enough, an unoccupied nest was discovered in 1940 on the bare ground not far from the large nest.

High day for Ferruginous Rough-legs was December 7, 1938: 18 were seen in 112 miles (6.2:1). On November 11, 1938, 18 were seen in 125 miles (6.9:1). High month was December, 1938: 66 were seen in 1,144 miles of travel (17.3:1).

During the breeding season this hawk occurred only on rangeland, but later was seen almost everywhere. As with the American Rough-leg, many are killed along highways.

Aquila chrysaetos. Golden Eagle.—Although a year round resident, the Golden Eagle was seen mainly during the winter months, and then only uncommonly. It nested in Palo Duro and Cito canyons in Randall County, and in 1941 was observed nesting in a large cottonwood in Hartley County. During the month of January, 1942, we saw 6 in 656 miles (109.3:1).

The Golden Eagle in the Texas Panhandle, as elsewhere in the west, is principally a bird of canyons and rangeland.

Haliaeetus leucocephalus. Bald Eagle.—Only one Bald Eagle was recorded, though it is reported as being not unusual in the Panhandle of Oklahoma.

Circus hudsonius. Marsh Hawk (Figure 1).—The Marsh Hawk is essentially a winter bird in the Texas Panhandle, although it appears early and stays late. During the wet summer of 1941 it nested in Randall County. A nest was found May 30, 1941. Marsh Hawks usually appeared early in August (August 1, 1939, 1941) and became scarce after April. Latest summer date: June 30, 1939. The high day for fall was September 9, 1939: 37 seen in 83 miles' travel (2.2:1). On February 1, 1940, 32 were seen in 116 miles (3.6:1), and on January 10, 1942, 37 were seen in 120 miles (3.2:1). Some of the high months were February, 1940: 74 seen in 372 miles (5.0:1); November, 1941: 88 in 527 miles (5.9:1); December, 1941: 133 seen in 948 miles (7.1:1); and January, 1942: 115 seen in 656 miles (5.7:1). The numbers of Marsh Hawks during several other months were fairly high. More Marsh Hawks were observed than any other species except the Swainson's Hawk. A total of 1,374 was seen in 26,768 miles' travel (19.5:1). Migration peaks apparently occurred in February and October (Figure 1).

While the Marsh Hawk is ubiquitous, it frequents croplands, especially cotton and sorghum fields, more than it does pasture. As would be expected, it was often seen near playas (wet-weather lakes). Marsh Hawks were particularly abundant in areas having large populations of cotton-rats (*Sigmodon hispidus*). The remains of this rodent were found in a fresh Marsh Hawk pellet, and nearby there were two dead cotton-rats. Jack rabbits and cotton-tails killed on the highway are a staple and abundant source of food. We witnessed an unsuccessful attack on a covey of Scaled Quail (*Callipepla squamata*), and we found Marsh Hawks eating Meadow Larks (*Sturnella neglecta*) and ducks, the latter presumably wounded.

Pandion haliaëtus. Osprey.—Ospreys were rare migrants through the Texas Panhandle. En route they obtain food in some of the larger lakes, where they were found fishing. Six Ospreys were seen, but only 4 of these figure in our data. One was seen on a power line pole on September 26, 1941, in Amarillo, Texas. Another was observed on June 18, 1942, at Buffalo Lake, Randall County.

Falco mexicanus. Prairie Falcon.—The Prairie Falcon was uncommon and was seen principally in the winter, although occasionally at other times. Summer observations lead us to believe that it may nest in some of the canyons. Although January, 1941, showed fewer miles per bird (93.0:1), so few miles were traveled during that month that it is best that October, 1939, be considered high. In this month, 15 were seen in 1,381 miles (92.1:1).

This falcon was seen about equally in rangeland and cropland. Like its larger relative, the Duck Hawk, it sometimes winters in cities. One frequented the larger buildings at Amarillo during the winters of 1938 and 1939. Also, like the Duck Hawk, this bird is sometimes seen at play. On one occasion a Prairie Falcon was observed making repeated stoops at a Ferruginous Rough-leg. The latter rolled over in air and presented a formidable defense, which caused the little falcon to swoop upward. On another occasion, a Prairie Falcon and a Marsh Hawk were observed in what appeared to be a game. The two maneuvered in such a manner as to be facing each other about 10 feet above the ground. They then rose vis-à-vis, keeping about three feet apart, to a height of about 50 feet, when they separated, dove earthward, and then repeated the trick. This continued for about three minutes.

Falco peregrinus. Duck Hawk.—The Duck Hawk was decidedly rare. Only three were seen on our travels, but two or three more have been seen when we were not traveling.

Falco sparverius. Sparrow Hawk (Figure 2).—This hawk ranked fourth in abundance and is a year round resident. It was most abundant in winter. Our high day was December 1, 1940: 10 seen in 36 miles (3.6:1). September 9, 1939, was also a high day: 10 seen in 83 miles (8.3:1). High fall month was December, 1941: 40 seen in 948 miles (23.7:1); and high spring month was April, 1939: 45 seen in 2,413 miles (53.6:1). August, 1941, (28.6:1), September, 1939 (34.7:1), and January, 1939 (32.0:1), were also high months. Migration data did not show well defined peaks.

This hawk generally frequents areas of tree growth and was commonly seen along railroad right of ways, sitting upon telegraph poles. One is likely to see Sparrow Hawks nearly anywhere in the Panhandle.

Unidentified hawks. It is to be expected that in a survey of this kind many hawks would be unidentified. Whenever it was convenient to do so, questionable identities were checked with a 7x35 binocular. Melanistic hawks, with the occasional exception of Swainson's Hawk and Ferruginous Rough-legs, were usually unidentifiable. Most of the unidentified birds were buteonine. We believe that all birds listed in the accompanying tables as unidentified hawks actually were hawks. We were careful to exclude Ravens and Mourning Doves.

TABLES 2 and 3
ABUNDANCE OF HAWKS BY SEASONS

Species	Winter 1938-1939		Spring 1939		Summer 1939		Fall 1939	
	No.	Rate*	No.	Rate*	No.	Rate*	No.	Rate*
Turkey Vulture	..	..	81	21.2	54	20.7	213	39.5
Mississippi Kite	..	..	..	..	70	26.9	47	8.7
Sharp-shinned Hawk	2	.7	..	..	2	.8	2	.4
Cooper's Hawk	8	2.8	2	.5	..	..	2	.4
Red-tailed Hawk	26	9.0	16	4.2	..	..	15	2.8
Swainson's Hawk	2	.7	120	31.3	106	40.8	2239	416.7
American Rough- legged Hawk	24	8.3	9	2.3	..	..	..	..
Ferruginous Rough- legged Hawk	136	47.2	44	11.5	12	4.6	25	4.6
Golden Eagle	6	2.1	6	1.6	2	.8	4	.7
Bald Eagle	..	..	1	.3	..	..	..	..
Marsh Hawk	178	61.7	85	22.2	8	3.1	354	65.8
Osprey	..	..	..	..	..	..	4	.7
Prairie Falcon	17	5.9	2	.5	2	.8	26	4.8
Duck Hawk	..	..	..	..	..	..	3	.5
Sparrow Hawk	58	20.1	71	18.5	14	5.4	118	21.9
Unidentified	74	25.6	70	18.2	14	5.4	176	32.7
Totals:	531	185.2	507	131.6	284	108.7	3228	588.2
Miles traveled during period:	2,887		3,834		2,601		5,384	

Species	Winter 1939-1940		Spring 1940		Summer 1940		Fall 1940	
	No.	Rate*	No.	Rate*	No.	Rate*	No.	Rate*
Turkey Vulture	..	..	20	15.0	22	28.0	2	3.3
Mississippi Kite	..	..	..	..	29	36.9	..	..
Sharp-shinned Hawk	..	..	..	..	..	..	1	1.7
Cooper's Hawk	..	..	1	.8	..	..	..	..
Red-tailed Hawk	13	7.5	3	2.4	..	..	4	6.7
Swainson's Hawk	2	1.1	3	2.4	7	8.9	4	6.7
American Rough- legged Hawk	5	2.9	7	5.6	..	..	..	..
Ferruginous Rough- legged Hawk	26	15.0	15	12.1	2	2.5	9	15.0
Golden Eagle	1	.6	3	2.4	..	..	..	..
Bald Eagle	..	..	..	..	..	..	..	..
Marsh Hawk	84	48.5	79	63.7	1	1.3	28	46.7
Osprey	..	..	..	..	..	..	..	..
Prairie Falcon	5	2.9	4	3.2	..	..	1	1.7
Duck Hawk	..	..	..	..	..	..	..	..
Sparrow Hawk	10	5.8	14	11.3	5	6.4	3	5.0
Unidentified	12	7.0	26	21.0	..	..	8	13.3
Totals:	144	90.1	147	146.3	66	84.0	60	100.1
Miles traveled during period:	1,730		1,239		785		600	

*Number per 1000 miles of travel.

TABLES 4 and 5
ABUNDANCE OF HAWKS BY SEASONS

Species	Winter 1940-1941		Spring 1941		Summer 1941		Fall 1941	
	No.	Rate*	No.	Rate*	No.	Rate*	No.	Rate*
Turkey Vulture	..	..	1	.8	27	16.7	18	21.2
Mississippi Kite	..	..	..	..	23	14.2	..	..
Sharp-shinned Hawk	..	..	..	..	..	..	..	..
Cooper's Hawk	..	..	..	..	..	..	..	..
Red-tailed Hawk	2	1.1	..	..	2	1.2	1	1.2
Swainson's Hawk	1	.5	6	4.6	21	13.0	66	77.5
American Rough- legged Hawk	2	1.1	2	1.5	..	..	..	..
Ferruginous Rough- legged Hawk	71	39.2	9	6.1	3	1.8	7	8.2
Golden Eagle	1	.5	..	..	..	..	..	..
Bald Eagle	..	..	..	..	..	..	..	..
Marsh Hawk	95	52.4	19	14.7	11	6.8	50	58.5
Osprey	..	..	..	..	..	..	..	..
Prairie Falcon	6	3.3	1	.8	1	.6	1	1.2
Duck Hawk	..	..	..	..	..	..	..	..
Sparrow Hawk	33	18.2	4	3.1	4	2.5	29	34.1
Unidentified	16	8.8	13	10.0	15	10.2	7	8.2
Totals:	227	125.0	55	42.5	107	66.2	179	212.8
Miles traveled during period:	1,812		1,295		1,617		850	

Species	Winter 1941-1942		Total Period 1938-1942	
	Number	Rate*	Number	Rate*
Turkey Vulture	..	..	438	16.4
Mississippi Kite	..	..	169	6.3
Sharp-shinned Hawk	1	.5	8	.3
Cooper's Hawk	2	.9	15	.6
Red-tailed Hawk	15	7.0	97	3.6
Swainson's Hawk	1	.5	2578	96.2
American Rough-legged Hawk	4	1.9	53	2.0
Ferruginous Rough-legged Hawk	56	26.2	415	15.5
Golden Eagle	9	4.2	32	1.2
Bald Eagle	..	..	1	tr.
Marsh Hawk	336	158.7	1374	51.3
Osprey	..	..	4	.2
Prairie Falcon	10	4.7	76	2.8
Duck Hawk	..	..	3	.1
Sparrow Hawk	70	32.9	433	16.2
Unidentified	48	22.5	479	17.9
Totals:	555	263.2	6175	232.5
Miles traveled during period	2,131		26,768	

*Number per 1000 miles of travel.

TABLE 6
RELATIVE SEASONAL ABUNDANCE OF HAWKS BY PERCENTAGE

	Turkey Vulture	Mississippi Kite	Sharp-shinned Hawk	Cooper's Hawk	Red-tailed Hawk	Swainson's Hawk	American Rough-legged Hawk	Ferruginous Rough-legged Hawk	Golden Eagle	Bald Eagle	Marsh Hawk	Osprey	Prairie Falcon	Duck Hawk	Sparrow Hawk	Unidentified
Winter '38-'39	..	..	.4	1.5	4.9	.4	4.5	25.6	1.1	..	33.3	..	3.2	..	10.9	13.9
Spring 1939	16.0	..	..	.4	3.2	23.7	1.8	8.7	1.2	.2	16.8	..	.4	..	14.0	13.8
Summer 1939	19.0	24.6	..	..	..	37.3	..	4.2	.7	..	2.8	..	.7	..	4.9	4.9
Fall 1939	6.6	1.5	tr.	tr.	..	69.4	..	.8	.1	..	11.0	.1	.8	tr.	3.6	5.5
Winter '39-'40	..	..	..	..	8.2	1.3	3.2	16.4	.6	..	53.2	..	3.2	..	6.3	7.6
Spring 1940	11.4	..	..	.6	1.7	1.7	4.0	8.6	1.7	..	45.1	..	2.3	..	8.0	14.8
Summer 1940	33.3	43.9	..	..	..	10.6	..	3.0	..	..	1.5	..	..	..	7.6	..
Fall 1940	3.3	..	1.7	..	6.7	6.7	..	15.0	..	..	46.7	..	1.7	..	5.0	13.3
Winter '40-'41	..	..	..	..	.9	.4	.9	31.3	.4	..	41.8	..	2.6	..	14.5	7.0
Spring 1941	1.8	..	..	..	..	10.9	3.6	16.4	..	..	34.5	..	1.8	..	7.2	23.6
Summer 1941	25.2	21.5	..	..	..	19.6	..	2.8	..	..	10.3	..	.9	..	3.8	14.0
Fall 1941	10.0	..	..	..	.6	36.9	..	3.9	..	..	27.9	..	.6	..	16.2	3.9
Winter '41-'42	..	..	..	.4	2.7	.2	.7	10.1	1.6	..	60.5	..	1.8	..	12.6	8.6
AVERAGE RELATIVE SEASONAL ABUNDANCE																
Winter	..	..	.2	.6	4.2	.6	2.3	20.8	.9	..	47.2	..	2.7	..	11.1	9.3
Spring	9.7	..	..	.3	1.6	12.1	3.1	11.2	1.0	tr.	32.1	..	1.5	..	9.7	17.4
Summer	25.8	30.0	.2	..	.6	22.5	..	3.3	.2	..	4.9	..	.5	..	5.4	6.3
Fall	6.6	.5	.6	tr.	2.6	37.7	..	6.6	tr.	..	28.5	tr.	1.0	tr.	8.3	7.6
Totals*	7.1	2.7	.1	.2	1.6	41.7	.8	6.7	.5	tr.	22.3	tr.	1.2	tr.	7.0	7.7

*Entire 39-months' period.

These are practically the only birds that might be confused with hawks in highway observation; the former might be mistaken for any of the larger hawks, while the latter are similar in size to the Sparrow Hawk. The unidentified hawks make up 7.7 per cent of all hawks observed, and the abilities of both of us as seen in our ratios of identified to unidentified birds are remarkably close. Excluding the large flocks of Swainson's Hawks, most of which were observed by Allan, there was less than 3 per cent difference in the ratios.

High points in the population curves of unidentified hawks (Figure 1) occur in August, September, and February. It is likely, therefore, that many of them are Swainson's Hawks in the fall, and that Marsh Hawks predominate in the spring.

SUMMARY

Physiographic and climatic conditions in the Texas Panhandle present excellent opportunities for highway hawk-censuses.

During a highway census covering a 39-month period (1938-1942) 6,175 hawks (including kites, vultures and eagles) were observed in 26,768 miles of travel.

With Swainson's Hawks and Marsh Hawks far outnumbering all others, 15 species were recorded out of a possible total of 18.

Hawks were seen at the rate of 232.5 per 1,000 miles, or one bird per 4.2 miles.

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THE DOWNY YOUNG OF OYSTER-CATCHERS

BY J. DAN WEBSTER

IN the hope that knowledge of the natal down of young oyster-catchers might provide clues to the proper classification in the genus *Haematopus*, this study was begun in the fall of 1941. Through the kindness of the authorities of various American museums, most of the extant downy specimens were available for comparison.¹ Eight races were represented by excellent examples in a series of 48 true downies, plus six significant specimens in partial natal plumage; four other subspecies were represented by one chick each in partial juvenal plumage. Although we commonly expect the natal down of related species to be more similar than adult plumages, the downy plumages of all but one of the 12 forms I studied was individually characteristic.

The most recent review of the entire genus *Haematopus* is that by Peters (1934:231-34). Peters based his arrangement largely on the revision of the genus by Stresemann (1927) as supplemented by Salomonsen's revision of the European forms (1930) and Hartert's (1927) work on the New Zealand forms; Peters recognized 21 forms belonging to four species. Recently Falla (1939) showed that there were four species in the New Zealand region, where Peters had recognized but two forms, and considered them subspecies of the wide-ranging *Haematopus ostralegus*. In the present paper I have recognized as species two additional forms accorded only subspecific rank (as races of *H. ostralegus*) by Stresemann (1927) and by Peters. Thus I have returned to the older classification utilized by Murphy (1925) for the Western Hemisphere forms.

The natal down of oyster-catchers shows four principal colors, arranged in a fairly constant pattern. (1) Pure white down is present on more or less of the underparts in every form but *fuliginosus*. (2) Black down forms two parallel stripes down the back, a stripe at the top of the thigh, a dot on the lores, and a dot behind the eye; also spots and a median stripe on the pileum in some forms. (3) Some shade of drab down covers those areas of the upper parts which are not black, the throat, and (in the dark-bellied forms) most of the ventral surface.

¹ The following museums and authorities courteously permitted the loan of specimens for study at Houston, Texas: American Museum of Natural History—Robert C. Murphy; California Academy of Sciences—James Moffitt; Museum of Comparative Zoology—J. L. Peters; Field Museum of Natural History (including the collection of H. B. Conover)—Rudyard Boulton and H. B. Conover; Fuertes Memorial Collection at Cornell University—George M. Sutton; Los Angeles County Museum (including the collection of G. Willett)—George Willett; Museum of Vertebrate Zoology—Alden H. Miller; San Diego Natural History Society—Laurence M. Huey; United States National Museum—Herbert Friedmann.

Before I began the present study I had examined both adult and young oyster-catchers at the California Academy of Sciences, the Museum of Comparative Zoology, the Field Museum, Cornell University, and the Museum of Vertebrate Zoology. Valuable help during the course of this work was rendered by Dr. Asa C. Chandler as well as by the museum authorities listed above.

(4) Some of the drab down of the upperparts is tipped with a shade of buff.

Haematopus palliatus palliatus

I examined seven downy specimens from Virginia and South Carolina. The rump and flank tipplings varied from Light Ochraceous Buff² to Ochraceous Buff (Ridgway's buff series runs: Pale Ochraceous Buff, Light Ochraceous Buff, Ochraceous Buff.); the lower back, wings, and face (that is, the auriculars and areas above and below the eye) were Avellaneous (a light, buffy drab). The sides and back of the neck were evenly Light Drab.

Haematopus palliatus pitanay

The single specimen examined from Peru was about three weeks of age; no differences in natal plumage from typical *H. p. palliatus* could be detected.

Haematopus palliatus frazari

I examined thirteen specimens from Lower California and Sonora. The rump and flanks were tipped with Light Ochraceous Buff; the lower back, face and wings were near Avellaneous, although varying from the true Avellaneous occurring in *H. p. palliatus*, to a slightly grayer shade. The sides and back of the neck were Hair Brown to Chaetura Drab. (Ridgway's Drab series is: Pale Drab Gray, Drab Gray, Light Drab, Drab, Hair Brown, Chaetura Drab, Chaetura Black.) Three or four small black spots were present on the pileum of three specimens, but such spots were in no case so extensive, so numerous, or so anteriorly placed as in the Old World oyster-catchers (see below). Bancroft (1927:52) mentioned and figured two *frazari* chicks from Scammons Lagoon, Lower California, which were the offspring of one normal plumaged, and one "black-bellied", *frazari* parent. These downies were collected by Laurence M. Huey, and formed part of the series of specimens I used. One member of the pair (San Diego Society Natural History 10538) was an average *frazari* chick, perfectly matching specimens from the Gulf of California. But the other (S.D.S.N.H. 10537) had several black spots on the back of the head (a character shared by two other *frazari* chicks in my series) and largely Drab Gray underparts. There was a triangular white patch on the upper breast, as in *bachmani*, but the ventral dark down was much lighter than in chicks of that species (Drab Gray rather than Drab).

Haematopus palliatus galapagensis

Examination of a chick entirely in the natal down may point to recognition of this large-footed form as the full species originally

² Throughout this paper, capitalized color names are used only where the color of the area described has been compared and identified with Ridgway's (1912) color key.

described by Ridgway (1886:331). The single specimen available (American Museum of Natural History, 735002) was about three weeks old when taken; it was the same one described by Rothschild and Hartert (1902:42) and referred to by Murphy (1936:982). The down of the throat was darker (Chaetura Drab) than the darkest *frazari*; the down of the back seemed to be Drab. The down remaining on and near the rectrices lacked the buffy tippings found in *frazari* and *H. p. palliatus*, and thus the entire tail was a dense black.

Haematopus bachmani

Of this species I examined 15 specimens from Alaska, British Columbia, and California. Unfortunately, the only young specimen available from the Santa Barbara Islands (George Willett's No. 752) was a bird nearly three weeks old. Down still present on this specimen seemed to be identical with that of northern chicks. The Light Ochraceous Buff or Ochraceous Buff tipping was in this species less extensive than in *palliatus*, resulting in a change in the ground color of lower back, wings, and face from Ridgway's brown series (e.g., Avellaneous, as in *palliatus*) to the drab series, accompanied by a darkening to Drab. The sides and back of the neck were very dark—Chaetura Black.

The most obvious and constant difference between the two species, *bachmani* and *palliatus*, so far as natal plumage was concerned, was in facial coloration. The side of the head of a *palliatus* subsp. chick was pale, almost buffy; that of a *bachmani* youngster (Webster, 1941: 156, fig. 6) was dark. The propriety of recognizing *bachmani* as a full species is questionable. I am sure that *bachmani* and *palliatus* are more closely related to each other than are *palliatus* and *ostralegus*. But until intergradation has been demonstrated in Lower California, where the two forms are co-resident, I hesitate to call them conspecific.

Haematopus ater

I examined three specimens, from Chile and the Falkland Islands. As Murphy (1925:15 and 1936:989) noted, the white ventral area, although much more extensive than in *bachmani*, did not cover the entire belly and flanks as in *palliatus*. Peculiar to this species was the restriction of Pale Ochraceous Buff tippings to very narrow strips along the margins of the dorsal and femoral black stripes. This localization of brown pigment resulted in a Mouse Gray color of back, lower belly, and head.

Haematopus leucopodus

Two specimens, from Tierra del Fuego and the Falklands, were examined. The chief point of interest was the remarkable similarity to *occidentalis*, from the British Isles. The pileum was prominently marked with black; the back was Drab, tipped sparsely with Ochraceous Buff; the upper breast, the throat and the sides of the neck were

Hair Brown. This species could, however, be differentiated from the downy English oyster-catcher (*H. ostralegus occidentalis*) by the basally black toenails and dark colored upper breast. The adult of this species has peculiar short toes and broad nails, but no trace of such characters could be detected in the chick.

Haematopus ostralegus occidentalis

I examined seven specimens from the British Isles of this, the best-known of all oyster-catchers. In view of the alleged relationships between this form and *palliatu*s (Murphy, 1925:2-4 and 1936:973-74; Stresemann, 1927:72-73) it is interesting that the New World species most closely resembling it in natal plumage are *leucopodus* from the South Atlantic and *bachmani* from the North Pacific rather than *palliatu*s of eastern North America. The entire upperparts and face were Drab (save for the usual black stripes); the sparse tipplings of the upperparts were Ochraceous Buff. The sides of the neck were Hair Brown, and the pileum was prominently spotted with black, as in *leucopodus*, but the sooty brown of the throat did not extend onto the breast as in that species.

Although I examined no downy young of *H. o. malacophaga*, from Iceland, it seems reasonable to assume that few differences in natal down would have been found, because adult *malacophaga* are differentiated from adult *occidentalis* solely on the basis of size (Salomonsen, 1930:56).

Haematopus ostralegus longirostris

The single specimen available, from Western Australia, was over three weeks old. The down left on the neck and throat was darker than that of *reischeki* (see below) and lighter than that of *occidentalis*.

Haematopus reischeki

This form of New Zealand oyster-catcher has recently (Falla, 1939:263) been assigned specific status, although several earlier workers, *i. e.*, Stresemann (1927:77), Hartert (1927:16) and Oliver (1930:278), regarded it as some kind of color variant or hybrid. Falla's studies led him to suggest (1939:264) that this form of oyster-catcher, from northwestern New Zealand, was more closely allied to *H. ostralegus longirostris* from Australia than was any other New Zealand species. But Falla, although he photographed a nest of newly hatched young (1939:266, fig. 2) was unable to collect specimens for a description of the natal plumage.

A single specimen (A.M.N.H. 735098) bore the label, "*Haematopus unicolor*; Kaipara Beach, near Helensville, North I., N. Z.; Robin Kemp, Jan. 9, 1915; stolen from a stoat; beak greenish gray, irides black, feet gray." Because Falla listed *reischeki* from Helensville, and indicated the hatching time of this species as January, it may be

presumed that this specimen was the undescribed natal form of *reischeki*, and that the designation "*unicolor*," on the label indicated black or largely black parents. This chick was paler than even the lightest *palliatu*s is gray brown and *ater* is sooty brown. The sides of the neck World forms, in marked contrast to the adult plumages of these species. For in the adult plumages *reischeki* is glossy black dorsally, whereas *palliatu*s is gray brown and *ater* is sooty brown. The sides of the neck were Mouse Gray, the back largely Light Drab, the down tippings Pale Ochraceous Buff.

Haematopus finschi

Although I examined no specimens of this form (native to South Island, New Zealand), which was well described in the natal plumage by Falla (1939:261), it might be mentioned that his description is very similar to that of *reischeki* given above. His figure (1939:266, fig. 1), however, suggests that *finschi* is somewhat darker, and more gray, than downy *reischeki*.

Haematopus fuliginosus

I examined two specimens, one from Bass Strait, the other from Western Australia. This species was peculiar among downy oyster-catchers in its even, rusty coloration (although the black marks on the pileum were plain) and in its complete lack of white plumage. The belly was Light Drab; the neck, throat and back were Hair Brown; the tippings of the dorsal down were Wood Brown.

Haematopus unicolor

Falla (1939:265) restricted the name "*unicolor*" to entirely black oyster-catchers from the rocky shores of southern and middle New Zealand. Oliver (1930:279) described the downy chick of this form as, "covered with blackish brown down," a description which would fit *fuliginosus*; in the single specimen I examined (A.M.N.H. 735143; no locality but "New Zealand"; largely in juvenal plumage), down remaining on the head and neck was only slightly lighter than that of *fuliginosus*; down left on the lower back was nearest Hair Brown, perhaps very slightly lighter than that of *fuliginosus*.

DISCUSSION

Murphy (1925:2-4) showed that the adult of *palliatu*s has retained essentially the juvenal plumage-phase of European *ostralegus*, differing chiefly in the extent of the white spotting of the primaries, a variable character which is associated with geographical distribution in oyster-catchers throughout the world. The differences between New World and Old World oyster-catchers are given in Table 1. It is my opinion that the two should not be regarded as conspecific.

TABLE 1
COMPARISON OF NEW AND OLD WORLD OYSTER-CATCHERS

	NEW WORLD FORMS	OLD WORLD FORMS
	<i>Adults</i>	<i>Adults</i>
Irides:	yellow	red
Feet:	white or white tinged with pink	red
Back:	brown (except <i>leucopodus</i>)	glossy black
Rump:	brown or black	white (except <i>reischeki</i> and black-bellied forms)
	<i>Downy Young</i>	<i>Downy Young</i>
Nails:	dark at base	light at base
Pileum:	unspotted, or slightly spotted with black (except <i>leucopodus</i>)	spotted and streaked prom- inently with black

SUMMARY

Comparison of 54 specimens of the genus *Haematopus* in natal plumage led to the following original conclusions: *H. palliatus frazari* chicks are darker than those of the nominate race and tend to be marked more often with black on the parietal region. *H. bachmani* chicks have a dark, drab face; *H. palliatus* subsp. chicks have a pale, buffy face. Chicks of *H. ostralegus occidentalis* and *H. leucopodus* are very similar.

Several differential characters (of both adult and young) are listed which distinguish Old World and New World oyster-catchers.

H. leucopodus from the Falkland Islands and South America seems to be the nearest thing to a living connecting link between eastern hemisphere and western hemisphere forms. In this species the plumage of both adults and young is close to the Old World type, the adult flesh colors are those of the New World type, but the configuration of the adult toes and toe-nails is unique.

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MYRON HARMON SWENK
1883-1941

BY JOHN T. ZIMMER

MYRON HARMON SWENK, Chairman of the Department of Entomology at the University of Nebraska, died at his home in Lincoln, Nebraska, on July 17, 1941. He was born at Polo, Illinois, on August 8, 1883, the son of Howard Swenk and Susanne Harmon Swenk. In 1885, the family moved to Beatrice, Nebraska, in whose public schools Myron received his preparatory education, graduating from the Beatrice High School in 1901. That year the family moved to Lincoln, where he entered the University of Nebraska and began his studies in the Department of Entomology under Professor Lawrence Bruner. He graduated with the degree of Bachelor of Arts in 1907 and received that of Master of Arts in 1908.

While an undergraduate, in 1904, Myron became Laboratory Assistant in Entomology. He was raised to the position of Adjunct Professor in 1907, Assistant Professor in 1910, Associate Professor in 1911, Professor of Economic Entomology in 1914, and Professor of Entomology in 1925, and was made Chairman of the Department of Entomology in 1919, in which capacity he served until July, 1941, a short time before his death, when ill health compelled his retirement from active duty. He also served the University on various committees and from 1912 to 1928 was Chairman of the Committee on Graduate Work on the Agricultural College Campus.

In addition to his pedagogical work, he was long associated with the Nebraska Agricultural Experiment Station, as Assistant Station Entomologist (1913-1919) and Entomologist (1919), and was also Assistant State Entomologist (1908-1919) and State Entomologist (1919-1927).

On April 24, 1918, he married Jane Chandler Bishop of Lincoln who, with his father and a sister, Iva Swenk, also of Lincoln, survives him.

Myron Swenk's chosen profession was entomology and his work in this subject, aside from his classroom activities, was primarily in the economic field, as was but natural in view of his official positions in an agricultural state. His numerous publications on economic entomology were begun while he was still an undergraduate student and continued throughout his lifetime, but they alone do not measure the full extent of his services to the farmers of Nebraska. The problems of the control of the insect enemies of the fields and orchards were his constant study. As a taxonomist, he was interested primarily in the bees, and most of his papers on systematic entomology deal with that group of insects. Their role in the pollination of plants was a phase of the subject that, from early years, drew his careful attention.

Entomology was closely seconded by ornithology as an avocation in which Professor Swenk played a very active part throughout his lifetime. He was one of the founders of the Nebraska Ornithologists' Union when it was instituted on December 16, 1899. He was elected its President in 1907-1908, Secretary in 1908-1910, Secretary-Treasurer in 1910-1912 and again from 1915 to 1937, and Editor-Custodian (1938-1941). He secured the affiliation of the Union with the Wilson Ornithological Club (1915) and served as President of the Club for the year 1918-1919. When the affiliation terminated in 1925 and *The Wilson Bulletin* ceased to be the official organ of the Union, he began the issue of a series of mimeographed "Letters of Information," of which sixty-eight numbers appeared. They contained the records of the activities of the Union and its members and supplied the place of a printed journal until *The Nebraska Bird Review* was initiated in 1933. The *Review* he continued to edit until early 1941. Thus, from the founding of the Nebraska Ornithologists' Union until his death, he served the society in one capacity or another and was editor of its publications for most of that time.

In 1904, under the joint authorship of Lawrence Bruner, Robert H. Wolcott, and Myron Swenk, there was published "A Preliminary Review of the Birds of Nebraska." This consisted of an annotated list of the birds recorded from the state, with keys for their identification; remarks on their distribution, seasonal occurrence, and abundance; and with citations of the records of the more uncommon forms. The account appeared in the Annual Report of the Nebraska State Board of Agriculture for the year 1903 and was immediately reissued in book form. It became the standard work of reference on Nebraska birds. Various additions and corrections have been published from time to time, several from the pen of Myron Swenk himself, but no more comprehensive account has appeared, and the book has not been supplanted. For many years, Swenk had in mind a complete descriptive work on the birds of the state, but it was not found possible to finance the undertaking, and it was never carried to completion. The biographer still has in his possession a portion of the manuscript notebooks that mark an early joint effort to assemble certain data for such a work.

Perhaps realizing that the more ambitious undertaking was out of the question, Professor Swenk began, in 1933, two series of articles in *The Nebraska Bird Review* entitled, respectively, "A History of Nebraska Ornithology" and "A Brief Synopsis of the Birds of Nebraska." These undoubtedly would have brought together a great deal of scattered information on the local bird life, but only four instalments of the "History" and three of the "Synopsis" were published before the author's death. Other articles from his pen were, however, both numerous and varied, ranging from simple records of local occurrences to such comprehensive studies as that on the Eskimo

Curlew (1915), the Whooping Crane (1933), the measurements of the geese of the *Branta canadensis* group (1934, 1935) and other important studies. Whatever the subjects or their importance, the articles are marked by the accuracy and careful attention to detail that characterize all of Myron Swenk's work.

Professor Swenk was interested in mammals to a somewhat lesser degree than in birds, but he has to his credit "A Preliminary Review of the Mammals of Nebraska" (1908), with three subsequent revisions of the list (1915, 1918, and 1920), and a number of other papers of taxonomic or economic interest, including the descriptions of five new mammalian subspecies. In 1939, he began a privately published series of papers on mammals under the general title of "Missouri Valley Fauna," of which three numbers appeared before his death.

He was affiliated with numerous scientific organizations including the American Association for the Advancement of Science, American Association of Economic Entomologists, American Ornithologists' Union, American Society of Mammalogists, Cooper Ornithological Club, Ecological Society of America, Nebraska Academy of Science, Nebraska Ornithologists' Union, Wildlife Society, and Wilson Ornithological Club, and the honorary societies of Alpha Zeta, Gamma Sigma Delta, Phi Sigma, and Sigma Xi.

As a teacher, Professor Swenk was exceptionally successful. His knowledge of his subject was profound, his manner of presentation clear and forceful, and he had the gift of inspiring his students to their best efforts. As a companion in the field he was genial, interesting, and alert, and it is a pleasure to recall many hours spent with him in past years, roaming the woods and fields, watching birds, collecting specimens, and discussing problems of mutual interest.

From his boyhood he was a keen, though conservative, collector, and he succeeded in building up an important private collection of some thousands of birds, mammals, and insects of the Missouri Valley region. After his death, the insects were presented by Mrs. Swenk to the Department of Entomology at the University of Nebraska, and the birds and mammals to the Nebraska State Museum. Mrs. Swenk has since expended considerable time and effort in cataloguing the birds and mammals in their new quarters and it is gratifying to know that, through her generosity, this material, of special value to Nebraskans, will remain in the state, accessible to students in the region. Local students will, however, miss the presence of Myron Swenk in person. His was the lasting flame that kept alight through the changing years of the Nebraska Ornithologists' Union and his the spirit that kept the organization a growing one. More than anyone, he made the Union his own, and the history of the organization for forty years is inextricably bound up with him. It will miss his guiding hand, his fund of information, and his unflinching interest in local problems which was at the service of Nebraska students. He left a foundation for

future work in the region for which all those who remain to carry on his work will feel extremely grateful.

In *The Nebraska Bird Review* (Vol. 10, No. 1: 6-15, July 7, 1942) will be found a bibliography of Myron Swenk's publications prepared by Dr. H. Douglas Tate, and in the same number (pp. 15-22) an additional paper (with Edson Fichter) on "The Distribution and Migration of the Solitary Sandpiper in Nebraska."

AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY

BIRD MIGRATION. By A. Landsborough Thomson. H. F. and G. Witherby, Ltd., 326 High Holborn, London, W. C. 1. 1942: 7 x 4½ in., 192 pp.; 7 photographs and 13 maps. 6s.

In this revised edition, Landsborough Thomson has brought up to date the useful short account of bird migration he originally published in 1936. Type for the new volume has been more closely set, reducing the total number of pages but not the text. The new edition is also printed on a cheap wartime pulp. About four pages of material and several maps have been added.

Ornithologists will be more interested in the new contents of the book than in its physical make-up. Brief accounts are given of the recent studies on homing (by Rüppell, Wodzicki, Lockley, and Griffin) and of the work of experimental biologists (Rowan, Bissonnette, and Wolfson). Mention is also made of the banding results of Nice, B. Roberts, R. J. Middleton, and others. These appear to be the three fields of inquiry currently yielding the most significant facts on bird migration.

Popular books on this subject have one fault in common. Designed for the general reader, they emphasize "the immensity of migration" and its complexity, and suggest little to the bird watcher in the way of concrete studies that he himself can carry out in the field. To a considerable extent this is attributable to the ideal of condensation that has governed recent books on bird migration. F. C. Lincoln summed up the subject in about 65,000 words in 1939; Thomson here covers it in about 50,000. Such a condensation also necessitates the omission of many aspects of a field that is admittedly complex. To the reviewer, the present volume is regrettably vague on the subject of the periodic irruptions studied by Gross, Formosof, and Speirs.

In spite of this, the book can be considered the best general statement of bird migration now available for the layman. Although British birds have deliberately been allowed to predominate as examples, a check of the excellent index reveals that about 43 per cent of the species listed are probably known to the average bird student in North America. Supplemented by Lincoln's pamphlet of 1935 (U. S. Dept. of Agriculture Circular, 363), it therefore offers American readers an inexpensive and up-to-date summary of the general features of bird migration and of our present theories on the subject.—J. J. Hickey.

ELMER T. JUDD, NORTH DAKOTA ORNITHOLOGIST

BY O. A. STEVENS

NORTH DAKOTA ornithologists have not been numerous, and the death of Elmer T. Judd made a notable gap among them. He was born at Bethel, Connecticut, on June 16, 1866. Even as a boy, he was interested in bird life, and attended meetings of the early and short-lived New Haven Ornithological Club. He came to North Dakota, then still Dakota Territory, in 1887, and settled on a farm eight miles north of Cando, Towner County. This area, situated in rolling prairie country, with many ponds but no streams, far enough north and east to be out of the dry plains region, is admirably suited to encourage ornithological pursuits. Devils Lake, the largest lake in the state, with well wooded edges, is about 40 miles southeast. The Turtle Mountains are about the same distance in an opposite direction, and Rock Lake, a fine large prairie slough, is about 25 miles directly north.

Judd must have sent back to the east glowing descriptions of the bird life of the virgin prairies, for toward the middle of April, 1895, Dr. L. B. Bishop of New Haven, Connecticut, W. H. Hoyt and John Shaler of Stamford, Connecticut, and Homer L. Bigelow of Boston, Massachusetts, came out prepared to study birds in earnest and stayed until the first of August. Dr. Bishop has kindly furnished me the following notes on the visit, which describe the country as an ornithological field and give an intimate picture of Judd.

"Judd was our guide, counsellor and friend, most efficient cook, housekeeper, and driver. After some ten days in Cando, we moved to a small house on Rock Lake, 23 miles north, kindly lent us by Dr. George W. Vaughn of Cando. There were passed some of the happiest days of my life, and most productive ornithologically. The country was unbroken prairie, full of birds, with almost no habitations of white men for 30 miles or more around, farther than we could see or drive. All was our own to collect in a paradise of strange birds, and enjoy in perfect freedom; and we made the most of it.

"With Judd's little bronchos, we roamed the countryside, and studied birds together. Judd drove us, cooked for us and tried to keep us in some order. As the days passed we learned to know him more intimately, admired his sterling honesty of purpose, and his unflinching patience and good temper, and we felt we had left a sincere friend when destiny called us home.

"I spent the summer of 1901, 1902 and 1905 with Alfred Eastgate and his family at Stump Lake, and we scoured all the country north-west to the middle of the Turtle Mountains, collecting. But in 1905 we found all the country, where I formerly roamed in freedom, filled with farms, flax and wheat. East of Rock Lake, where in 1895 there was not a building as far as the eye could see, I counted about 200 farm

buildings in sight from one point across Rock Lake.”

The work of that summer of 1895 and the observations of E. S. Bryant (1894) were used in Judd's "List of North Dakota Birds" (1917), published privately at Cando, which listed 255 forms from the area. Among these were Hoyt's Horned Lark and the Dakota Song Sparrow, which had been collected by the party; Bishop (1896) had named the Song Sparrow for Judd and the Horned Lark for Hoyt. Some years later, Bishop (1921) also described the Lesser Loon from the collections made that summer.

Judd did some collecting himself, but I am uncertain about the amount. Mr. J. E. Graf, Associate Director of the U. S. National Museum, informs me that the museum has in its collections a skin and two sets of eggs of Baird's Sparrow, three skeletons of Prairie Chicken, five sets of eggs of Chestnut-collared Longspur, one set each of the Shoveller and McCown's Longspur, all collected by Judd. The collections of Bigelow passed to the Museum of Comparative Zoology at Harvard College. The extensive collections of skins made by Bishop went to the Field Museum of Natural History in Chicago in 1939, the eggs to the Peabody Museum of Yale University a few years later.

This part of North Dakota has been visited and described by other ornithologists—Herbert K. Job in 1898, A. C. Bent, Bishop and Job, in 1901, and Vernon Bailey and Florence Merriam Bailey in 1913 and 1917. In 1921, Norman A. Wood, of the University of Michigan, visited North Dakota while preparing a list of the birds of the state (1923), and he has kindly sent me the following notes:

“While engaged in a preliminary survey of the bird life of North Dakota in 1921, with headquarters at the Biological Station (of the University of North Dakota, since discontinued) at Devils Lake from May 2 to July 25, Mrs. Wood and I were delighted with a visit from Mr. Judd, who invited us to his home at Cando on June 1st. After a few short trips about Cando in his auto (no longer the bronchos), he drove us north, to and across the boundary line in the same region where Coues worked in 1873, and took a large series of Baird's Sparrow (and where I took my only specimens of this species).

“Another auto trip was made with him to the fish hatchery at Fish Lake in the Turtle Mountains, where we took specimens of the Dakota Song Sparrow in the type region. On May 28, 1921, Mr. Judd drove us to the Sully's Hill National Park and to the Indian Reservation near there. We enjoyed his company and great knowledge of the bird life of the state. Mr. Judd was well known and respected throughout the state, and his passing is a great loss to all who knew him and especially to me who knew him so well.”

Before his paper of 1917 Judd had published three notes on game birds (1891, 1892, 1893) in *Forest and Stream*. I have been unable to find record of any further publications by him, but he continued active

in promoting the conservation of bird life. He was State Game and Fish Commissioner from 1922 to 1924 and president of the North Dakota Audubon Society from 1924 until his death. My own acquaintance with him began about 1925. He was a frequent visitor in Fargo, and we had a number of pleasant discussions. We carried on quite an active correspondence from 1924 to 1926, when he read the manuscript for my own publication (1926), which of course made much use of his. He died at Bismarck, North Dakota, on February 27, 1940, and was buried at Cando, North Dakota.

He became a Master Mason in January, 1890, and his life has been well described by Walter L. Stockwell, Grand Secretary and Librarian (1941).

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NORTH DAKOTA AGRICULTURAL COLLEGE, FARGO, NORTH DAKOTA

GENERAL NOTES

Least Bittern at Long Lake, North Dakota.—Because of the paucity of records of this bird in North Dakota, it seems desirable to report an observation of the Least Bittern (*Ixobrychus exilis*) at Long Lake near Moffit, Burleigh County, North Dakota, August 28, 1942. The bird was flushed from a dense growth of *Scirpus acutus*. It flew within 20 feet of me and then disappeared into another stand of bulrush. Light conditions were excellent, and there seemed no possibility of mistaken identification.—CLARENCE COTTAM, *Fish and Wildlife Service, Chicago, Illinois*.

An Ohio Record of the Surf Scoter.—On October 7, 1942, we collected a female Surf Scoter (*Melanitta perspicillata*) on Lake Erie, between South Bass and Middle Bass Islands, Ottawa County, Ohio. The bird was several hundred yards from shore, and during a half hour of observation was seen to feed only by dabbling in the manner of a shoal-water duck.

The total bulk of the stomach contents was 21 cc., of which 20 per cent was fine gravel; 20 per cent, plant material (parts of rhizomes, and three *Potamogeton* seeds); 60 per cent, parts of invertebrates. The recognizable portions of the invertebrates consisted of: pieces of the shells of 8 small snails; at least 42 cucumber beetles (Chrysomelidae); 2 ham beetles (Corynetidae); one rove beetle (Staphylinidae); one ground beetle (Carabidae); one water beetle (Hydrophilidae); one predacious diving beetle (Dytiscidae); 12 large hornets (Vespidae); 2 wasps (Psammocharidae); 3 chinch bugs (Lygaeidae); one stink bug (Pentatomidae). The preponderance of adult land insects is interesting, since Bent (*U. S. Nat. Mus. Bull.*, 130, 1925:148) and other authors state that even on interior lakes the Surf Scoter's food consists principally of molluscs, crayfish, nymphs of aquatic insects, and a small amount of vegetable matter, and is obtained chiefly by diving.

The Surf Scoter is apparently the rarest of the three species of scoters found in Ohio, and there are few published records. This skin is deposited in Ohio State Museum.—MILTON B. and MARY A. TRAUTMAN, *F. T. Stone Laboratory, Ohio State University, Put-in-Bay, Ohio*.

Remains of the Wild Turkey in Wisconsin.—The Oshkosh Public Museum has a large collection of bird bones recovered from the Indian refuse pits on the eastern shore of Lake Winneconne, Winnebago County. The writer was instrumental in having these bones sent to Alexander Wetmore for identification. Among the bones were four metacarpals of the Wild Turkey (*Meleagris gallopavo silvestris*). This is striking confirmation of the statement of Allouez (*Wilson Bulletin*, 54, 1942:175) that he found Wild Turkeys at Lake Winneconne in 1670. Thanks are due to Dr. Wetmore for the labor involved in working over the large mass of bones.—A. W. SCHORGER, *168 North Prospect Avenue, Madison, Wisconsin*.

Two Long-eared Owl Nests near Toledo, Ohio.—The Long-eared Owl (*Asio wilsonianus*) has been regarded as a rare winter visitor in the Toledo region, with a decided preference for dense evergreen cover (L. W. Campbell, "Birds of Lucas County," 1940), although nests have been recorded in 12 northern Ohio counties.

Then, in the spring of 1942, Laurel Van Camp discovered two nests in small deciduous woodlands in this area. The first was found April 11, in a grove of small trees surrounded by level tilled country, in Sandusky County, near Kingsway, not far from the Sandusky River. It was apparently an abandoned Crow nest, relined with strips of bark, and was placed at a height of 20 feet, against the trunk of a red maple. When discovered April 11, the female was brooding. Five

nestlings, the smallest not over three days old, were present April 23, but only four on May 8, the fifth having fallen to the ground. Although the pellets revealed nothing but meadow mice (*Microtus*) remains, a half-eaten small rabbit lay on the nest at the time of the last visit.

A second nest of similar construction and location, but in a small pin oak, was found May 9, near the base of Little Cedar Point, Lucas County, in a wood that did not exceed ten acres, lying between an extensive Lake Erie marsh and level open farm land. There were six nestlings. Comparison with the young in the other nest led to the conclusion that these had hatched about April 18. On May 16, they were able to crawl out on limbs when approached. When the nest was visited May 23, the adults were near, but the young were not found. We believe that they left voluntarily. On the rim of the nest lay a partly plucked Yellow-throated Vireo (*Vireo flavifrons*).—LAUREL VAN CAMP, *Genoa, Ohio*, and HAROLD MAYFIELD, *3311 Parkwood Avenue, Toledo, Ohio*.

Evidence for the Former Occurrence of the Ivory-billed Woodpecker in Ohio.—The Ivory-billed Woodpecker (*Campephilus principalis*) was found years ago in Franklin County, Indiana, adjacent to the southwestern corner of Ohio, and on this basis it has been carried in the hypothetical list of birds for the latter state, on the logical assumption that formerly it must have occurred there. There have been no positive records for it, however.

Recently Robert Goslin has sent to me for identification a set of birds' bones excavated in 1940 and 1941 by H. R. McPherson of Columbus, Ohio, from the Feurt Village Site in Clay Township, Scioto County, Ohio, east of the Scioto River, and not far from the Ohio River, which marks the southern boundary of the State. The material is presumed to date back to the fifteenth or sixteenth century, since it was found at one of the sites of the Fort Ancient Culture.

Among the 24 species of birds included in this collection I was interested to find a metatarsus of the Ivory-bill (now preserved in the osteological collections of the U. S. National Museum). It appears to me that this constitutes a definite record for the former occurrence of this bird in Ohio. It is true that the Ivory-bill was considered of some value by the Indians, who without question carried the heads and bills about, using them in medicine bundles and in other ways. It seems hardly probable, however, that the foot (which was of no particular interest) would have been taken to a locality distant from where the bird was killed.

Other interesting species whose bones are found in this deposit are the Prairie Chicken (*Tympanuchus americanus*), the Passenger Pigeon (*Ectopistes migratorius*) and the Raven (*Corvus corax*). The deposit also contained remains of two other woodpeckers, the Pileated Woodpecker and the Flicker.—ALEXANDER WETMORE, *Smithsonian Institution, Washington, D. C.*

Roosting Habits of the Verdin.—For several summers I have observed the Verdin (*Auriparus flaviceps*) at Hot Springs, Brewster County, Texas. In this rough, dry country it is a common resident along chaparral-lined arroyos of the lowlands, and its compact nests are easy to find. Noting, almost invariably, an accumulation of excreta at the nest-entrance, I found myself wondering about the species' roosting habits.

Frequently during the last hour of daylight I came upon a nest with a protruding tail visible at the outer edge of the tunnel-like doorway. By cupping my hand over the nest-hole, I succeeded in capturing a bird now and then. Of five finally captured thus, all were adult. Every attempt to capture roosting birds not in such a "tail out" position failed.

At dusk on July 2, 1942, I found a nest with two tails showing in the entrance, and succeeded in capturing both birds, which proved to be young of the year. (At the same nest I had caught an adult on August 17, 1941.) The two immature birds

and the branch of granjeno (*Celtis pallida*) supporting the nest were brought indoors and placed in a cage.

During the first night the captives roosted on the twigs just under the nest. On the following night and every night thereafter they slept in the nest, tails pointed out the doorway. During the morning of July 8 they tore a small hole in the nest dome. At 10:30 that evening I flashed a light through this opening and discerned the birds sleeping side by side, each with head under scapulars and tail extending through the doorway. This was their sleeping position each night until they were released on July 12—to the excited *tschep-tscheps* of an adult pair, presumably the parent birds, that had been keeping daily vigil at a window near the cage.—LOVIE M. WHITAKER, 210 Plaza, Las Vegas, New Mexico.

An Unusual Nest of the Bronzed Grackle.—On April 16, 1941, as I was walking through an old apple orchard, a Bronzed Grackle (*Quiscalus quiscula aeneus*) flushed from a hole in one of the trees. On investigating the hole I found the Grackle's nest and four eggs. It was apparently an old Flicker hole, enlarged by decay and further excavating. The orchard was partly surrounded by large pine trees, planted many years ago as a windbreak. Several pairs of Grackles were nesting in the pine branches. I was surprised to find this one pair nesting in a hole, with so many of the pine trees they usually favor close at hand.—CLARK K. LLOYD, 2712 Hoover Avenue, Dayton, Ohio.

Snakes Destroying Birds' Eggs and Young.—Although during a period of a few years the average bird student may find many bird nests whose contents are destroyed, he rarely happens to visit a nest at the time of the destruction. I have had a number of such experiences involving snakes as the predators and list them in the order in which they occurred.

On July 27, 1930, when passing a friend's house in Battle Creek, he called me into the yard, explaining that a snake had eaten four well-grown Chipping Sparrows (*Spizella passerina passerina*) from a nest four feet from the ground in a grapevine in their yard. The snake, a Common Garter Snake (*Thamnophis sirtalis sirtalis*), lay dead beside the grapevines, and when dissected proved to contain the remains of one of the Chipping Sparrows, the others having probably jumped out of the nest the minute the snake captured the one.

On June 5, 1941, while studying birds along the bank of the Battle Creek river, in Convis Township, Calhoun County, Michigan, I found a nest and five eggs of a Prothonotary Warbler (*Protonotaria citrea*) in the hollowed end of a branch of a fallen maple tree. On June 19 at 2 P.M. I found both birds scolding a Pilot Snake (*Elaphe obsoleta obsoleta*) which was wrapped around the end of the branch with its head inside the opening that contained the nest. When killed, he was found to contain all five young of the Prothonotary Warbler, which were about two days old. The nest was only two feet from the ground, 159 feet from the river, in the bottomland area. The snake was identified by Morris Aiken of the Battle Creek Public School Museum.

While visiting the Bernard W. Baker Sanctuary in Convis Township, Calhoun County, on August 17, 1941, I heard the continued scolding notes of a Goldfinch (*Spinus tristis tristis*) on a side-hill south of the marsh, where I found the bird, a male, so interested in something that he did not note my approach until I was within three feet. The Goldfinch nest was located in a small hawthorn tree about four feet from the ground. Underneath the nest was a young bird, still unable to fly. On the opposite side of the tree was a five-foot Blue Racer (*Coluber constrictor flaviventris*), which I soon captured. With slight pressure, another young Goldfinch, the size of the one found on the ground, was forced from the mouth of the snake.—LAWRENCE H. WALKINSHAW, Battle Creek, Michigan.

EDITORIAL

The color plate with which we begin this new volume is financed largely by the proceeds from the auction, at our Urbana meeting, of a number of George Sutton's original drawings and paintings generously donated for this purpose by the artist. This plate is an important contribution to scientific knowledge and, incidentally, it will bring back happy memories to those of us who were privileged to participate in that memorable auction presided over by the forceful and persuasive James Boswell Young.

The Wilson Ornithological Club starts the year 1943 with sober prospects of rising publication costs and an increased rate of membership loss, at least among certain classes of members, such as those leaving for service overseas. Richard L. Weaver and his Membership Committee are working steadily, but they will need more help from our members throughout the country if they are to make a complete success of their task.

Members can also help by raising their own membership class. No one need hesitate to take out a Life Membership because of any apparent conflict with the War Bond campaigns, for the Club's receipts from Life Membership dues are being invested in those same War Bonds.

We are greatly indebted to Ruth D. Turner for her prompt and accurate work in preparing the index for the 1942 volume of the *Bulletin*.

We ask contributors not to try to pay for reprints in advance. It is rarely possible for an author to guess the exact amount of the bill, and his attempt, however well intended, only complicates our problem. Galley proof on articles, notes, and reviews is always sent to authors, and an inquiry is made at that time about possible reprint needs. The reprints are made soon after the *Bulletin* is published and then the type is taken down. It is therefore impossible to fill reprint orders received after the date of publication. Reprints are sent to the author by the press, usually within three weeks. Immediately afterward bills for the reprints, transportation, and tax are sent out to the authors. Finally, we remind you that there is a minimum of 100 on reprint orders. The price scale is printed inside the back cover of every *Bulletin*.

ORNITHOLOGICAL NEWS

The American Ornithologists' Union has awarded the Brewster Medal to Margaret M. Nice for her study "Life History of the Song Sparrow."

Ruth D. Turner, formerly at the New England Museum of Natural History in Boston, has accepted a position in the Zoology Department of Vassar College.

Prof. C. W. G. Eifrig, a member of our Club since 1907, has retired from active work at River Forest, Illinois, and has moved to Windermere, Orange County, Florida. He began his ornithological work in 1895 near Pittsburgh, but later moved to Cumberland, Maryland, and then to Ottawa, Canada; for the last 33 years he has been in northern Illinois. He has published extensively in *The Wilson Bulletin* and elsewhere. For 14 years he served as president of the Illinois Audubon Society.

ORNITHOLOGICAL LITERATURE ¹

THE IVORY-BILLED WOODPECKER. By James T. Tanner. National Audubon Society Research Report No. 1: xii + 111 pp., colored frontispiece and 20 pls., 22 figs. October, 1942. Paper covers. \$2.50.

We welcome the inauguration of a series of research monographs by the National Audubon Society. That very active and progressive society rightly "considers facts obtainable through scientific research the essential basis for wise policies governing the conservation of wildlife." Ornithologists had strikingly failed to secure the necessary information on this magnificent species, and so the Society itself initiated an intensive study. The extent of the previous neglect of the Ivory-bill is almost incredible. We note that: the latest and most complete study of the Ivory-bill's anatomy was published by Audubon in 1839; the only published record of the weight of an Ivory-bill was by Catesby (1731); the food contents of but three stomachs were ever saved; and neither the incubation nor nestling period had ever been recorded.

As John H. Baker says, the choice of James Tanner was a happy one. This report demonstrates clearly his energy, intelligence, and scientific attitude of mind. From 1937 to 1939 he spent 21 months in the field, traveling more than 45,000 miles and visiting 45 widely separated localities ranging from South Carolina and Florida to Louisiana and Texas. He makes little mention of the physical hardships involved, and few of his readers will realize the labor and risks of such a campaign in southern swamp forests. His thorough coverage of the published material while preparing his report is demonstrated in the accurate bibliography of 153 titles.

The report includes sections describing the bird itself, its habitat requirements and geographical distribution (with 18 maps), the history of its disappearance from most of the original range, its present numbers, its breeding habits, and its conservation. One important section is that devoted to the Ivory-bill's food and feeding habits. Naturally, since it was out of the question to collect specimens, this account suffers from the scarcity of material, but Tanner has by great ingenuity and industry done much to overcome the handicap. For example, he has even attempted (and apparently with considerable success) to analyze forests from a woodpecker's point of view, taking into account the botanical composition of the forest, the proportion of insect-harboring wood, and the insect populations. We should perhaps mention that the locality record of Moseley's Ivory-bill (which Tanner quotes from Cottam and Knappen's food habits paper) is just another example of the errors which appear with such disturbing frequency in the records of the Fish and Wildlife Service. "Bowling Green" is actually just the collector's home town in Ohio and not the Louisiana home of that Ivory-bill (which Moseley took 18 miles north of Holly Ridge, a station on the Vicksburg-Shreveport railroad).

We find little about the Report to criticize. Tanner seems to have examined but 91 of the 200 to 250 specimens which he estimates to be in the museums of this country, and yet in his discussion of plumages and molts, for example, he indicates that he was hampered by a shortage of material. The comparison of the Ivory-bill's "nesting success" (six nests) with Mrs. Nice's results on 211 Song Sparrow nests seems far-fetched. Throughout the paper Tanner uses the adjective "juvenal" indiscriminately, both in the sense that Dwight proposed when he introduced the word and as a synonym of juvenile. And finally, the price of \$2.50 on a 123-page, paper-covered, bulletin is hard to understand.

Tanner concludes that "the collecting and shooting of Ivory-bills has not been a major cause of the species' decrease, has not been as important as the destruction of the Ivory-bill's habitat by logging. But now that there are so few Ivory-bills living, the shooting of a few birds might become the final cause for their extinction."

¹ For additional reviews see pages 22 and 50.

Tanner has done a fine job, and the Audubon Society has published his report handsomely. However, the Ivory-bill is in a desperate situation. Will this report be allowed to serve as the Ivory-bill's obituary, or will conservationists follow the matter through so that state and federal agencies may act quickly enough to save the few small tracts of big timber where alone the Ivory-bill can survive?—J. VAN TYNE.

THE ROSEATE SPOONBILL. By Robert Porter Allen. National Audubon Society Research Report No. 2: xviii + 142 pp., colored frontispiece and 20 pls., 44 figs. December, 1942. Paper covers. \$2.50.

This monograph, along with that of James T. Tanner on "The Ivory-billed Woodpecker," stems from the recently established research program of the National Audubon Society. It is definitely a scientific report, though it starts with the assumption that the Roseate Spoonbill should be—yes, must be—preserved as an element in the fauna of the United States. Since this magnificent and bizarre bird is shown to conflict to a negligible degree with man's economic welfare, this pre-conception will probably not be challenged from any responsible source. Nor will many be inclined to take issue with a second assumption, that the preserve and warden system of the Audubon Society has been an effective factor in the survival of the precariously small colonies in Florida and in the growth of the population in Texas. The author makes clear his belief, however, that an overflow from larger colonies in the Antilles and in Mexico has been mainly responsible for the maintenance of the species in the Southeast and for its increase in Texas. Just how the breeding populations to the southward have affected and will continue to affect the conservation of the species in the southern United States remains to be determined by further research. In the meantime rigid care and continued vigil are still required to prevent the extirpation of the species in the United States.

The vivid enthusiasm of a bird lover is not concealed between the printed lines of description and of cautious and critical interpretation. One wonders whether Allen's unquenchable delight over the sight of spoonbills exceeded his joy in scientific discovery. Whatever its basis, his enthusiasm overcame the discomforts and loneliness of living for months with these birds and their ecological associates.

This intimate contact with the Roseate Spoonbill has enabled the author to locate and to census all extant colonies in the United States, and hence to compare present-day habitats and populations with former homes and numbers, as reconstructed by a prolonged historical study. He has determined the facts of migration, further emphasizing the dependence of the Florida and Texas colonies on the stocks of lands to the south. He has worked out the prenuptial and the mating behavior in detail. He has determined also the six plumages, in a four-year cycle of development. Food has been treated at length, from the viewpoint of food-chains and general ecological relations.

In the matter of food one might criticize the author for drawing lengthy and involved conclusions from inadequate data, for he gives stomach analyses of only five birds. We realize, of course, that the need for protection was too strongly felt to warrant a large kill for food samples, and that the author's long observations of the feeding birds and his analyses of organisms in the feeding waters furnished much data on the spoonbill's probable diet. Again one might criticize a rather sweeping conclusion as to harm done by ectoparasites, when only four birds were autopsied. The discussion on the fishes that live in the feeding waters of the Roseate Spoonbill is marred by numerous slips and mistakes.

The treatment of "limiting factors" is a fine piece of applied ecology, and is the product of much study and honest thought. The conclusion is reached that man, long the most serious enemy of the spoonbill, "is now of negligible importance as a decimating factor in the U. S. portion of the range." Several "welfare" and several "decimating" factors are analyzed. No outstanding critical factor was discovered.—CARL L. HUBBS.

THE REPRODUCTIVE CYCLES OF THE BRITISH AND CONTINENTAL RACES OF THE STARLING. By W. S. Bullough. Phil. Trans. Roy. Soc. London, Ser. B, Biol. Sci., Vol. 231, No. 580:165-246. August 31, 1942.

This is a thorough, careful study based on the examination of 786 specimens of *Sturnus vulgaris* from Yorkshire, the majority taken from communal roosts in fall and winter. Detailed accounts, illustrated with sketches and microphotographs, are given of the reproductive systems of both sexes at different ages.

"It is shown that there are differences between the sedentary British starling and the migratory Continental bird in the seasonal variations of these systems. The gonads of the first-year British and Continental starlings begin to grow in February, but the rate of growth in the British bird is greater than that in the Continental. The gonads of the adult British starlings do not regress so far in summer as those of the Continental birds, and they start to grow precociously in early autumn. The gonads of the adult Continental starlings do not begin to grow until January or February, the time when the gonad growth of the British birds is accelerated. In February and March the gonads of the adult British birds grow much more rapidly than those of the Continental birds" (p. 165).

Continental and British birds were distinguished partly by behavior, partly by banding, and partly by the state of the neck feathers, (since British birds wear off the tips by hole-exploration). Sex was told by eye-color—brownish in males, yellowish in females; by the more pointed throat and breast feathers of the males; and (when the beak is yellow) by the grey base of the mandibles in the male. With adult British Starlings the beak becomes yellow in autumn, with Continental birds not until January or February. Male Starlings were found not to breed until their second year, females in their first year.

The British Starling is markedly sedentary, aside from some wandering in summer by a proportion of the juveniles. In the fall, adult females "all appeared to be paired . . . and the surplus of unpaired males also occupied holes and staked out territories" (p. 227). Some British Starlings roost in their nesting holes throughout the year, while others frequent the communal roosts from June through December. British Starlings go to roost in holes at about the time in the afternoon that Continental Starlings leave for their roosts 15 miles distant; thus British Starlings get less light and less exercise than the Continental birds, yet their gonads develop much more precociously. The author says: "It is known that extra light in winter is capable of stimulating the gonads of starlings to precocious growth (see review by Bissonnette 1936), and it is therefore probable that, in late winter and early spring, the increase in the length of day helps to induce the growth of the gonads in both races of starlings. The variation of the external environment, however, merely helps as a superficial control to render more precise the timing of an animal's internal rhythm, a conclusion which, supported by the evidence obtained from a study of the reproductive cycle of the minnow (*Phoxinus laevis* L.), was put forward by Bullough (1939, 1941)" (p. 236).

The suggestion is made that the gonads of British Starlings seldom regress enough to allow the attachment to the nesting site to be broken. It is otherwise with the Continental birds, who "are released for the southward migration. In late winter and spring, when the gonads grow once more, the birds are induced to return to their nesting areas. Applied to birds in general, this theory, which is certainly oversimplified, means that the basis of the autumn southward migration is negative (the absence of a stimulus), and that of the spring northward migration is positive (the renewal of the stimulus)" (p. 238).

On the basis of the physiological differences between these two populations of Starlings, the author divides them into subspecies, naming the British bird *Sturnus vulgaris britannicus*. He suggests that the behavior of Starlings in this country gives evidence that both races are present. A notable paper, well planned and well executed.—M. M. Nice.

THE DUCKS, GEESE AND SWANS OF NORTH AMERICA. By Francis H. Kortright; illustrated by T. M. Shortt. American Wildlife Institute, Investment Bldg., Wash., D. C. 1942: 6 x 8¾ in., viii + 476 pp., many text figs., 36 color pls. \$4.50 (de luxe edition \$10.00).

The author of this fine manual modestly disclaims being an ornithologist, and indeed the name of Francis Kortright is probably unfamiliar to many in this field, but if he was not so recognized before, we certainly claim him as an ornithologist now. In a field noted for its profusion of handsome illustrated books, Kortright and Terence M. Shortt (also a comparative newcomer) have, at their first attempt, produced a volume which for combined utility and beauty will stand in the first rank.

There are many new features. The section on sex- and age-determination includes information that will be new to almost any ornithologist. Another section gives the weight, length, and wing-spread (in avoidupois and inches) of both sexes in each species. These were carefully compiled from a large amount of data including that in many of the large museums. In the case of the male Mallard, the weights given are based on 1,577 individuals! The excellent exposition of the "very simple and extremely important" matter of scientific nomenclature, and the explanation of the pronunciation and meaning of the scientific name of each species, will do much to win converts to ornithology from the ranks of those duck hunters who have supposed that such scientific matters would be too technical to master. The accounts of waterfowl molts and plumages are far more complete and understandable than any hitherto published. There are small maps to show the summer and winter distribution of each native species, but the scale is so small that some of them are very hard to read.

There is an extensive and well-chosen bibliography. However, some of the titles are inaccurate, and many rather incomplete, and therefore difficult to use.

The book is magnificently illustrated. A series of 36 color plates depicts, with two to five plumages each, all North American ducks, geese, and swans, and even some of the hybrids between species. Four plates are devoted to the downy young—a very attractive and intensely interesting series. Unfortunately an occasional plate in the volumes we have seen is somewhat marred by poor printing. A maximum sized image has been secured by filling the page completely with the color plate, but the slightest error in trimming results in clipping the end of a bill or tail here and there. The text is interspersed with drawings which show the characteristics of the various species as they appear when swimming, flying, standing, and sometimes in other poses. These will be very helpful except in the case of the figures of flying Mute and Whistling Swans, which have been accidentally transposed.

We can recommend this book in the highest terms to ornithologists and sportsmen alike.—J. Van Tyne.

WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been received recently:

- William H. Burt: 5 reprints
- Lynds Jones: 19 magazines
- Leon Kelso: 1 pamphlet
- Karl F. Lagler: 2 reprints, 3 reports
- Harrison F. Lewis: "The Natural History of the
Double-crested Cormorant"
- Dayton Stoner: 5 reprints
- Lawrence H. Walkinshaw: 10 reprints

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WILDLIFE CONSERVATION

Proposal to Establish Large National Park in Yukon Territory.—On December 8, 1942, the Dominion Government reserved an area of 10,130 square miles along the Canada-Alaska Military Highway, in the southwestern part of Yukon Territory, in order that it may be examined in detail and may be available in its present condition for establishment of a National Park at a later date. This area contains outstanding mountain and glacier scenery, as well as foothills that are the home of a large population of big game, including grizzly bear, mountain goat, Dall's mountain sheep, moose, and Osborn caribou.

Conservation in the National Parks of Canada Attacked and Defended.—The National Parks of Canada are set aside not only as areas devoted to recreational and educational purposes, but also as wildlife sanctuaries, where native wild animals, along with vegetation and the geological formations which contribute to what we call scenery, are to be preserved as far as possible in their natural state, with the influence of man kept to a minimum. Like most policies in a democratic country, this policy is frequently criticized and attacked, especially by persons who want the national parks to produce a maximum quantity of shootable game and who object to conservation of predators such as cougars, wolves, foxes, eagles, hawks, and owls. A recent attack of this kind is found in a paper entitled "Sabotage in the National Parks," published by W. C. Fisher in the issue of *Hunting and Fishing in Canada* for October, 1942. This author claims that "sportsmen are the only true friends of wildlife," that "animals were placed on the earth for the benefit of man," and that "the Parks officials are enamoured with the phrase 'The Balance of Nature.'" He concludes that the National Parks policy with respect to predators must be changed and suggests as a better policy, "Game shall be raised for Mankind," including the tourist, alpine climber, camera man, and sportsman.

A different view of the subject is presented by Professor J. R. Dymond, Director of the Royal Ontario Museum of Zoology, in a paper entitled "Game in the National Parks," which is published in the issue of the same magazine for January, 1943. Professor Dymond points out the need for keeping game populations within such limits that available resources can support them in good condition. He also points out that control by predators, which take the weak and subnormal, tends to improve the game stock, while control by hunters, who seek to kill the finest individuals, tends toward deterioration of the stock. He concludes: "The principle of creating and maintaining National Parks for the preservation of natural life, plant and animal, in representative areas of the different regions of the earth is steadily spreading to all parts of the world."

Publication of a third paper on the subject is promised by the management of the magazine.—HARRISON F. LEWIS.

Golden Eagles and Bighorns

"In the spring of 1940, an eagle's nest was discovered in the very heart of the lambing grounds. Two eaglets were raised in the nest and it was under continuous observation from June 1 to August 1 . . . It need only be said here that no remains of lambs or adult sheep were found . . .

"To date no case of predation by eagles has been seen by a Survey member nor has one been reported for the Crystal Creek area. The conclusion is that eagles may be exonerated of any serious blame for the decline of the Crystal Creek bighorn sheep herd." (Hones, R. F. and N. M. Frost, "A Wyoming Bighorn Sheep study," *Wyo. Game and Fish Dept. Bull.*, 1, 1942: 56.)

"Some eagles nested close to the lambing grounds. One nest was under observation from May 15, at which time the two eaglets were about ten days old, until they left the nest early in July. Pellet examinations and actual observations

during that period indicated that the eagles were feeding on prairie dogs . . . The only other item of food found in pellets or at the nest was a trace of rabbit. These observations are not conclusive, but they do indicate that, in the Tarryall Mountains, the eagle is a minor factor . . .

"No evidence of predation by golden eagles was found." (Spencer, C. C., "Notes of the life history of Rocky Mountain Bighorn Sheep in the Tarryall Mountains of Colorado," *Jour. Mammalogy*, 24, 1943: 9, 11)—F. N. H.

To the Editor of the *Wilson Bulletin*:

In the December, 1942, issue, Mr. Hamerstrom took exception to a filler which appeared in the *Minnesota Conservation Volunteer* and attempted to "reveal" the true conditions of the Minnesota caribou herd. He was particularly critical of liberating the animals from an enclosure and then opening a part of the refuge to deer hunting this past fall.

Due to excessive rainfall, it was necessary to turn the animals free, for almost all of the corral is swampy and was filled with water during the summer. The area, opened to deer hunting for eleven days this past fall, lies along the north shore of Upper Red Lake, extending eight miles in length and approximately one and one-half miles in width. It amounts to about 7,680 acres. The nearest part of open territory is about five miles southeast from the corral. In upland country this distance may seem relatively short but the strip between the corral and open area is largely muskeg and open swamp which is virtually impassible until frozen. It is not classed as caribou range, for the Soil Conservation Service technicians have mapped the area as potential waterfowl habitat. They also have outlined the suitable caribou range as extending to the north, east and west of the corral in the opposite direction from the area opened to hunting and well within the sanctuary.

During the hunting season every precaution was taken to protect the caribou. An area of 407,700 acres was maintained as an inviolate sanctuary. The boundaries of the new hunting area were posted with special signs calling the hunters' attention to the species and the penalties for killing one. Extra patrolmen were detailed to the area and every hunter they met was cautioned to be alert to prevent shooting any caribou.

The deer season closed without a single mishap to the protected species. Some of the animals were sighted, not in the newly opened area, but to the north and east of the corral. The "blunder" referred to by Mr. Hamerstrom was, indeed, good wildlife management, for if the animals had been left in the corral they surely would have perished. The deer in the newly opened territory received a reasonable thinning down and no damage was done.

The article is an example of the condition which often occurs—that of hue and cry by sincere persons not familiar with the problem and armed with only a part of the facts.

LANSING A. PARKER
Division of Game & Fish
St. Paul, Minnesota

I criticise only the deer hunting so close to the point of the caribou release. It is axiomatic that one should expect wild animals, upon release from confinement, to make extensive movements of an exploratory nature. As a corollary, one should expect these movements to include areas of unsuitable range. No one knows exactly what caribou do under these circumstances: too few transplantings have been made. The conservative policy, therefore, would have been to admit the likelihood of such a movement and to safeguard it in every practicable way, recognizing that muskeg and swamp is no barrier to caribou and that the well-meaning of most hunters is no guarantee against accidents.—F. N. Hamerstrom, Jr.

Exotic Game Birds

Ralph T. King has ably discussed the problem of exotic game birds in his article "Is it wise policy to introduce exotic game birds?" (*Audubon Magazine*, 1942, 44:136-145, 230-236, 306-310). His conclusions were:

"(1) Economically the introduction of foreign species has been and undoubtedly will continue to be highly expensive. (2) The number of well intentioned introductions that have resulted in establishment of the introduced species and have since proven to be non-beneficial if not actually injurious is equally as great as the number that have been proven to be desirable. (3) Introductions resulting in establishment always create heavier demands on both foods and coverts, may involve the introduction of new parasites and diseases, and may result in cross-breeding to the detriment of closely related native stock. Furthermore such introductions do not necessarily result in reducing the hunting pressure on diminished native species. (4) Introductions of additional animals into exhausted or deficient environments can only result in the loss of the animals and further deterioration of the environments. (5) Introduced species can and have increased to pest proportions. (6) We cannot be sure of the population behavior, food habits and degree of spread of any introduced species until *several* years after the species has become successfully established. (7) Any successful introduction must inevitably change natural associations and the native fauna to some extent. We cannot tell to what extent until the introduced species is established. (8) Unfortunately we have not taken advantage of our opportunities and as a consequence have learned relatively little about the costs and results of introductions."—F. N. H.

WILDLIFE CONSERVATION COMMITTEE

Frederick N. Hamerstrom, Jr., Chairman

NEW LIFE MEMBERS

We take this opportunity to introduce to the Wilson Club three of our new Life Members: George B. Thorp, George H. Lowery, Jr., and Bernard W. Baker. Others will be presented in subsequent issues of the *Bulletin*. We hope the Endowment and Membership Committees will keep us supplied with candidates for indefinite continuation of this series.



GEORGE B. THORP, a former professor of aeronautical engineering at the Carnegie Institute of Technology, has made a hobby of ornithology for many years. He has been president of the Audubon Society of Western Pennsylvania for the past three years; is a leader and one of the sponsors of the Pymatuning Group, whose interest centers in the Pymatuning Wildlife Refuge in northwestern Pennsylvania; is Chairman of the Endowment Committee of the W.O.C.; is a member of the A.O.U., the National Audubon Society, and the Sewickley Valley Audubon Society. He has been engaged in Americanization work in connection with refugees, under the sponsorship of the American Friends Service Committee.



GEORGE H. LOWERY, JR., is Curator of the Museum of Zoology of Louisiana State University. He received the Master of Science degree from that institution in 1936, at which time the University established a zoological museum under his direction. He was appointed Curator and later Assistant Professor in Zoology, a position which he now holds. Since the establishment of the Museum of Zoology in 1936, thousands of birds, mammals and other vertebrates have been assembled by him and his students. His chief ornithological interests are in taxonomy and distribution, particularly in relation to the lower Mississippi Valley and certain sections of Mexico. He is a member of the A.O.U., and is affiliated with the Cooper Ornithological Club and various other scientific organizations.



BERNARD W. BAKER is a former dairy farmer, jack of all trades, successful chain store owner and operator, whose hobbies are ornithology, running a seventy-five acre bird and wildlife sanctuary in Ottawa County, Michigan, taking kodachrome slides of bird and wildlife, and lecturing to nature groups and schools. He is a member of the A.O.U., the National Audubon Society, and the Michigan Audubon Society.

ANNUAL REPORTS

REPORT OF THE TREASURER FOR 1942

Despite rising prices and the difficult conditions which have caused the loss of many members, our balance is larger than a year ago. This is due to the generous donations of time and energy by the editors, secretary, and membership chairman, and to the constant economies practiced by these officers as well as to the loyalty of the members. The auction of paintings donated by President Sutton was responsible for \$159.50 of our present balance.

Balance as shown by last report dated Nov. 22, 1941	\$ 42.04
<i>Receipts</i> Nov. 17, 1941 to Dec. 31, 1942	
Dues:	
Associate	1,185.35
Active	970.09
Sustaining	200.00
Subscriptions to the <i>Wilson Bulletin</i>	99.00
Contributions	325.41
Sale of back numbers of the <i>Wilson Bulletin</i>	179.00
Miscellaneous Receipts	5.10
	<hr/>
TOTAL RECEIPTS	\$3,005.99

Disbursements:

The <i>Wilson Bulletin</i> : printing, engraving, mailing	\$2,001.42
Editor's expense: postage, mailing	60.09
Secretary's expense: stationery, postage, clerical aid	159.10
Treasurer's expense: postage, printing, clerical aid	79.65
Membership Committee expense: postage, printing	151.83
Annual meeting of 1941: programs, badges	122.02
Bank charges	47.18
Bad checks returned	17.03
Subscription refunds on erroneous orders	12.70
Miscellaneous: reprints, purchase of old <i>Bulletins</i>	20.49
TOTAL DISBURSEMENTS	\$2,671.51
Balance on hand in St. Anthony Park State Bank,	
St. Paul, Minnesota. Dec. 31, 1942	\$ 334.48

ENDOWMENT FUND

The endowment fund made substantial increases during the year as a result of the activities of the Endowment Committee, and because we received during the year a bequest, the first during the present treasurer's term of office. The income from the endowment fund is used entirely for improving *The Wilson Bulletin*.

Bonds on deposit in safety deposit box, St. Anthony Park	
State Bank, St. Paul:	
U.S. Postal Savings Coupon Bonds dated July 1, 1935.....	\$780.00
U.S. Savings Bonds, maturity value May 31, 1945	
\$900.00, purchase value	675.00
U.S. Savings Bonds, maturity value Aug. 1, 1948	
\$1,075.00, purchase value	806.25
Balance in savings account, St. Anthony Park State Bank,	
Oct. 1, 1941	142.26
<i>Received during year:</i>	
Interest on U.S. Postal Savings Coupon Bonds	39.00
Interest on savings account	3.79
Contribution	5.00
Bequest from estate of Marcia Clay, deceased member	100.00
New Life Members	525.00
Balance on hand in savings account, St. Anthony Park	
State Bank, St. Paul, Minnesota, on Dec. 31, 1942.....	\$ 815.05
Total endowment fund, savings account and bonds at purchase	
value	\$3076.30

Respectfully submitted,

GUSTAV SWANSON, *Treasurer*

December 31, 1942

REPORT OF THE SECRETARY FOR 1942

Once again the orderly procedure of the Wilson Ornithological Club has been interrupted by war. The annual meeting for 1942, scheduled for Ithaca, New York, was postponed, nor have any definite plans been drawn for further meetings until after the emergency is over.

The Club closed its year (as of December 1) with a membership of 1,054. During 1942 we lost 293 members and gained 166 new ones, the net loss being 127 members. The greater part of this loss is, the secretary believes, directly attributable to the war. We now have more than a hundred of our members in the armed services, and more are constantly being called up. Another factor contributing to the decrease in membership was the omission of the annual meeting. These meetings have always been important in attracting new members.

As in other recent years the Club owes a heavy debt of gratitude to Richard L. Weaver, and to the members of his Membership Committee. They have been unflagging in their work of solicitation, and fertile in devices for finding new members. Largely through their efforts, our membership has grown considerably in New England and in other eastern states.

Faced with the necessity of conducting the Club's election and other business by mail, the president, George M. Sutton, appointed a nominating committee consisting of Margaret M. Nice, Chairman, H. L. Stoddard, and Jesse M. Shaver. This committee published its report in the December *Wilson Bulletin*, nominating a slate of candidates as follows:

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

All members of the club were invited to vote for officers, either from the suggested slate, or as they otherwise chose. All ballots received by the secretary have been in ratification of the committee's slate, and the election of the officers named above is hereby certified. The Club's constitution places the responsibility for electing an editor on the Council; this election has been held, and has resulted in the unanimous selection of Josselyn Van Tyne to serve during 1943.

Late in the year George M. Sutton was commissioned a captain in the United States Army, and has been forced to give up temporarily the active direction of Wilson Club affairs. In his absence S. Charles Kendeigh becomes acting president for 1943. O. S. Pettingill, Jr., automatically becomes acting first vice-president. Another member of the Council, Burt L. Monroe, is also now in active military service.

The Secretary wishes to express his sincerest thanks to those who have helped him, and have borne with his many shortcomings during his first year in office. It has been a trying period, and there have been many delays, seemingly unavoidable. He hopes sincerely that every member of the Club will feel a personal interest in maintaining the membership of the organization, and in contributing to its continued progress.

Respectfully submitted,

March 2, 1943

MAURICE G. BROOKS, *Secretary*

REPORT OF THE ENDOWMENT FUND COMMITTEE

During the past year this newly constituted committee, after preliminary discussions, came to substantial agreement as to the nature of the campaign to be conducted for additional endowment, and laid plans for a long range effort. An initial statement was made in the June *Bulletin*; and as it was generally considered that conditions did not warrant sending out a letter to the entire membership on the subject, a fuller statement with a more direct appeal was inserted in the December *Bulletin*.

In the meantime the membership was apportioned on a geographical basis to the members of the committee for making personal appeals; and while this work has as yet only begun, and has hardly touched some regions, nevertheless at least six new Life Memberships have come in. As was to be expected, the committee's work has suffered by reason of the war. One of its members has been called to service, others are finding less time for non-war work, and it is proving more difficult to interest the membership in such matters. It is hoped that as members pay their 1943 dues they will give serious consideration to transferring to the Life Membership class.

Respectfully submitted,

February 26, 1943

GEORGE B. THORP, *Chairman*

REPORT OF THE ILLUSTRATIONS COMMITTEE

The present chairman took office in January, 1942, and the following members agreed to serve on the committee—Roger Peterson, Karl Maslowski, Richard Grossenheider and T. M. Shortt.

The exact functions of the recently formed Illustrations Committee were very nebulous, and the committee's operation this year has reflected this uncertainty. It is sometimes difficult for such a widely dispersed committee to function quickly enough to provide the answer to problems which arise late in the editing of a given *Bulletin*. The committee, however, has been able to be of some assistance to the editor. We aided in securing illustrations for the September issue of the

Bulletin. Some illustrative materials for other issues were submitted to the chairman for criticism, and ideas have been exchanged with the editor regarding illustrations in past issues. A list of artists and photographers who have offered materials for use as illustrations in the *Bulletin* has been compiled.

The committee suggests that a file of the species of birds for which various artists or photographers have illustrative material available for use in the *Bulletin* would be of value to the editor. The compiling of such a file would be a constructive function for succeeding Illustrations Committees.

Respectfully submitted,

February 15, 1943

W. J. BRECKENRIDGE, *Chairman*

REPORT OF THE COMMITTEE ON AFFILIATED SOCIETIES

At the 1941 annual meeting the affiliation of the Inland Bird Banding Association, the Virginia Ornithological Society, and the Georgia Ornithological Society was formally completed. The Wilson Club heartily welcomes these organizations to affiliation and believes that the association will be of mutual benefit.

The matter of affiliation with our organization was referred to committee by the Wisconsin Society for Ornithology at their annual meeting in April, 1942. A vote will be taken at the coming annual meeting in April at Waukesha.

The committee will welcome any suggestion for the development of affiliation activities and the names of groups that might be interested in affiliation.

Since the annual meeting of 1941 Burt L. Monroe and George H. Lowery, Jr., acted successively as chairman of this committee, but the exigencies of war and other matters forced them to relinquish their duties.

Respectfully submitted,

February 12, 1943

GORDON M. MEADE, M.D., *Chairman*

THE WILSON BULLETIN PUBLICATION DATES

The actual dates of publication of the four numbers in 1942 were: March 23, June 22, September 23, December 31.

TO OUR CONTRIBUTORS

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

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

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

BIBLIOGRAPHY. Literature cited should ordinarily be listed at the end of articles. These citations should be complete and references to them in the text should be made by the year of the citation and the exact pages referred to.

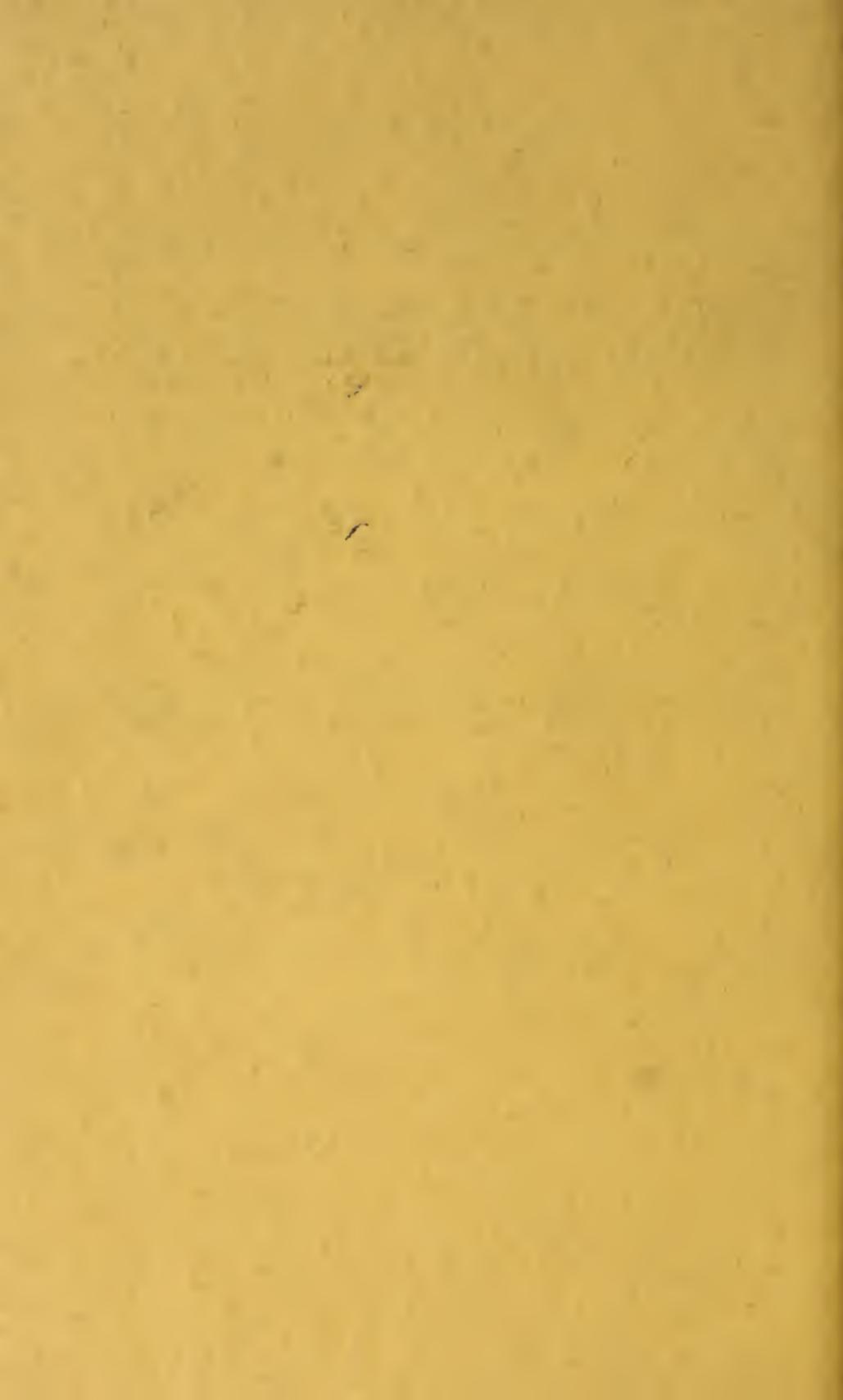
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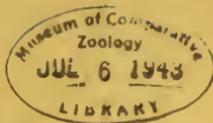
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The Wilson Bulletin



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Ann Arbor, Michigan

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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—George Miksch Sutton, Cornell University, Ithaca, N.Y.

First Vice-President—S. Charles Kendeigh, University of Illinois, Champaign, Illinois.

Second Vice-President—Olin Sewall Pettingill, Jr., Carleton College, Northfield, Minnesota.

Treasurer—Milton B. Trautman, Stone Laboratory, Put-in-Bay, Ohio.

Secretary—Maurice Brooks, University of West Virginia, Morgantown, West Virginia.

Editor—Josselyn Van Tyne, University of Michigan, Ann Arbor, Mich.

Associate Editors—Margaret M. Nice and F. N. Hamerstrom, Jr.

Membership dues are: sustaining membership, \$5.00; active membership, \$3.00; associate membership, \$2.00 per calendar year.



Minneapolis, 1903

Photo by Thomas S. Roberts

WOOD THRUSH

THE WILSON BULLETIN

A QUARTERLY MAGAZINE OF ORNITHOLOGY

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Vol. 55

JUNE, 1943

No. 2

A NESTING STUDY OF THE WOOD THRUSH¹

BY HERVEY BRACKBILL

IN Baltimore, in 1942, a color-banded pair of Wood Thrushes (*Hylocichla mustelina*) was watched for 75 hours during two nestings. All of the watching was done openly, from distances of 25 to 50 feet, the birds showing no hesitancy about their affairs.

MIGRATION AND DISTRIBUTION

Arrival and departure. The male took up territory with loud song early on the morning of April 29, the first day on which Wood Thrushes were noted in his part of the city; he was color-banded the same morning. The female, a partial albino which it would have been impossible to overlook, was first noticed on the afternoon of May 2; she was then already in company of the male and was color-banded the same day. The male was last seen July 20 and the female July 26; the Wood Thrush, as a species, was present through September 16.

Habitat. Resler (1891:106) stated 50 years ago that at Baltimore the Wood Thrush "frequents shady woods, especially near the banks of a brook or small river" and "appears to be not so well known as the majority of our other songsters, in consequence of being more solitary and shy." Weaver (1939:16) likewise stresses dampness of woodland habitat at Ithaca, New York; notes that undergrowth and saplings also seem to be necessary; and mentions an "increasing tendency" to dwell about occupied houses "in the vicinity of gorges, streams, woods, or damp places."

Dugmore (1900:169), however, found "damp or dry places . . . indiscriminately chosen" for nesting in the neighborhood of New York City, and Cooke (1929:65) found the birds much less shy, reporting that in the region of Washington, D.C., "they now nest freely about lawns in the suburbs as well as in the woods." Chapman (1940:413) also places them on "well-shaded lawns."

My own observations of the last decade in Baltimore accord with those of the latter group of writers. Shrubbery or undergrowth does, however, appear to be essential—as cover for newly-fledged young.

¹ Grateful acknowledgment is made to Mrs. Margaret M. Nice for criticism during the preparation of this paper.

But I have not found the species restricted to the immediate vicinity of streams, nor have I found the woods which it inhabits to be more moist than others. In contrast to the nests mapped by Weaver (1939:17), of which the one farthest from water was only 150 feet away, the first nest of my thrushes was 800 feet from water (except for a bird bath), and other Wood Thrushes nested at even greater distances; song is common every summer in suburban neighborhoods 2,000 and 3,200 feet from water.

The habitat of my birds, 350 feet above sea level, was a block in northwest Baltimore that is lined on three sides by detached houses; on the fourth side a large vacant lot runs in deeply. That lot and most of the back yards bear a close stand of oaks—chiefly white oaks (*Quercus alba*)—70 feet tall, with also a huge elm, a smaller beech, and two or three mulberries. There are a few isolated trees between houses, and oaks in most of the front yards. The outer half of the vacant lot is heavily weed-grown, and practically all of the yards contain more or less shrubbery.

NESTS

Nest sites. Despite the comparative wildness and privacy offered by the well-wooded heart of this block, the thrushes' nests were built in trees that stood between, and close beside, houses. The second nest was 90 yards north-northeast of the first.

The first nest was placed 17 feet up in a 50-foot beech (*Fagus grandifolia*); it was set upon the base of a horizontal fork 10 feet out from the trunk, and was 10 feet from the side of a house. The second nest was 13 feet up in a scraggly 16-foot tree of heaven (*Ailanthus altissima*); it was set amid four new shoots which rose steeply from the tip of an old stem, and was $6\frac{1}{2}$ feet from the side of a house.

Building and laying. I saw none of the building or laying; incubation of three-egg clutches was under way in both nests when they were found.

Weaver (1939:16) suggests that the female chooses the nest site,² and reports a building time of 5 days. Dugmore (1900:169) gives the incubation period as 12 days. Using those figures, assuming that the eggs were laid on successive days and that incubation began after the laying of the second egg, and calculating back from the hatching dates of May 30 and 31, it appears that work on the first nest began about May 13, 11 days after the female's arrival in the territory.

Similar calculations indicate that the second nest was begun on the eighth day after the first brood was fledged, and that the first egg of the second set was laid on the thirteenth day. Weaver (1939:22)

² My color-banded male has returned in 1943, but he has a different mate: a normally plumaged bird, so far unbanded. Nevertheless, his nest is near completion only 6 inches from the site of his first-brood nest of 1942. This indicates strongly that the male selected this site. All of the building that I have seen, however, has been done by the female.

observed a fledging-to-egg interval of 16 days for one pair of Wood Thrushes at Ithaca.

INCUBATION

Amount. The eggs were incubated entirely by the female, who was on the nest for 78.0 per cent of the 940 minutes that first-brood incubation was watched and for 80.3 per cent of 1,014 minutes at the second nest. The bird's night term on the nest was about $9\frac{1}{4}$ hours. Thus the eggs were covered for approximately 87 per cent of the day's 24 hours.

Twenty-three complete sittings observed at both nests ranged in length from $7\frac{1}{4}$ to $58\frac{1}{2}$ minutes; 11 at the first nest averaged 31 minutes, 12 at the second nest averaged 27. Forty-one intervals off both nests ranged from one to 16 minutes; 22 at the first nest averaged $8\frac{1}{2}$ minutes, 19 at the second nest averaged $6\frac{1}{10}$.

Among sittings not seen in their entirety were one unfinished at the end of 70 minutes on May 28, the second day before the hatching of the first brood began, and one unfinished at the end of 76 minutes on July 6, the day before the hatching of the second brood began. These suggest especially close sitting during the last days of incubation. During a 90 minute observation period on July 5, however, sittings were of only normal lengths.

During rain. The female was once watched at incubation in the scantily-leaved ailanthus during a terrific downpour for 18 minutes, followed by a drizzle for 10. Three times in the first four minutes she half rose and then resettled herself, apparently adjusting to the torrent. For the first 13 minutes she held her head up at a 60-degree angle from its normal horizontal position, possibly to compress the plumage of the nape and so shed more water. After that she sat normally.

During high wind. While incubating in the spindly ailanthus tree the female was also watched for 80 minutes during a period of strong puffy winds. The puffs now and then carried the nest, atop the slight and almost vertical stem, over an arc of from three to at least five feet; twice the nest was carried so far that it tilted downward at 45 degrees, and once it almost stood on edge.

The lesser puffs did not seem to inconvenience the bird; she even rose during two of them and stretched her wings and legs. But two of the three extreme swings appeared to throw her off balance: she stepped out to one of the supporting shoots while the tilt was greatest, and then back on again. She moved unhurriedly, and it seemed each time that the eggs must spill before she returned to the nest.

Male's activities during sittings. During the female's sittings on her first clutch the male usually occupied himself out in the territory, foraging, singing, preening, or just idling. Two trees on the edge of the oak grove, 75 and 85 feet north of the nest-beech, were favorite perching places, no doubt because they commanded a clear view of the beech

and so enabled him to see when the female left to feed. For it was usually only upon her departure that he went to the nest to stand guard. A few times, too, he kept his guard from these oaks.

Not infrequently, though, the male spent some time in the nest-tree itself while the female was on these first-brood eggs: periods that ranged from a few seconds to almost half of the sitting. During these periods he might preen a bit, or simply stand idle, but was only once observed to sing (for seven minutes of a nine-minute stay).

The male's activities during the female's second-brood sittings differed in two ways: he was still feeding the first-brood young during the first week of incubation and, even after he had become free of that task, he spent no time in the nest-tree with the female. Since he did once perch for five minutes on the roof-edge some yards above the second nest, it may be that this change in behavior was not only part of a general decrease in attentiveness during the second nesting but was due in some degree to the smallness of the ailanthus; in the beech he had usually perched 10 feet away from his mate, and no such distance was possible in the ailanthus.

His favorite perches during second-brood incubation were 50 feet north and 90 feet south of the nest; the first commanded a view of the nest, the second did not.

Male's activities between sittings. When the female left the first-brood nest to forage, the male almost invariably kept guard over it, usually from the rim of the nest or some perch in the home tree. Sometimes he sang during part of his watch—twice he sang half a dozen phrases while standing on the nest-rim, and another time sang for two minutes while standing just beside the nest. During only one of the female's 22 absences while this nest was under observation was the male neither seen nor heard.

At the second nest he stood guard during only 12 of the female's 19 observed absences. In doing so during 5 out of 8 while he still was feeding first-brood young he set a surprisingly good record; however, after becoming free of feeding duties he maintained only that reduced ratio, guarding during 7 of 11 absences, so that here, too, a decrease in attentiveness appears. Another difference in behavior was that he never sang while on guard in the second nest-tree, although he did sing a few times from other guard stations nearby.

Hatch. Of the first clutch, one egg hatched May 30 and the other two May 31. The second set of three hatched on three successive days, July 7 to 9. The hatching hour was determined for only one egg (the last one to hatch of the first set): 2 hours 17 minutes after sunrise, at 6:59 A.M. The female was sitting at the time, and she flew away south-westerly with half of the shell; three minutes later, while she was still away, the male alighted at the nest, made a feeding, and then carried the other half of the shell away northward.

BROODING

Amount. The female alone brooded the young. She did so on every day of their nest life, and also at night—whether throughout every night was not determined, but the persistence of her diurnal brooding makes that seem probable.

She covered her first family for 62.8 per cent of 641 minutes' observation, during which the temperature range was 61° to 85° F. and the skies varied from clear to misting. She covered her second family for 45.5 per cent of 610 minutes' observation; mere attendance, during hot weather, raised her total time at this nest to 72.7 per cent. The temperature range during these observations was 73° to 95°, the skies clear.

There was no progressive daily decrease in brooding at the first nest, nor any clear correlation between weather and amount of brooding. These statements also hold for the second nest, except at temperatures of 93° and above.

At 93° and above, both the female and the nestlings showed discomfort by holding their bills open more or less of the time, and the female did almost no actual brooding but simply stood for 46.5 to 85.0 per cent of the time on the nest's rim or on a branch beside the nest—but, *curiously enough, never on the sunward side, where she would have shaded the young.* On some days this behavior was continued beyond the period of extreme heat—until the temperature had fallen as low as 88°.

FEEDING

Sharing of work. Both parents fed both broods of young both in and out of the nest, but the male fed them much more often than the female. He made two-thirds of the feedings while each brood was in the nest, and almost all the observed feedings after each brood left the nest.

Length of day. I observed when second-brood feedings started on one morning (at 4:27 A.M., 24 minutes before sunrise), and how late they lasted on one evening (until 7:42 P.M., 8 minutes after sunset), which would suggest a feeding day of 15¼ hours. Both observations were made in clear weather.

Rate. During 826 minutes that feedings were watched at the first-brood nest, 120 trips were made with food: 78 by the male, 40 by the female, and 2 by an undetermined parent. At least five times the male fed two nestlings on one visit, and at least three times the female took part of the food he brought and fed an extra nestling. Counting 128 feedings, then, the average interval was 6.4 minutes, and the rate of feedings was 9.3 per hour for the brood of three.

During 813 minutes of feedings at the second nest, 61 trips were made: 42 by the male, 16 by the female, 3 by an undetermined parent. The male at least twice and the female once fed two nestlings on one

visit. Counting 64 feedings, the average interval was 13 minutes for this brood of three, a rate of 4.7 feedings per hour—just half the rate for the first brood.

No steady increase in feedings from day to day was noted at either nest.

Despite the difference in their observed feeding rates, with no perceptible difference in the size of meals, the second brood left the territory when 10 to 12 days old, the same age at which the first brood left the nest—equivalent acts, since the first brood obviously could have been led away at once had not the second nest held the parents to the territory.

Male's feedings. Because the female brooded so much, she was usually on the nest when the male arrived with food. At the first nest the female generally stayed during the feedings, and it was not unusual for the male to make two or three trips during single sittings. At the second nest, on the other hand, the female almost always flew away as soon as the male arrived.

When the female left the first nest upon his arrival, the male sometimes kept guard until her return, as he had done when there were eggs, but he was never seen to keep guard for the full interval after a second-brood feeding. At both nests he occasionally stood guard during just a part of the female's absence, then disappeared, and at both he occasionally made repeated feedings—as many as five—while she was away. Now and then he made two feedings before beginning guard duty at the first nest.

Female's feedings. At both nests the female made her feedings almost exclusively upon returning from her own meals to resume brooding. At the first nest she brought food on almost all of those returns; at the second nest, on less than half of them. Not until the latter part of each brood's stay in the nest did she occasionally make one feeding, then fly directly away to find more food.

Female "trims" food. On the first few days of the nestlings' life the female took some pains to see that their food was readily digestible. She herself gave them only caterpillars and very small insects, and she kept an eye on the male's offerings. If he, too, had brought a caterpillar or particularly small insect she let him feed the young at once, but when his catch was an insect of any size, she picked off, and herself ate, such parts as the head and wings before rising and letting him feed the young. That procedure was seen on both of the first brood's hatching days, and again on the day the birds were three and four days old. It was seen once on the day the second brood was four to six days old.

On June 30, which was about the sixth day of second-brood incubation, there occurred an incident that seemed to be an anachronistic instance of food "trimming." While the female was sitting, the male alighted beside the nest with a caterpillar. The female arose, dabbed in the nest for some seconds, then in accordance with normal behavior

flew away to forage. Still holding the caterpillar, the male stood guard for 11 minutes. Then as the female returned he moved slightly so as to face her squarely and, after she had again used her bill briefly in the nest, she pulled the head off the caterpillar and ate it and immediately the male swallowed the remainder. This incidentally, was the only time that a caterpillar was seen to be trimmed.

Feeding troubles. Food which one nestling could not or would not swallow was taken from it and given to another bird. A caterpillar had been brought to the nest by the male. When it remained partly visible in the mouth into which he stuffed it, the watching female pushed or pulled at it several times. Then, that youngster still failing to swallow it, the male withdrew it and fed it to another.

On two other occasions parents misjudged the swallowing abilities of their young. The male once placed a mulberry in a nestling's mouth crosswise and had to pick it up and replace it twice before getting it in lengthwise so that it could be swallowed. Again, one adult (I believe the male) of a pair crossing the study territory with young tried three times to jam into the mouth of one fledgling a cherry too large for it even to hold, and only after these repeated failures began tearing the fruit to pieces and feeding it that way.

Out-of-nest feedings. After the young had left the nests, feedings were seen as follows: First brood: by the male, 28, of all three birds; by the female, 2, of one bird. Second brood: by the male, 10, of two birds; by the female, 2, of the third bird.

In addition, on the ninth day after her first brood left the nest, the female was once seen to feed one of two strange juveniles which with their parents had come into the territory four days earlier.

Posturing rare. Only once was one of the fledglings noticed to flutter its wings when fed. It was then 21 or 22 days old, and it hurried across a lawn toward the male with head thrust forward, bill open, and wings fluttering. A juvenile of the trespassing family likewise was seen just once to flutter when fed. No such behavior was seen while the young were in the nests.

Nature of food. Distinguishable food given the young during their nestling days was: hairless caterpillars, earthworms, red mulberries, white mulberries. Distinguishable food after they left the nest was: Japanese beetles, white grub, earthworm, hairless caterpillar, red, white and unripe mulberries.

NEST SANITATION

The nestlings' feces were almost always eaten by the parents, but a few times were carried away. When the female remained at the nest through feedings by the male, he did not wait for the excreta to appear.

The two or three occasions on which excreta were carried away—by both parents—all fell during morning twilight, although this was not the usual manner of disposal at that time of day. During my only

period of evening twilight observation, all excreta were eaten. At a nest of Robins (*Turdus migratorius*) which was studied sketchily, the one time out of six that excreta were carried away instead of being eaten also fell during morning twilight.

THE YOUNG

Fledging. All of the first-brood young left the nest June 12, when they were 12 and 13 days old. All of the second-brood young left the nest prematurely, upon being banded July 17, when they were 8 to 10 days old.

Flight powers. I did not see the young birds' very first flights, but on its initial day out of the nest one of the first-brood young made a flight of about 25 feet from a low bush to a perch 10 feet up in a tree. Two days later this brood was flying strongly. A juvenile of another pair flew 50 feet on a level course on its first afternoon out of the nest; that appeared to be the extent of its powers.

Habitat. On their first day out of the nest the first-brood young resorted to bushes, perching about three feet above the ground. Two days later they were found in trees, and positions 8 to 15 feet above the ground remained the rule until a week later when they began to do some of their own foraging. Thenceforth they divided their time between trees and the ground.

The second-brood young also showed the tendency to get above the ground. Having left the nest before they could fly, these birds were unable to get up into bushes, but on their second day at large they began to perch on stones a few inches high, and on spots a few inches up in fallen bush, which they could reach by climbing.

Dispersal. While entirely dependent, the fledglings whenever they could be found were scattered over the territory 28 to 60 yards from each other. After they began to do some of their own foraging, any two of the three first-brood birds might be found travelling together, either by themselves or in train of a parent.

When the young finally left the nesting territory they appeared to do so singly. Two first-brood birds remained four days longer than the third and then vanished seven hours apart. Two second-brood birds left something more than two hours apart, the third not until a day later; the first of these three and the adult female disappeared simultaneously and probably together, for the female was attending this bird when last seen; the male and the third juvenile likewise vanished at the same time; I have no idea whether the middle youngster, which had meanwhile disappeared, went over to the departed female's care, or was still under the male's and merely undiscoverable.

Period of dependency. At least one of the first-brood young was doing some of its own foraging by the age of 20 days, and all were by the age of 23; one still was fed when 31 or 32 days old, and the others

at least as late as 25 to 28 days. Last seen in the territory when 28 to 32 days old, all of the first brood presumably were independent when they left the area.

NUMBER OF BROODS

Bailey (1913:351) states that "sometimes" two broods are reared by the Wood Thrush in Virginia. Weaver (1939:22) reports two broods raised by a pair at Ithaca, New York. Two seem to be the rule at Baltimore; Resler (1891:106) so judged from late dates for newly-fledged young, and not only did the subjects of my study raise two broods, but the color-banded male of a neighboring pair which fledged birds in mid-June was still casually observed through July 29, and in song through July 26, dates which suggest that he also nested again.

Weaver, watching a marked pair of birds, found as I did that the same ones remained together for the second nesting.

TERRITORY

The initial territory was practically identical with the area described under *Habitat*. It included all of that city block except one edge, where paved driveways and a comparatively close placing of buildings reduced the amounts of lawn and shrubbery. This territory was just about 100 yards square. Other Wood Thrushes nested in all of the surrounding blocks; the one other nest that I searched out was a first-brood one 80 yards south-southeast of the study pair's first nest.

Between the two nestings there appeared to be a slight extension of territory northward, and when the second nest was built on the north edge of the original territory the birds made a pronounced extension in that direction, the neighboring thrush on the north having apparently moved away. The new territory was not determined precisely, but the birds—freely crossing a paved street—were seen to go at least 75 yards northeast of their second nest, while they also held onto the heart of their original block. Their final territory, therefore, must have been something like 125 x 100 yards.

These were suburban territories, then, of about 2 and 2½ acres; Weaver (1939:18) found territories in stream-side woodland to range from ½ acre to 2 acres.

Other birds nesting within these territories were: a number of pairs of Robins, a number of pairs of Starlings (*Sturnus vulgaris*), some English Sparrows (*Passer domesticus*), a pair of Catbirds (*Dumetella carolinensis*), a pair of Blue Jays (*Cyanocitta cristata*), and almost certainly a pair of Chewinks (*Pipilo erythrophthalmus*).

During both nestings there were innumerable encroachments upon territory by other Wood Thrushes. The interlopers used a bird bath, foraged, and sang on the edges of the study-pair's land, and usually with impunity since the nesting birds could not be everywhere at once. The outstanding invasion was one made between broods by another pair

with two semi-dependent young; this family stayed in the territory for five days and roved over practically every part of it. One of that pair, apparently the female, was a color-banded bird.

The nesting female was seen to defend territory twice and the male four times. On the other hand, the female once allowed a strange Wood Thrush to perch for half a minute and utter some little calls only three feet below the nest on which she was incubating her second set of eggs; she once foraged peaceably near the "female" of the trespassing family, and, as already noted, she once fed one of that trespasser's young. The male also once tolerated this "female," though he defended territory against its mate and one of its young.

The female's first defense of territory was seen May 10. She flew at a stranger on the ground a few times and then pursued it mildly as it withdrew from the territory. Her other defense was seen July 4: a stranger appeared on the ground 15 yards from the nest, and the female flew off her eggs with a burst of *quit* calls; she then hopped in pursuit, uttering at intervals a short explosive cry that had a musical quality and suggested rudimentary or vestigial song. About 20 yards from the nest, although the stranger was certainly still in the territory, the female turned back and began foraging; the other bird then disappeared.

Three of the male's four defenses were made against the trespassing family in the period between the two nestings. Once he flew at the supposed male and chased it out of the territory; once he seemed to be satisfied when by hopping toward this trespasser he made it retreat a short distance, for he himself thereupon flew away in the opposite direction. The other two defenses were more interesting, one because it seemed to be made against a juvenile, and the last because it was a battle of song.

In the case of the juvenile, the study male was in a mulberry tree when the "female" trespasser and her two young appeared on the ground below. After a minute and a half the male flew at the little group, and one of the juveniles fled. The other two birds paid no attention to the attack, and the study male then began to forage peaceably only a few yards from them.

The battle of song lasted seven minutes, and the nesting male was victorious. It occurred the morning of July 1, while the female was sitting on her second set of eggs. Thirty yards south of the nest the male was singing intermittently: song which at this date was no longer first-class, but rather weak in volume and slightly slow in pace. For 10 minutes he sang, then he changed to a variety of calls for half a minute, then he disappeared, and just as he did so a strange adult was noticed on the ground beneath his tree, and one of the study male's first-brood juveniles in another tree nearby. Soon the stranger flew up near the juvenile. In a little while the nesting male returned. He fed his offspring, then darted at the stranger, who fled to a tree some distance southwest, giving several phrases of song on his way. The nester, after

his little dash, alighted again near his juvenile and launched into loud, fine song. Almost at once the stranger also began singing loudly. At that, the nester moved to a tree nearer him; and when, after some minutes, the stranger made a slight advance, the nester also moved forward another short distance, so that finally the birds were singing only 8 or 10 yards apart. Seven minutes after the struggle by song began, the stranger apparently admitted defeat by turning silent, and presumably he flew away—he had been hidden by foliage at the last. The nesting male sang on for a quarter-minute more, then returned to his normal affairs.

These Wood Thrushes were very tolerant of other species in their nest-trees. While the female was sitting on her first set of eggs, Starlings three times, English Sparrows four times, and a Robin once, were seen to spend from a few seconds to several minutes in the beech without being molested. Some of those birds were in far parts of the tree, as much as seven yards from the nest, but others were only one and two yards from the sitting bird; also, some of them called, and scolded, and the Robin sang for a minute and a half. Likewise, while she was brooding her first nestlings the female permitted a couple of English Sparrows, a Starling and a Catbird to enter the tree. Once during the second nesting, while both Thrushes were absent from the tiny ailanthus tree, a Brown Thrasher (*Toxostoma rufum*) spent some seconds preening only two or three yards from the eggs without attracting either parent.

No such hostility to Robins as Weaver reports (1939:19) was shown by these Wood Thrushes; Robins nested within about 50 feet of both Wood Thrush nests, and no clashes were seen. The only birds of other species toward which hostility was displayed were a Blue Jay and a Purple Grackle (*Quiscalus q. quiscalus*), and these had not entered the nest-trees nor made any move to do so. On the first brood's last morning in the nest the female interrupted her covering of them when a Jay appeared, foraging and calling, in a tree 25 yards away. She flew to a wire near that tree; soon the male also appeared, and both began steady calls of concern; then the male flew into the Jay's tree and continued his calls there. Some Robins and a Catbird were attracted, and they joined in the scolding. None made any attack, however, and after three minutes the Jay flew away of its own accord. In contrast, on the second day of the second-brood hatch, a Jay which appeared briefly only 10 yards from the nest was engaged by a Robin, but the female Wood Thrush continued to sit and the male did not appear. The Grackle was attacked by the male when it appeared on the ground 10 yards from the second nest, which then held young 4 to 6 days old; the Thrush flew at the Grackle several times, and in a minute or two the Grackle went away.

VOICE

MALE. The male sang regularly from his arrival on April 29 through the morning of July 8, which was the second of the three days of second-

brood hatching. After that, he was observed to sing only July 12 and 15, and then only a few poor phrases. Other Wood Thrushes sang with considerable regularity as late as August 2; the last song was heard August 15. Weaver (1939:20) states that at Ithaca "there was song in the evening only, after the young had left the nest"; there was song in my bird's territory every morning of the period between broods, and the singer was once searched out and confirmed as the breeding male. Other notes given by the male were:

Cheuh-heuh-heuh-heuh. The commonest call; sometimes one or two syllables longer or shorter; unaccented or the last syllable slightly accented. Apparently the call which Weaver writes "Trrrrrr." Used, as she records, to indicate uneasiness, and also apparently as a location note.

Strings of as many as five "quit's." These are the *pit* and *quirt* notes to which Chapman (1940:413) and Weaver (1939:19) give opposite meanings, and which seem to vary slightly in sound only because of differences in force of utterance. Sometimes given calmly, and the meaning then not clear. Usually given very loudly and excitedly, and then they indicated great distress and served as a battle cry and a call for aid.

Heeh. Always given singly. Possibly denoted excitement. This apparently is the "squeaky whistle" listed by Weaver, but it was never used during my observations to urge the female off the nest or to urge the young to eat, as noted in the Ithaca study.

A low-pitched rattle or trill varying in length. Meaning unknown. Given three times as the male flew from the nest-tree: twice upon the female's return from a foraging trip, ending his guard duty; once upon his departure seven minutes after she had returned from foraging. On one of the occasions the nest held eggs, on two it held young. Another male was once observed to give this note under similar circumstances: as he flew from a guard post near his nest-tree upon the female's return to their young.

FEMALE. The female used the *cheuh-heuh-heuh-heuh* call in the same ways as the male. Once she gave one or two of these calls while standing beside the nest, and twice she gave one immediately after going on the nest to incubate. A queer-toned variant, more nearly a whistle than usual, was given by her several times when I approached her fledged young, and once when the squeals of an unrelated young Wood Thrush attracted her to the banding trap.

The strings of loud and excited *quit's* also were given by the female: once while defending territory against another Wood Thrush, and a number of times as she struck at a small mirror mounted on a pole, which was used to see inside her second nest. Similar uses of these notes are recorded by Weaver.

The only other note heard from the female was the explosive and somewhat musical one uttered during a defense of territory and already mentioned under *Territory*.

YOUNG. The first-brood young were not heard to make a sound until their last morning in the nest, when at the age of 12 and 13 days one or more gave some little *chip's* or *chik's*. The young—exact age unknown—in another first-brood nest were giving such calls on the day before they took wing. The study-birds' second-brood young were silent throughout their nest life; however, as soon as they left the nest (prematurely, at the ages of 8 to 10 days), they began uttering this same note—a fact which shows its character as a location call. I recorded this note at various times as *tsih*, *chik*, *chip*, *tsip*, *tseep*, and *cheep*, its quality depending considerably upon its volume.

When last seen (at the ages of 10 to 12 days), the second-brood young were still giving the above note exclusively. By the age of 21 days, when they were partly independent, the first-brood juveniles had begun to give *tih-tih's* as well, and soon these calls were lengthened to three, four and even more syllables, so that they seemed to be a rudimentary form of the adults' *cheuh-heuh-heuh-heuh*. The earlier *chip* notes were continued, however, to the age of at least 32 days, when these juveniles disappeared.

A loud burst of *quit's* identical with those of adults was given by a fledgling just a few hours out of the nest, when it was chased.

ALBINISM

The female's albinism consisted of one white feather in the crown a short distance behind the right eye, some white feathers among the upper tail coverts, and four white rectrices. The six young of the two broods were color-banded while still in the nest; no sign of albinism was seen up to the age of 32 days with the first brood, 12 days with the second.

Knight (1940:574) states that among ten broods of young raised in five years by a partly albino (male?) Robin there were no albinistic birds. Smith (1934:109) reports that albinistic touches did appear in the offspring of a partly albino female Robin.

SUMMARY

A pair of color-banded Wood Thrushes in suburban Baltimore remained together through two broods of three young each; nesting success was 100 per cent.

The second nest was built 90 yards north-northeast of the first; the general locations of the two were similar; the placements differed.

The immediate proximity of a stream was not found, as by some other observers, to be a habitat requirement.

The female alone incubated. Attentive periods at the first and second nests averaged 31 and 27 minutes, respectively; inattentive periods $8\frac{1}{2}$ and $6\frac{1}{10}$ minutes; the percentage of daylight hours spent on the nest was 78 and 80.3.

The incubating bird's behavior during rain and during high wind is described.

The first-brood hatch extended over two days, that of the second brood over three. The hatching hour of one egg was 6:59 A.M., 2 hours 17 minutes after sunrise. The shell was carried away.

The female alone brooded the nestlings. Brooding lasted throughout the young's nest life. No progressive daily decrease in the brooding was found, nor any clear correlation between weather and amount of brooding except at temperatures of 93° F. and above, when attentiveness changed from covering to mere attendance—without shading.

Both parents fed the young. The male made many more feedings than the female, but the female showed the better appreciation of the nestlings' needs; on the young's first days she gave them softer food than did the male, and she also trimmed certain portions away from some of the food he tendered.

During comparable series of observations the average rate of feedings at the first nest was 9.3 per hour, at the second nest only 4.7, with equivalent food loads.

Both parents were somewhat less attentive to the second brood than to the first. For example, the male guarded the first nest between almost all of the female's sittings, but guarded the second during only 60 per cent of her absences. At the first nest single periods of brooding by the female often encompassed two or three food trips by the male, but the female almost always flew away from the second nest the moment her mate arrived. The parents were equally responsible for the 50 per cent drop in feeding rate from brood to brood.

The nestlings' excreta were usually eaten, by both parents, but two or three times, during morning twilight, were carried away.

All of the first brood left the nest on the same day, when 12 and 13 days old. These birds were doing some of their own foraging by the age of 20 and 23 days; they continued to be fed by the parents to the age of 25 to 32 days; they left the territory, presumably independent, at 28 to 32 days.

Two broods seem to be the rule at Baltimore.

First-brood territory was about 100 x 100 yards in extent, second-brood territory probably 100 x 125 yards.

Both adults defended territory against their own species, but not especially vigorously; the observed defenses are described. On the other hand, the female once fed a juvenile of a trespassing family that remained in the territory five days. The study pair were very tolerant of several other species, displaying hostility only toward a Blue Jay and a Purple Grackle.

The notes uttered by male, female, and young are described, with comment on their uses; the female's use of a note suggesting song is mentioned.

Partial albinism in the female was not inherited in the juvenal plumage by any of the six young.

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BIRD DISPLAY. AN INTRODUCTION TO THE STUDY OF BIRD PSYCHOLOGY. By Edward A. ARMSTRONG. Cambridge at the University Press; Macmillan Co., N.Y. 1942: 5½ x 8½ in., xvi + 381 pp., 22 pls. \$5.50.

The study of bird psychology has only recently emerged from its anecdotal, anthropomorphic stage, and this excellent handbook will probably surprise many students, who, because the literature has been so extremely scattered, have not realized the extent of the progress we have made. Armstrong has not only assembled, correlated, and interpreted this literature, but has wisely included the full references which provide the evidence for his statements. If we question a generalization, we can promptly turn to the original sources and form our own conclusions.

The author's fine admonition to students of bird behavior demands quotation in full:

"An interesting observation of a bird's behaviour should be no less carefully recorded and reverently preserved than the type specimen of a new subspecies. Lack of regard for this principle has long prevented the outdoor study of birds from being considered much more than the harmless hobby of men who preferred looking at birds to killing them. Now that field ornithology is increasingly recognised to be a serious scientific discipline from which careless observation and wanton generalisation should be sternly excluded, it is essential that its literature should eschew the vagueness which has hampered the progress of bird-behaviour studies in the past. It is not enough to be told that birds do this or that; we should be told what reliable observer has seen them do it."

This book contains such a profusion of quotations from many sources that inevitably some will be criticized by any reader. There is, for example, the description of the dance of the Sharp-tailed Grouse (p. 73), which is based on a long out-dated, and in part anthropomorphic, account, and to which Armstrong adds a probably erroneous statement. One even turns up (p. 13) the old misconception of birds sleeping with the head under the wing. But perhaps the worst example is the quotation in full (p. 185) from a recent best-selling novel (!) of an apparently imaginary description of the dance of the Whooping Crane.

The book is handsomely illustrated with 40 photographs by the author and others. There is a bibliography of nearly 700 titles, a good index, and a separate list of the scientific equivalents of all bird names used in the text.—J. Van Tyne.

TERRITORIALITY, DISPLAY, AND CERTAIN
ECOLOGICAL RELATIONS OF THE
AMERICAN WOODCOCK¹

BY FRANK A. PITELKA

FOLLOWING the appearance of Pettingill's monograph (1936) on the American Woodcock (*Philohela minor*) attention was drawn to our limited evidence for territoriality in that species (Linsdale, 1936). Recently, however, Norris, Beule, and Studholme (1940) and Studholme and Norris (1942) have published limited observations which touch on the problem of territoriality. With the same problem in mind, in the early spring of 1939, I undertook to study a small concentration of Woodcocks on a semi-wooded plot north of Crystal Lake Park, Urbana, Champaign County, Illinois.



Figure 1. Habitat of the Woodcock. Photograph taken facing west near upper end of north-south road in territory C (Figures 3 and 5); east-west road is seen in right background. All of the open area seen in this photograph constituted part of male C's display territory; his feeding area was located in the woodland seen in left background.

The area of study, approximately 45 acres in extent, is illustrated in Figures 1 to 3. The open portions of this area were used by Woodcocks as "singing-fields" for their crepuscular displays. During the day, Woodcocks were confined largely to the wooded and more densely vegetated portions within the northern half of the area. The patch of relatively dense deciduous woodland (Figure 1) contained white oak (*Quercus alba*), red oak (*Q. rubra*), ash (*Fraxinus* sp.), shagbark

¹Contribution from the Zoological Laboratory of the University of Illinois.

hickory (*Carya ovata*), and elm (*Ulmus americana*). Thickets to the southeast of the main wooded area contained large hawthorn shrubs (*Crataegus* sp.), honey locust (*Gleditsia triacanthos*), and young elms. Additional hawthorns, elms, and a few sycamores (*Platanus occidentalis*) were scattered over the open area partially encircled by the old stream bed or "ox-bow" (Figure 3), which was bordered largely by willows (*Salix* sp.). The ground cover of this open area consisted only of matted dead vegetation (largely grasses); the leaf-littered floor of the wooded area was overlain with the usual stratum of small shrubs. Within a haw thicket and woods of the northern half of the study area, there were small shallow pools, the edges of which were frequented by the Woodcocks. Several recent studies of the American Woodcock include data of interest on habitat preferences (Aldous, 1938; Merovka, 1939; Studholme and Norris, 1942).



Figure 2. Westward view across display territories of males B and A, showing "open" portions of study area, as indicated in Figure 3.

Observations extended from early March to mid-April and totalled approximately 40 hours. The Woodcock was first recorded on the study area on March 5, when a single bird was flushed by J. Murray Speirs. Crepuscular calling and singing of the males was noted from March 9, when at least two performing males were present, through April 3. It is possible, since no observations were made between March 5 and 9, that calling and singing began prior to March 9. Following April 3, no Woodcocks were detected on the area, and apparently none remained to breed that season. Observations included 10 full evening performances and one morning performance (Table 1).

TABLE 1
SUMMARIZATION OF CALLING AND SINGING PERIODS

Date	Birds Studied ¹	Calling Periods	Pre-display Calling	Singing Periods	Post-display Calling	No. of Singing Birds	No. of Calling Birds
Mar. 9		(Flight displays)					
10	B	(Flight displays)	15 min.	6:20-6:50 P. M. 30 min.		2	2
13		6:05-6:50 P. M. 45 min.	33	6:13-6:40	0 min.	3	5
14	A, B	5:40-6:42	—	<i>None</i>	2	4	6
17	A, B	6:13-6:24	—	6:23-6:46	—	3	5
20	A, B	6:09-6:51	14	6:18-6:51	—	0	3
21	A	6:14-6:58	12	6:26-6:54	4	3	6
	A	6:11-6:52	7	6:18-6:51	1	7	7+
22	C	6:09-7:00 P. M. 51	15	6:24-6:56 P. M. 32	4	—	—
24	C	4:45-5:26 A. M. 41	13	4:58-5:26 A. M. 28	0	5	8
27	A, B	6:30-7:06 P. M. 36	4	6:34-7:00 P. M. 26	6	3	5+ ²
28	A, B	6:33-6:59	3	6:36-6:58	1	3	4
31	B	6:39-7:01	4	6:43-6:57 P. M. 14	4	2	3 ³
	A	6:50-6:59	—	<i>None</i>	—	—	—
Apr. 3	A, B	6:36-6:54 P. M. 18	—	<i>None</i>	—	0	2

¹ In this column are listed the males, as designated in the text, to which particular attention was paid on different dates.

² Following this morning singing period, a systematic survey disclosed the presence of at least 12 Woodcocks.

³ An additional individual was found on the feeding area of male A just before calling began.

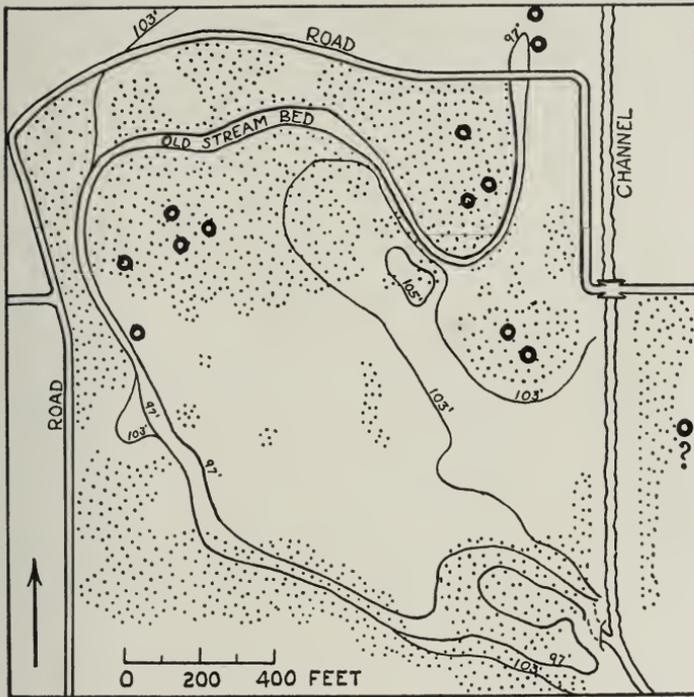


Figure 3. Map of study area. Dotted portions represent areas covered with woodland or relatively tall and dense thickets; clear portions represent areas covered with grasses, forbs, and numerous scattered shrubs, and a few small trees. Small dark circles indicate distribution of Woodcocks over feeding areas following the morning display period of March 24.

Weather data (Figure 4) were provided by the University of Illinois Meteorological Station through the kindness of H. P. Etler. Supplementary field measurements of temperature were made with an ordinary mercury thermometer. Data on light intensities were obtained with an illumination meter (Model 603, Weston Electrical Instrument Corp., Newark, New Jersey). For the loan of field equipment, I am indebted to S. C. Kendeigh and V. E. Shelford, and to the Department of Zoology, University of Illinois.

Acknowledgement is made gratefully to Mrs. Margaret M. Nice, S. C. Kendeigh, J. T. Nichols, and especially to O. S. Pettingill, Jr., for critical reading of the manuscript. I wish also to thank Mr. and Mrs. J. Murray Speirs for their field notes on the Woodcock, also recorded at Urbana; J. T. Nichols for records of song-flights and nesting of the Woodcock on Long Island; and C. T. Black for excerpts from the manuscript notes of I. E. Hess, formerly of Philo, Illinois.

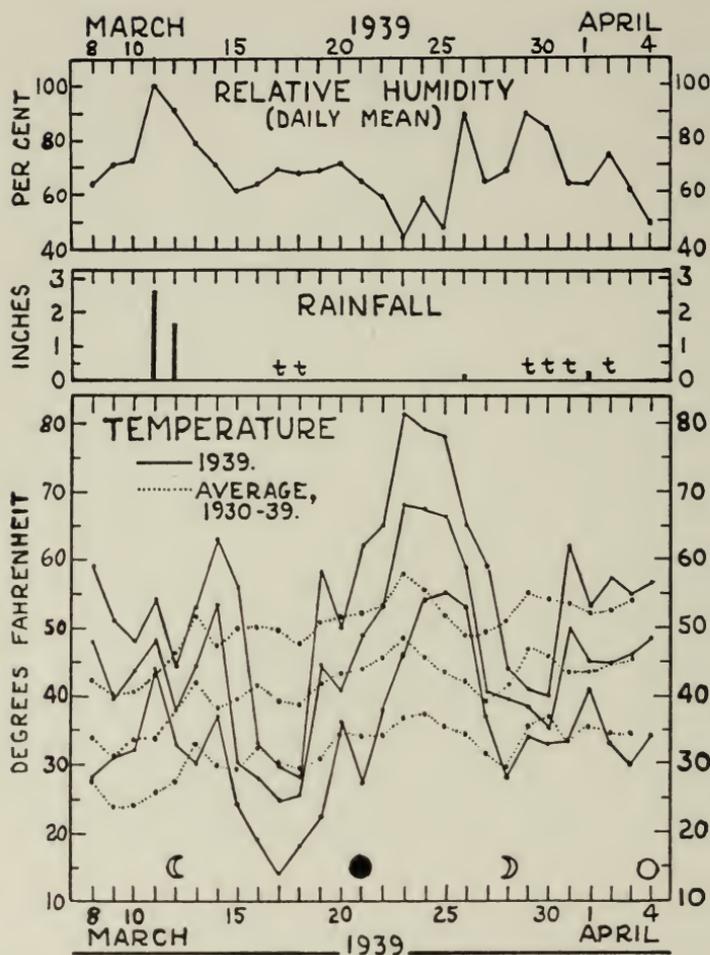


Figure 4. Weather data for the period of observation. In the graph of temperature data, daily values include minima, means, and maxima. In the graph of rainfall, *t* = trace. Moon phases are shown in the lower part of the figure.

THE PROBLEM OF TERRITORIALISM

In the American Woodcock, habitat and spatial relations are relatively complex. Within the period and geographic range of breeding, the male confines himself to a feeding area (usually wooded—the “diurnal territory” described by Pettingill, 1936:280) except for excursions to an adjoining display ground (= open-country territory or the singing-field) during crepuscular or nocturnal periods. Feeding areas may be temporary, largely because of weather factors, and they undoubtedly shift with the advance of the spring and summer seasons.

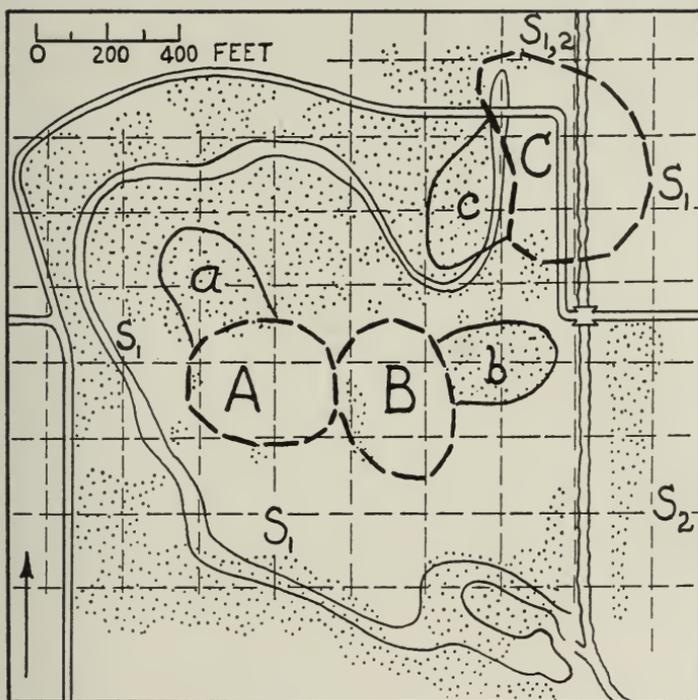


Figure 5. Open-country display territories (A, B, C) and adjoining feeding areas (a, b, c) of three male Woodcocks. Distribution of additional singing males is shown for March 21 (S₁) and 24 (S₂).

Following mating, the female occupies an area within which the nest is placed. This she leaves periodically to feed at sites at variable distance from the nest. The female performs all nesting duties, and, except for mating, the two sexes apparently remain independent of each other.

The question now remains, does the male or female display territoriality within one or more parts of the breeding habitat occupied by the species? Various aspects of this question are considered below, but to simplify the discussion, it may be stated at the outset that only the display sites of the male Woodcock are known to be defended, and only these areas will be termed territories.²

My observations were made largely on three males (A, B, and C) which remained established on fairly definite feeding and display grounds throughout the period of study. The display territories and feeding areas of these males are shown in Figure 5. The territorial boundaries shown are based on (1) location of calling posts on the

² The term territory, as used here, will refer to any defended area. This follows recent usage by Nice (1941:441) and other investigators.

ground, (2) spatial extent of the display flights, and (3) territorial claims as evidenced by threat behavior and chases. These points are all discussed in the following sections. The feeding areas were determined by repeated observations of individuals within the limits shown, and of the emergence of each of the males A, B, and C, from his respective feeding area prior to display. Whereas these birds were not marked, all evidence drawn from their behavior leads me to conclude that the same birds held the same territories throughout the period of occupancy.

During the four-week observation period, there were, besides females, at least five additional displaying males on the study area. The latter were present for only one to three days. In Figure 5, locations of singing males other than A, B, and C are shown for March 21 (S_1) and March 24 (S_2). It was not feasible to census the study area repeatedly, but such data as are available indicate that numbers of individuals increased to March 21, when there were between 10 and 15 Woodcocks present. On March 22, Speirs estimated that there were 14 in the area. On March 24, following a morning singing period, a systematic census count revealed at least 12 Woodcocks (Figure 3), although only 5 of these had performed (Figure 5).

CALL NOTES

1. *The Peent Note and Crepuscular Calling Periods.*

The harsh, loud, nasal note given repeatedly by the male on the display territory has been expressed verbally in numerous ways (Pettingill, 1936:292). *Peent* is one of the more acceptable renditions and is used throughout the following discussions. Apparently both sexes may call on the display territory of one male, although calls of birds other than the occupant male are given only intermittently and briefly (see also Brewster, 1937:168). In some instances the *peents* of several birds on one territory may sound similar, but in several instances, it was possible to distinguish *peents* lower pitched than those of the performing males. Pettingill (1936:294) has suggested that the lower-pitched calls may be those of females, and a difference in the quality of calls between the two sexes has also been suggested in the European Woodcock (*Scolopax rusticola*) by Pay (see Steinfatt, 1938:389).

On March 28 and 31, males A and B both called a few times from their respective feeding areas before flying to their display territories. Pettingill (1936:282, 296) and Brewster (1937:170) also cite instances when calling began on feeding areas. Generally, however, calling began almost immediately after arrival on the display territory. One bird began the calling, others followed, and calling continued up to the first flight song; thereafter periods of calling alternated with song. During the preliminary period, all individuals exhibited an acceleration of calling, probably synchronized with the approach of darkness. The number of

calls given per minute prior to the first song ranged usually from 6 to 20 (Figure 6). For male A, however, the maximum rate, recorded just before the first song, was 26 calls per minute. If no interruption occurred, it maintained this rate between songs during the height of the display period. In this respect, male A differed from the other birds, with whom the rate of calling was lower, as a rule, between songs than before the first song. Pettingill (1936:294) records a maximum of 27 calls per minute between flight songs.

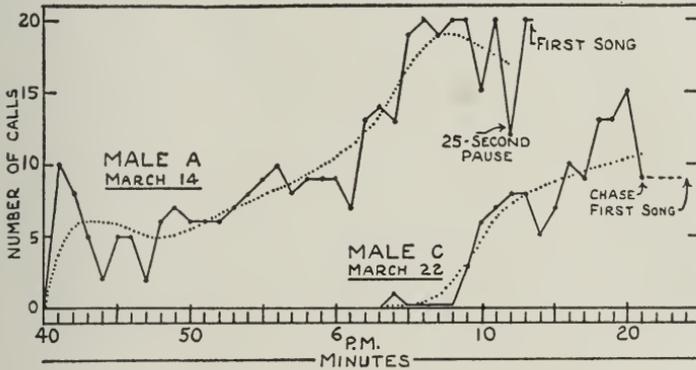


Figure 6. Two examples of preliminary calling periods of the male Woodcock, showing acceleration of calling prior to display.

A preliminary calling period may be illustrated by a record of calls given by six birds scattered over the open area south of the woods on the evening of March 13. From 6:05 to 6:10, bird 1 called alone, giving four calls. From 6:10 to 6:15, 23 calls were given by bird 1, and 17 by bird 2; bird 3 called once. From 6:15 to 6:20, 34 calls were given by bird 1, 27 by bird 2, and 15 by bird 3. Birds 4 and 5 each gave four calls during this five minutes, and bird 6, three. The first song began at 6:20.

Neighboring males A and B consistently called more frequently during territorial occupation than male C, whose "neighbor troubles" were only intermittent. This type of competition is also seen in the observations of Norris *et al.* (1940:14) who, by imitating the *peent* note, stimulated established males to call more vigorously and to attempt assault on the "intruder."

The lengths of calling periods (including the singing periods from the beginning of the first song within an evening's performance through the last song) are summarized in Table 1. Calling periods are equivalent to total time spent on the display territory. During this time, the *peent* note is given continually, except for interruptions by flight display.

Given the suitable habitat, the chief factors which enter into the variation among calling periods of established birds are light intensity,

weather (especially temperature), and psychological stimulation exerted among neighboring individuals. Other factors affecting calling (and display as well) are not to be overlooked: the presence of females may influence calling and display; and the strength of the sexual urge in relation to particular time of the breeding cycle would be reflected in the length of calling and display periods (Studholme and Norris, 1942:233). During the early part of the breeding season, the complex of environmental and physiological factors which influence migratory movements may be superimposed on the previously mentioned factors, and birds seemingly established in suitable habitat may depart after subsidence of territorial calling and display (see below).

Light intensity.—Light measurements were taken on display grounds. The receptor piece of the illumination meter was placed on clear ground six feet away from the recorder and directed toward the zenith. During evening and morning observation periods, readings were taken every five minutes (Figure 7). Measurements were also taken with the receptor piece six feet above the ground and directed toward the sunset, but because of certain irregularities in the data, these were discarded. Moreover, the bird on the ground is obviously affected more directly by light of the zenith.

TABLE 2
RECORDS OF LIGHT INTENSITY AND TEMPERATURE AT THE BEGINNING OF
CREPUSCULAR CALLING

Date	Beginning of Calling	Light Intensity (Foot-candles)	Temperature (U. of I. Sta.)	Field Temperature
March 20	6:09 P. M.	17	38°F.	
21	6:14	11	53	
22	6:09	28	56	
27	6:30	2	37	36.5°F.
28	6:33	1.5	38	37.0
31	6:39	2.3	52	51.3

The amount of illumination at the beginning of calling on the display territory showed an appreciable variation (Figure 7 and Table 2). On March 22, calling began at 28 foot-candles, whereas on March 28, it began at 1.5 foot-candles. The average of six records is 10.3. Pettigill (1936:297) reports only one measurement, of two foot-candles, obtained with an exposure meter directed toward the sunset.

The possibility that the start of calling might be related in part to temperature does not appear to be supported by the available (admittedly limited) data (Table 2). The beginning of the calling periods may be determined by the time of departure from the feeding area, and therefore by the light intensity at the site of departure. Since such areas are visibly shaded by even leafless winter vegetation, the features of the particular site which the bird occupies would affect the onset

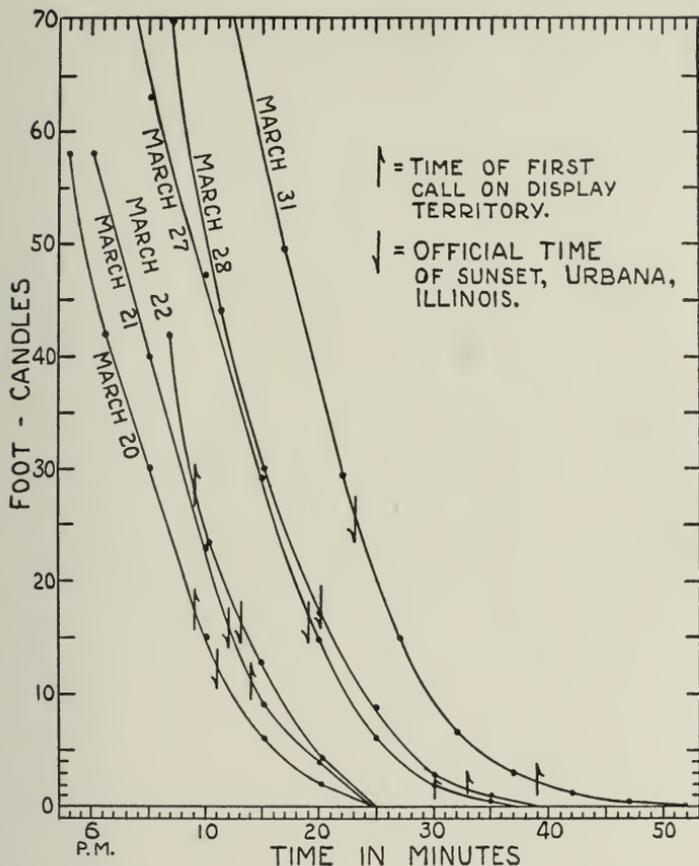


Figure 7. The time of first evening call in relation to light intensity. Each line represents declining light values during one evening. A symbol on each line indicates time of first call on the display territory in relation to light intensity at that moment. Light readings (taken every five minutes) are shown by points along the lines. (See also Table 3.)

of calling. It was observed, in fact, that Male C, whose feeding area was at the eastern end of the forested area and therefore less lighted in the evening, consistently appeared on his display territory before males A or B on theirs. Accurate arrival times for all males are available for three evenings:

	A	B	C
March 21	6:14	6:14+	6:11 P.M.
March 27	6:30	6:30+	6:23
March 28	6:28	6:30	6:24

The rate of calling and the time calling begins are both affected in any one bird by the activity of neighboring birds. Calling begun by

one bird stimulated others to leave their feeding areas to take up positions on singing fields. Calling was sustained at higher rates (20 to 26 calls per minute) during periods on March 20, 21, and 22, when Woodcocks were apparently most numerous on the study area (Table 1). On each of these evenings, calling also started relatively earlier.

The effect of cloudiness on length of calling period is seen on March 14, a dull, hazy evening, when calling began 24 minutes before sunset and continued for 32 minutes before the first song-flight (Table 3). On six more or less clear evenings (March 20-31, Table 3), calling began 4 minutes before, to 16 minutes after, sunset and continued for only 3 to 15 minutes before the first song. (See also Pettingill, 1936:297.)

TABLE 3
BEGINNING OF CALLING AND SINGING IN RELATION TO SUNSET
(URBANA, ILLINOIS, LATITUDE 40°N.)

Date	Time of Sunset	Beginning of Calling	Interval after Sunset ¹	Beginning of Singing	Interval after Sunset ²	Sky Conditions
March 13	6:03 P. M.	6:05 P. M.	2 min.	6:20 P. M.	17 min.	?
14	6:04	5:40	-24	6:13	9	Cloudy
17	6:07	6:13	6	—	—	Clear
20	6:11	6:09	-2	6:23	12	Clear
21	6:12	6:14	2	6:26	14	Clear
22	6:13	6:09	-4	6:24	11	Clear
27	6:19	6:30	11	6:34	15	Clear
28	6:20	6:33	14	6:36	16	Partly cloudy
31	6:23	6:39	16	6:43	20	Clear
April 3	6:26	6:36	10	—	—	Clear

¹ Average of these 10 records is 3 minutes after sunset.

² Average of these 8 records is 14 minutes after sunset.

Temperature.—A correlation of length of calling periods with temperature is shown in Figure 8. Two temperature values are given for each date: value at time of calling and the day's mean. This diagram illustrates the effect of temperature *at the time* of the evening or morning calling periods. The *daily mean* temperature, shown in Figures 4 and 8, may serve as an index to the day-to-day changes, and undoubtedly the summated effect of these changes is reflected in the general physiology of the bird; that is, a Woodcock's crepuscular performance may be influenced as much by the temperature conditions of the preceding 24-hour period as by temperature at the moment of display. At least for evening periods, lengths of calling periods appear to correlate more consistently with daily mean temperatures than with temperatures during the calling periods. At best, however, these data are only suggestive.

On March 27 and 28, there was less preliminary calling, and during singing periods, performances began to be less frequent and less

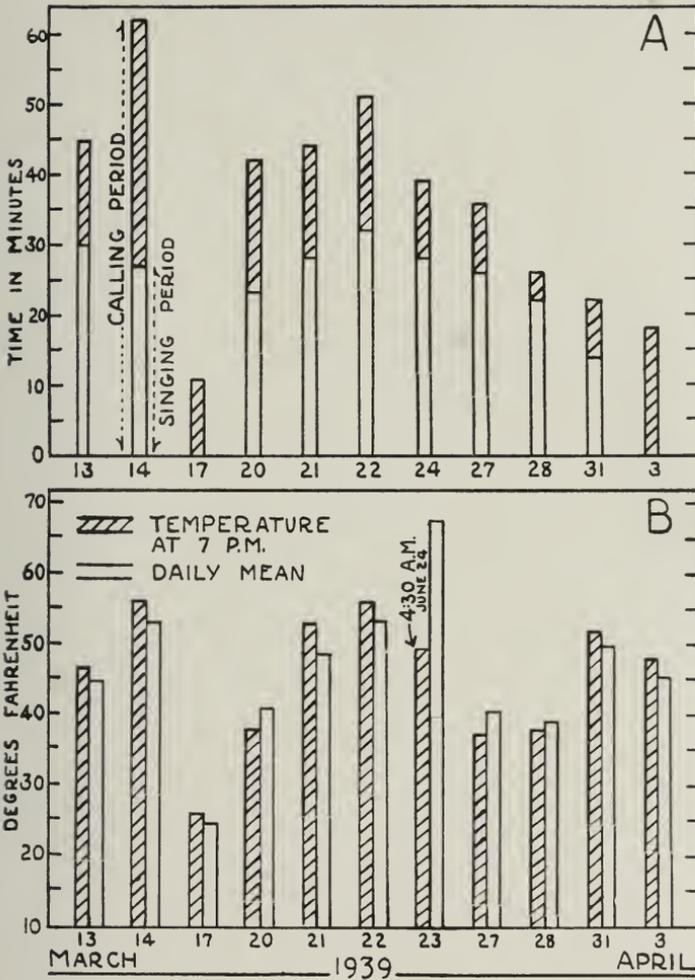


Figure 8. Correlation of daily temperature values with lengths of calling and singing periods; note that the total time designated as a calling period includes the singing period.

forceful. The data are too limited for an explanation of this subsidence of calling and display and of the ultimate disappearance of all the birds. The species is a summer resident in the region, although at present it is probably not regularly so. The weather record (Figure 4) shows unseasonably high temperature during the period March 22 to 27. Following this period, the birds apparently dispersed; on March 31, males A, B, and C were still present; on April 3, only males A and B were present, and on April 4 and thereafter, no Woodcocks were found.

During the cold evening of March 17 (temperature 26° F.), there was only a brief period of activity. No songs were given. At least three individuals called; the maximum number of calls was five within one minute, given by a single bird. Otherwise, however, no effect of temperature on *rate* of calling was detected. Of interest here is Brooks' record (1935:308) from West Virginia of a male calling and singing on April 27, 1930, when the temperature was 30° F. It remains yet for someone to determine whether the temperature thresholds for calling and singing are the same throughout the breeding season or whether these thresholds fall as the season advances (Witherby *et al.*, 1940:187).

2. Other Calls.

A second frequent note may be interpreted as *ka-kak-ka-k-k-k*, referred to in my subsequent discussion as a cackle. It appears to function in assault and threat, while the *peent* note appears to be one of warning, announcement, and advertisement. The cackle was heard most frequently when Woodcocks were most numerous. On several occasions the occupant of a territory was observed to give the cackle note during a preliminary, somewhat circular, flight just above the low vegetation. These flights occurred well after the calling had begun and from 3 to 10 minutes before the first song-flight. They were accompanied by a continuous whirring of the wings as heard at the onset of the song-flight. The cackle note was also given by an established male in silent flight just as it approached an intruder, whose calling had disclosed his position. All intruders were assaulted in this way. In some instances, the assault was followed by a chase, in others by a display flight, either from the site of intrusion or from the male's usual territorial position (see also Brewster, 1937:170). Also, the initial ascent in a song-flight was interrupted by slight dips marked by the cackle note (Figure 10, F). One particularly belligerent male (C) uttered this note on several occasions just as he alighted on his territory after a flight. Here, it seemed likely that the calls were evoked by the light-instruments placed close to the bird's favorite ground or by my crawling along the ground nearby. Once the cackle note was heard on A's feeding area, just prior to his flight to the display territory.

Norris *et al.* (1940:13) observed that Woodcocks flying over a singing-field were chased by the occupant male, who uttered the cackle note. Further, they observed that the *peents* of birds near a male in his singing field produced the same reaction. Pettingill (1936:268, 305) also observed that the cackle note was given when several birds were present in the vicinity of a singing-field, and he interpreted it as a note of reproof. Later, he observed two birds thought to be male and female and again heard the cackle note. He suggested that females may cackle also and referred to cackling as notes of felicitation or "talking sounds." My observations do not support that interpretation. I found that males uttered the cackle sound when assaulting any intruder and

when invading a close neighbor's territory and attempting to displace him (see below). In these and other usages described above, the note seemed clearly to function as an intimidation device. Only the territorial males produced this sound. I suspect that if not assaulted, another Woodcock present on a display territory would be a receptive female. There appear to be no published records of anyone's collecting and sexing suspected females on display territories. Trautman (1940:249) collected a suspected female in a display flight; it proved to be a male.

The third important note given during the crepuscular performance is a softer call interpreted in my notes as *ka-rurr*, recorded by Pettingill (1936:268) as *took-oo*. When the listener is only a few feet away from the bird, the note has a rolling quality evident in the first transcription; at greater distances, the note sounds softer, as in the second. In my own case, I could not hear this note at distances greater than 15 feet. The call is given one to three times between *peents*, each *took-oo* note except the last, which is followed immediately by a *peent*, being followed by a brief pause (Brewster, 1894:292; Pettingill, 1936:294). The observations of Norris *et al.* (1940:12) would indicate that the *took-oo* note is one of invitation and solicitation prior to and after copulation. They report that a male approaching a decoy, prior to treading, utters only the *took-oo* note. Brewster (1937:168) suggests that this note is also given by the female.

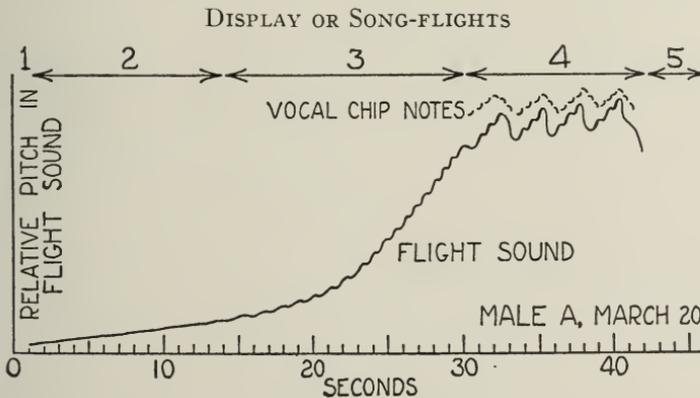


Figure 9. Pattern of sounds and time-relations observed in the song-flight of a male Woodcock. Divisions of the display, according to discussion in the text, are shown along the upper margin.

While the literature on the song-flight of the American Woodcock is extensive, most of it really states little more than that the performance is a truly phenomenal sight. Brewster (1894) and Pettingill (1936) have given us the best word pictures of the song-flight. In adding further to the literature, I am interested not only in elaborating

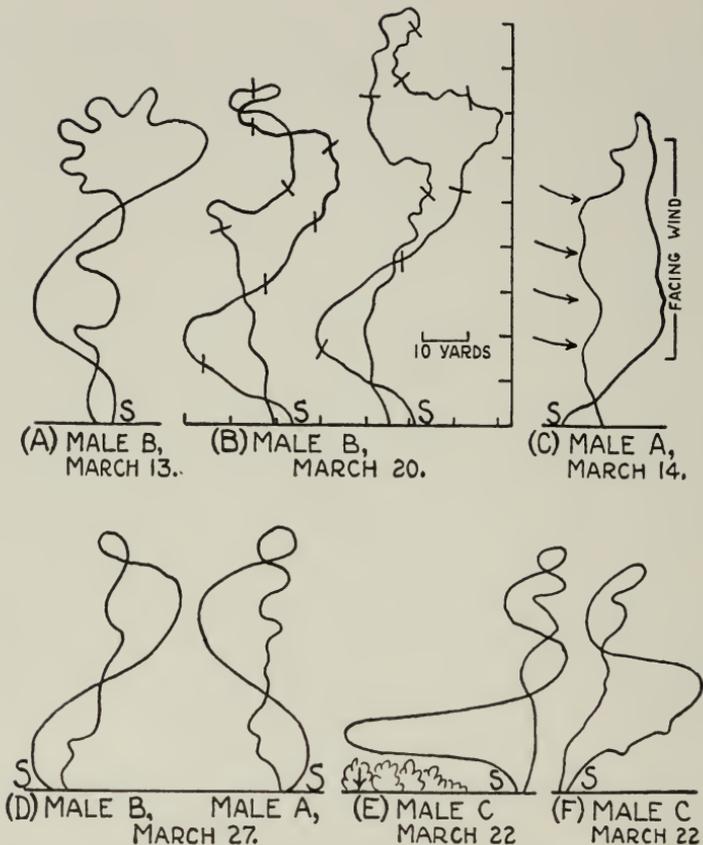


Figure 10. Courses taken by song-flights of male Woodcocks, all viewed from the side. Ascent begins at S. (A) Generalized pattern of the flight, based on a series of flights of male B. (B) Two flights of a single male with five-second intervals marked by cross-lines to show time relations. A scale is added to show approximate breadth and height of flights. (C) A flight performed in a fairly strong wind. (D) Courses of flight displays of competing neighboring males. (E) Flight of a male who began to ascend near a neighboring male (position of latter shown by small arrow). (F) Flight of a male showing dips in steady ascent during which the cackle note was given toward another male (S₁, Figure 5).

and amplifying certain details of the song, but also, and more importantly, in presenting a simplified and somewhat graphic picture of it in order to provide some basis for comparison with other Scolopacinae. Typical performances are illustrated in Figure 10, A and B.

The display of the Woodcock may be divided conveniently into five parts: initial silent flight, regular ascent, pulsated ascent, climax of wing and vocal sounds, and silent descent (Figure 9). (1) The start of a song-flight is silent and lasts but a few seconds. (2) The whirr of the wings is then heard with a gradual rise in the pitch as the bird

begins to climb slowly in a large regular spiral about the point of beginning; this part of the song-flight usually lasts about 15 seconds. (3) During the third part, which is the greater part of the ascent, there is a pulsation in the whirr of the wings, which becomes increasingly pronounced; at first there seems to be a distinct sound, *zzet*, alternating with each whirr of wing sound; toward the end of the main ascent, when the wing pulse is quick, these notes are obliterated. (4) At or near the peak of the ascent, the wing sounds become most distinct and are given in series of three or four, alternating with *zzet* sounds, which are again audible. This is followed by dips and irregularities in flight, during which wing sounds are reduced. Corresponding to these dips, there are series of vocal chip notes, sometimes termed "twittering" (Figure 9). The fact that the *zzet* sounds are heard during the series of chip notes suggests that they are wing sounds. This climax period in the song-flight lasts 10 to 15 seconds and may include part of the descent. (5) It is followed by a rapid and silent dive-descent to a spot near the starting point.

Exceptions to this general picture are seen in the behavior of male C, whose singing-field was enclosed in part by tall vegetation (Figures 1 and 5). He was observed to precede an ascent by a silent flight to a point about 150 feet away, where the sound of the wings was then begun (Figure 10, E). Likewise, the descent may not always be direct. Male C was observed to circle over the trees and shrubs to the west and south of his territory before alighting. Pettingill (1936:284) observed a male begin the first song-flight of an evening from his feeding area and end it on the display territory.

Males may leave the display territory immediately after descent without alighting; they may leave after alighting without calling; or they may remain on the territory for a short period (2 to 6 minutes, Table 1), during which calling continues, but subsides more or less sharply (from 14 to 2 calls per minute). Brewster (1894:297) and Pettingill (1936:300) report similar observations, although the post-display calling reported by the latter author continued for 8 to 20 minutes. On March 31, a moon-lit night, the sound of flight was heard, from the territory of male B, 8 and 10 minutes after calling ended; but during several hours' wait, no further activity was noted.

Song-flights vary in length among different individuals as well as in a single individual (Table 4). The songs generally do not exceed one minute in length. In my observations 60 seconds was maximum, in those of Pettingill (1936:291), 66 seconds. My observations on height of song-flights (Figure 10, B) agree in all essentials with those of Pettingill (1936:291).

The chief function of the display flight appears to be territorial advertisement, and, whereas the cackle note serves as a threat, the song-flight may at times function as a superlative threat behavior in

TABLE 4
DURATION OF SONG-FLIGHTS

	Date	Number of Performances	Average Length	Extremes
Male A	March 14	11	34 sec.	29-40 sec.
	21	7	43	40-45
	27	8	40.5	37-44
	28	5	41	40-42
Male B	March 13	6	54	45-60
	27	3	46	45-48
Male C	March 22	4	52.5	50-55
	24	3	49	43-55

the face of a need for stronger offense. To cite some illustrative observations: On March 20, male A flew toward an intruder, giving the cackle note as he approached. (The lower pitched *peents* of the intruder suggested it to be a female.) A few seconds after alighting near the intruder, the male performed a flight display. On March 22, male C flew toward an intruder without alighting and returned immediately to his calling ground, where he started a song-flight. On the same date, male C flew toward the area of a neighbor to the south, giving the threat note, and then continued into a song-flight (Figure 10, E). And, finally, in beginning his ascent, male C, circling widely above the territory of a calling neighbor (S_1), would interrupt the steady whirr of his wings with the threat note just above the other bird (Figure 10, F). Similarly, male A uttered the threat note during his ascent, as male B called from his territory (March 27).

A difference between *Philohela minor* and *Scolopax rusticola* worth noting at this time is that in details of the song-flight. The male of *Philohela minor* displays over a rather circumscribed area, separate from his feeding area. The male of *Scolopax rusticola* displays over a comparatively large area, which apparently includes his feeding sites; he seems to follow the bounds of selected territories in horizontal flight circuits, from several hundred yards to one or two miles long, over or along the edges of wooded areas, flying back and forth several times during a single crepuscular period (Warwick and van Someren, 1936: 167). A similar horizontal display flight occurs in *Scolopax saturata* (Mayr and Rand, 1937:29).

In the case of *Scolopax*, the area covered by display flights makes study of territorial relations among neighboring males rather difficult, but the flights appear to bear the same significance in territoriality as those of *Philohela*. Witherby *et al.* (1940:187) term them advertisement flights. Warwick and van Someren (1936:171) consider "roding" (as the crepuscular flights are known in Great Britain) to be largely

aggressive and to have the same territorial basis as song has in many passerines. My own opinion on comparable behavior in *Philohela* is in agreement with these views.

"Double" Flights and Female Display.—On March 22, Mr. and Mrs. Speirs had the good fortune to observe two Woodcocks in a peculiar flight over the territory of male B. It appears that the two birds began song-flights simultaneously, ascending about 20 feet apart. The usual whirr of wings was heard during the ascent, but instead of the gradual rise and subsequent pulsation, these two birds merely approached each other repeatedly while mounting to a height comparable with that of normal song-flights. Following this, there was a smooth descent without any chipping or twittering. I can only suggest that these were probably two males who merely chanced to start their flight simultaneously.

There is no satisfactory record for female display in the American Woodcock, and the possibility of a mating flight remains doubtful. Brooks (1935:307) describes a circular flight of two birds together; he suggests that one may have been a female, but admits that the two birds may have been males which happened to begin their flights at the same time. Bagg and Eliot (1937:208) state that "occasionally two birds perform together, facing each other, seeming to climb perpendicularly up the air, each alternately the higher; but whether these are mates, or rival males, and whether both sing, is as yet unknown." According to Zedlitz (1927:76) and Steinfatt (1938:390), the female of the European Woodcock does not display. Warwick and van Someren (1936:170) consider flights of two birds together to be those of male and female, but apparently no attempt was made to settle this point conclusively (see Zedlitz, 1927:77).

Light.—Whereas calling began over an appreciable range of light intensities, singing began consistently when the light fell between 1 and 0.5 foot-candles (Table 5). On the morning of March 24, both

TABLE 5
TIME OF FIRST SONG IN RELATION TO LIGHT

Date	Time	Light Intensity
March 20	6:23 P. M.	1-0.5 foot-candles
21	6:26	0
22	6:24	1-0.5
27	6:34	1-0.5
28	6:36	1-0.5
31	6:43	1-0.5

calling and singing ceased before the light indicator rose above zero. Brewster (1894:293) observed that there was less daylight during the morning singing period as compared with the evening period.

Temperature and Wind.—At least from March 13 through 28 (Figure 8), length of song period, in correspondence with length of calling period, may be correlated with temperature; that is, from day to day, song periods tend to vary in length directly with variations in daily temperature (Pettingill, 1936:296). Song periods varied in length from 21 to 33 minutes (Table 6). After March 27 the dispersal mentioned earlier began, accompanied by a subsidence of singing and calling (Table 1 and Figure 8). The singing periods during this latter part of the study are therefore regarded as subnormal.

TABLE 6
DURATION OF SINGING PERIODS AND FREQUENCY OF SONG-FLIGHTS

	Date	Time	Length of Singing Periods ¹	Number of Song-flights	Average Interval Between Flight Starts
Male A	March 14	6:13-6:40 P. M.	27 min.	16	1.7 min.
	20	6:23-6:46	23	10	2.3
	21	6:26-6:54	28	10	2.8
	27	6:34-7:00	26	16	1.6
	28	6:37-6:58	21	9	2.3
Male B	March 27	6:34-7:00	26	15	1.7
	28	6:36-6:58	22	9	2.4
	31	6:43-6:57	14	5	2.8
Male C	March 21	6:18-6:51 P. M.	33	12	2.7
	24	4:58-5:26 A. M.	28	11	2.5

¹ Measured from first to last song-flight.

Whereas length of singing periods was correlated with temperature, there was no evidence that frequency of song-flights during the singing period (Table 6) was affected by temperature. On the cold evening of March 17, no song-flights were performed. It will be recalled that no effect of temperature on rate of calling was noted except on March 17. Records of three males on various dates show that, at least within the range of available data, the variation in frequency of song-flights is slight. The low figures for March 14 and 27 may be accounted for by exceptional competitive behavior between neighboring males. Among the remaining records, song-flights were begun, on the average, once every 2.3 to 2.8 minutes—a relatively regular rate—irrespective of the length of the singing period.

Wind may have marked effect on the length and general performance of the song-flight (Pettingill, 1936:292, 293). In Figure 10, C, a song-flight performed in strong wind is diagrammed as viewed from the side. Under such conditions, the flights are shortened (see the record of male A for March 14, Table 4). Part 3 of the song-flight was shortened markedly in the face of strong wind, and lasted from 3 to 10 seconds (average 5.5 for 9 records) as against a normal 10 to 15 seconds on calm evenings.

TERRITORIAL BEHAVIOR

At present, only the display sites are known to be defended. It follows then that neither the feeding areas of the males nor the nesting areas of the females can be called territories. Pettingill (letter) properly points out that it would be unusual for a bird not to show evidence of territoriality in the vicinity of the nest, but no data are available. Woodcocks may be gregarious on feeding grounds in winter and in migration, but it yet remains to be determined whether or not they are gregarious in late spring and summer. Under present-day conditions of reduced abundance, there is limited opportunity to investigate these points. During day-time observations (March 24) on the study area, when at least 12 Woodcocks were found about suitable feeding areas (Figure 3), no intolerance or chasing was seen. In the literature on Scolopacinae, I have found no mention of territorial behavior on feeding or nesting areas.

Extent of Feeding Area and Territory.—The size of the feeding area occupied by the male Woodcock appeared to be determined largely by availability and suitability of foraging sites. The area over which a bird forages may vary to a considerable degree (Pettingill, 1936:283). The birds believed to be occupants of areas *a*, *b*, and *c* (Figure 5) were seen regularly at favored feeding sites within parts of their respective areas. The feeding areas of these birds were between 250 and 300 feet in diameter and larger than examples mentioned by Pettingill. But I attribute this to the greater extent of suitable feeding grounds in my study area. At the time of observation, scattered spring ponds and moist, soft, leaf-littered woodland floor provided excellent sites for them. Areas *a* and *c* were both surrounded by additional ground over which feeding might have occurred. I would suggest that these feeding areas were probably maximal in extent.

Calling sites on the display territory were confined to areas relatively small, and more or less circular, ranging from 50 to 75 feet in diameter. Areas of about equal extent are described by Pettingill (1936:284) and Aldous (1938:840). Depending apparently on the presence of shrubby masses over the display territory, there may be what Norris *et al.* (1940:9) term a "primary singing ground" together with one or more "auxiliary" areas. This agrees in essence with my observations of singing-grounds with scattered shrubs and without clear-cut openings, where a male might call usually from one favored site, but would move occasionally to another site as much as 75 feet away. The areas described by Norris *et al.* (average 21x37 feet) probably were small chiefly because of this vegetational factor. Brewster (1925:230; 1937:166) observed males singing and alighting at different points in fields of several acres instead of maintaining more or less definite stations.

My observations on the extent of the area covered by one song-flight differ from those of most earlier reports. Most flights, the ascents of which were more or less circular, were spread over areas of only 35- to 40-yard diameter ($\frac{1}{3}$ acre). Certain irregular flights of male C extended over as much as $\frac{2}{3}$ of an acre; moreover, male C consistently flew over larger areas than males A or B. He also was the most belligerent and held the largest territory. Further, the placement of the calling site in relation to large vegetational masses was such that his ascent could not be made over a circle about a beginning point, and this largely accounted for the irregularities in his song-flights (see Figure 10, E). Other factors, for instance the proximity of competing males, may influence the spatial extent, as well as the vigor, of the flight-song. Pettingill (letter) states that the total area covered by a song-flight seldom, if ever, exceeds 300 feet square (about two acres).³ This figure was calculated to include flights begun or ended outside the display territory and flights performed in strong wind. Brooks (1935: 308) reports circles of as much as 400 yards in diameter. Such circles would be over $2\frac{1}{2}$ acres in size! Brewster's estimate (1894:293) that a flight may extend over five acres likewise seems to be excessive.

However, the display flights do not always cover the same area. On different flights, males may fly in different directions so that the total area covered by all flights of one male may reach two to five acres (Figure 5). A male asserts his claims in any part of the area generally covered by his song-flights in spite of the fact that calling is usually confined to the center of the area.

Relations of Neighboring Males.—Several references have already been made to the territorial behavior displayed among neighboring Woodcocks; namely, (1) chasing of intruders, (2) preliminary flights over territories, and (3) warning and threat notes. In addition, chases occurred among closely neighboring birds one of whom would leave his own area, invade that of a neighbor, and chase or attempt to chase him away, indicating overlap of areas claimed by individual males. On March 21 and 22, male C chased and probably attacked at least three neighboring males (Figure 5); the third male, present only on March 22, called from the open area along the south border of C's territory, west of the road. There were numerous other instances, involving males A and B also, when fewer birds were present. Retaliatory chases were also noted. Male C assaulted and probably chased at least twice a close neighbor to the south. He was apparently successful in driving him off, for following the encounters, the south bird began a song-flight and ascended over the territory of male C, then continued to the north in a direct flight, and did not return.

Competition between males A and B was noted several times. On

³ In Pettingill's monograph, the statement concerning area covered by a song-flight (1936:291) should read 300 feet square instead of 300 yards square. In a letter, he suggests that this correction be recorded here.

March 21, for instance, male A was observed to display again almost immediately after descent if male B was in display at that time. On March 27, male A displayed six times, and male B five times, within the same period of six minutes. Similarly, on March 28, males A and B gave five overlapping performances (three by male B) within a period of three minutes. Another demonstration of competitive behavior was seen in the directions of the respective ascents of males A and B, as shown in Figure 10, D, again suggesting overlap of territorial areas desired by each male. This feature of the song-flights of the two neighboring males was observed repeatedly when both were performing.

Pettingill (1936:282) observed an established bird fly over to the calling site of a second bird and there begin a song-flight. He saw no combat between one male and two others which were established within 300 yards of the first, but I found males fighting and actively competing when they were 500 feet apart (Figure 5). Aldous (1938:840) observed the shortest distance between two singing grounds to be 400 feet; this apparently refers to the boundaries, so that occupant males were probably farther apart. He makes no mention of any competitive behavior.

STRUTTING AND MATING

While calling, the male maintained a stiff stance with head pulled back, wings dropped, and tail spread and held vertically (see also Pettingill, 1936:294). When uttering the *peent* note he jerked his head backward. Usually, the calls were given from one position, which was then changed by a few steps. But on two occasions I saw a rhythmic strutting (by male C, March 22). Tail, wings, and head were held as described above. The bird moved stiffly along a straight line for about two feet, then turned about 120° to the left, giving a *peent* note at the end of the turn. The original direction of movement was then resumed, and at the end of another two feet, another turn was made. This performance was repeated several times.

This behavior appears to be only a manifestation of excitement during the display period. Female Woodcocks strut similarly when disturbed from the nest (Ford, 1926; Murphy, 1926), and I would regard this behavior (wings dropped, tail spread, etc.) as comparable with that seen in individuals of a variety of species when excited. It is not necessarily a courtship display—the behavior preliminary to mating may be distinctly different, as described by Norris *et al.* (1940:10). But it is possible that strutting may occur just prior to copulation: Pulchaski (see Steinfatt, 1938:410) reports a displaying male *Scolopax rusticola* that alighted near a nest which contained an incomplete clutch; the female left the nest and strutted, then crouched; copulation followed.

What can be said of the relation of mating to the display territory? The established male appears to resent all intruders and assaults them

with the cackle note. Females may visit the singing-field (Pettingill, 1936:284), but visiting birds may include males as well, both established (as competing neighbors) or unestablished (as transients or new arrivals on breeding grounds). Several authors insist on interpreting chases as occurring between male and female. The events subsequent to any territorial intrusion are determined largely by the responses of the outsider to intimidation. On several occasions, I have seen the male approach an intruder and then either display in a song-flight or chase the intruder—a chase if the latter leaves, or a display if the intruder stays his ground. Norris *et al.* (1940:10) suggest that copulation is attempted if the intruding bird remains quiet. They observed that a decoy of male proportions placed in normal standing position on a territory, if seen by the established male, was received sooner or later as a female, and copulation was attempted. Here the important point is that an intruder remaining quiet on the singing grounds of a male is accepted by him as a receptive female. Under these circumstances, the male assumed a peculiar stance, first described by Norris *et al.* With wings raised and legs stiffened, the male approached the decoy, dropping his wings occasionally and uttering only the *took-oo* notes. Treading occurred from both sides as well as from behind. Any conclusions drawn from these observations must remain tentative, however, until full data on behavior before and after natural copulation are available.

An observation of mating in the European Woodcock has been mentioned above. The only report of copulation in the American Woodcock is that of Shelley (Pettingill, 1936:305); this record apparently was also made on the display territory. I did not observe copulation. From our limited information, it appears that mating may occur either on display grounds or near nesting sites, but initial matings of a breeding season probably occur on the display grounds. The question arises: does one male establish a pairing bond with a female during the egg-laying period and later visit the site of the nest? Or does the occurrence of mating near the nest result from a chance discovery of a receptive female by a male moving about favorable feeding grounds?

Pettingill (1936:306) and Norris *et al.* (1940:9) consider the Woodcock to be polygamous, but the available evidence is not satisfactory. Circumstantial evidence drawn from my observations agrees with that cited by Pettingill (1936:305): more than one bird may enter the display territory and apparently remain for a time; likewise, on diurnal feeding areas, several birds may be present (Figure 3). Pair formation does not occur in the European Woodcock (Steinfatt, 1938:387), and the species is regarded as polygamous (Zedlitz, 1925:67). Zedlitz (1927:75) reports females of *Scolopax rusticola* to be polyandrous in areas where males are numerous. The studies of Steinfatt and

Zedlitz suggest that several copulations are necessary for the completion of a clutch. Considering the comparable breeding biology of *Philohela* and *Scolopax*, it is possible that these conditions obtain in *Philohela*, also. On the other hand, Aldous (1938:842) regards the species as monogamous. Certain observations by Brewster (1925:228, 229) favor this contention.

DISPLAY IN RELATION TO MIGRATION AND NESTING

Woodcocks did not remain to nest on the study area in 1939, and from the foregoing discussion, it is evident that American Woodcocks may, during passage northward, become established temporarily and exhibit territoriality. According to data sent to me by J. Murray Speirs, performing males were present in Champaign County in 1940 at least from March 19 to April 2, but departed; in the spring of 1941, although several observers looked for Woodcocks, none was found.

Data from other parts of the northeastern United States, presented below, show that flight displays of the Woodcock are normally given for approximately two months beyond the latest record from Champaign County. Most breeding records fall in April. There seems to be little doubt that the birds which left the study area became re-established elsewhere.

Territorial behavior, then, may not necessarily be restricted to sites where actual breeding will take place. Studholme and Norris (1942:231) report migratory movements of Woodcocks and variations in numbers of singing males during the first week of April in central Pennsylvania; after the first week, numbers were more or less stabilized, and territories were definitely established. Steinfatt (1938:384, 386) observed that males of *Scolopax rusticola* performed their crepuscular flights when stopping in the course of spring migration. It may be added that flight displays of the American Woodcock have been observed at the time of fall migration (Pettingill, 1936:303).

In east-central Illinois, as in most other parts of the state, the Woodcock generally arrives in spring during the first half of March (Pettingill, 1936:233). The earliest arrival date at Urbana is March 5. The species may be fairly common locally during migration, but as a summer resident it is uncommon. Available nesting records show that eggs are laid from late March through April (Hess, 1910:31 and 1912, MS). Nesting records from northeastern states generally range from late March through May, however, and at any particular location the breeding season may be irregular because of the relatively long time span during which nesting may take place (Brooks, 1930:249). Yet there is no satisfactory evidence that the American Woodcock generally nests more than once a year. Two nestings may take place on occasion, as suggested by records of Pettingill (1936:218), Hicks (1933:181), and Bagg and Eliot (1937:208). The European Woodcock regularly breeds twice a year (Steinfatt, 1938:390).

In east-central Illinois, display flights have been observed from March 9 through April 2. Records over a series of years, however, would probably extend this period. In northwestern Ohio, for example, records of males in flight displays extend from February 28 through May 10 (Trautman, 1940:249); in the Cayuga Lake basin, New York, from March 14 to June 2 (Pettingill, 1936:277, 297); and on Long Island, New York, from February 13 to May 28 (J. T. Nichols, letter). Bagg and Eliot (1937:208) record males in the Connecticut Valley, Massachusetts, giving crepuscular calls on February 5 and 24; dates on which flight displays were seen range from March 4 to June 7. One late date, July 17, 1933, is also given. Studholme and Norris (1942:233) found that most males ceased regular display by the middle of May, although irregular display continued until June 3. Their observations indicate that there is only one cycle of active display among the established males of an area. In the European Woodcock, there are two cycles of active flight display corresponding to the two broods per nesting season (Steinfatt, 1938:384): the "Frühlingsbalz," in East Prussia, lasts from late March through April and the "Sommerbalz" lasts from early May through most of June, or even until as late as July 12.

In making this study of the American Woodcock, I attempted primarily to investigate certain features of territorial relations left unsettled by earlier studies. Unlike Pettingill's experience (1936:283), I found evidence for (1) competition in selection and maintenance of a display territory, (2) combat, (3) overlap of territories, (4) leaving of territories to fight neighbors, and (5) increased vigor of singing among neighboring males. However, these points need to be amplified through further observation and study. My own field work was limited by lack of time. There is obviously a great deal yet to be learned about the American Woodcock, and several questions must be apparent to the reader. Among these are the problems of polygamy, pair-formation, and territoriality on areas other than display sites. Investigators may gain some idea of the data needed for the American Woodcock by reading the excellent summarization by Witherby *et al.* (1940:184) of available data on the European species.

SUMMARY

During the early spring of 1939, a study of territoriality, display, and certain ecological relations of the American Woodcock was undertaken at Urbana, Champaign County, Illinois. From a small concentration of migrant Woodcocks present on the semi-wooded study area from March 5 to April 3, three established males were studied. They were confined to more or less definite feeding areas and to open-country, crepuscular-display territories.

A call-note of advertisement and warning, *peent*, is given repeat-

edly on the display territory when the occupant male is not performing a song-flight. Competition among neighboring males accelerates rate of calling. Normal, day-to-day variations in temperature do not appear to affect rate of calling. But the length of the crepuscular calling period tends to correlate directly with temperature variations; that is, calling periods are longer when daily temperatures are higher. There is undoubtedly a relation between light intensity and beginning and ending of crepuscular calling, but other factors complicate this relation.

The cackle note is given by an established male in assault and threat toward other birds who invade his territory or who occupy neighboring territories.

The song-flights of the male Woodcock function chiefly in territorial advertisement but may also function in intimidation. Neighboring males may compete through more frequent performance of the song-flight. The frequency with which the song-flight is performed does not appear to be affected by temperature. First song-flights were given during evening display periods when the light intensity fell to 1.0 to 0.5 foot-candles. Length of singing period as well as length of calling period tends to vary according to day-to-day temperature fluctuations.

Only the display sites of males are known to be defended, and at present only these can be termed territories. Manifestations of territoriality among established males are seen in competitive selection and maintenance of singing-fields, combat, overlap of display territories, efforts to displace neighbors through aggression, and increased vigor of singing and calling among closely neighboring males.

Feeding areas occupied by three males were 250 to 300 feet in diameter. Calling sites ranged from 50 to 75 feet in diameter, but territorial claims are asserted over larger areas, defined in part by outer limits of display flights. Single flights may cover areas of $\frac{1}{3}$ to $\frac{2}{3}$ of an acre. All flights of a single male may cover a total area of two to five acres.

Both male and female Woodcocks may strut when excited. Strutting is not necessarily a courtship display preliminary to mating.

Territorial males resent all intruders and assault them with the cackle note. Events subsequent to any intrusion are determined largely by responses of the intruder to intimidation.

American Woodcocks may become temporarily established on territories during the period of spring migration.

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NIDIFICATION OF THE PASSERINE BIRDS
OF HISPANIOLA

BY JAMES BOND

WHEN I began my survey of the avifauna of the West Indies in 1927 very little was known of the nesting habits of the birds of Hispaniola, and I tried to fill this gap during the nine months that I spent on the island. It seemed especially important to secure information on the nesting of the endemic species, all of which I encountered in the field and most of which I collected. It must not be forgotten that the instinct to construct a particular type of nest is inherited, just as structural and color characters are; and although rarely mentioned by systematists, the type of nest is, I believe, frequently more indicative of relationships than anatomical characters are.

This paper deals only with the Passeriformes, not only because birds of this order are the least known, but also because their nesting habits (with a few exceptions) are of greater taxonomic significance. For example, the nidification of the continental *Schiffornis turdinus* indicates that this peculiar species is a member of the suborder Mesomyodi and should probably be referred to the Cotingidae. Griscom (1932:277) writes that "the characters which make it a member of the Mesomyodi are only assumed" and that "in life *Schiffornis* is thrush-like in habits and appearance." But no thrush that I know of builds a nest or has eggs resembling those of *Schiffornis*. Again, nests and eggs of the peculiar family Pterotochidae suggest relationships with the New Zealand "wrens" (*Xenicus*, etc). As an example among non-Passerine families, I believe that a comparative study of nidification of the swifts will prove particularly helpful to systematists.

After examination of hundreds of nests of West Indian birds from all parts of the region, I have reached the following conclusions:

(a) Quite distinct or at least not strictly representative species of the same genus usually build distinctive nests (e.g. *Elaenia martinica*, *E. flavogaster*, *E. fallax*).

(b) Representative species and subspecies build similar types of nests, and the eggs are usually similar. There is more individual than subspecific variation in nest construction.

(c) In the West Indies many of the rarer passerine species lay not more than two eggs, the common species seldom less but rarely more than three. In the Greater Antilles, certain genera (e.g. *Myiarchus*, *Corvus*) frequently, if not habitually, lay four eggs.

(d) In southern Haiti the breeding season of most of the rarer passerine birds is toward the end of the first rainy season (May and June), and but one brood is raised annually. The season is not nearly so definite with the commoner species, some of which (e.g. *Coereba*,

Tiaris) may be found nesting at any season of the year, and they probably rear two broods. Birds apparently nest earlier in northern Haiti than in the south.

ANNOTATED LIST *

Gray Kingbird, *Tyrannus dominicensis dominicensis*

The Gray Kingbird habitually lays three eggs in Hispaniola. A few nests were found with one or two eggs, but these were probably incomplete or may have represented a second laying. Nests found from April 18 to June 1.

Loggerhead Flycatcher, *Tolmarchus caudifasciatus gabbi*

This flycatcher builds a flimsy, cup-shaped nest like that of the Gray Kingbird. One nest, which I found near Kenscoff, contained two heavily incubated eggs, which were unfortunately broken when an attempt was made to collect them. Mr. George Smooker of Trinidad has a set of three eggs that was taken in Haiti by Dr. J. G. Myers, formerly of the Imperial College of Tropical Agriculture in Trinidad. These eggs he describes (in a letter) as follows: "ground a medium cream color; upper markings umber-brown of rather varying shades, splashed and scattered irregularly over the surface of the shell, but more pronounced at the larger end where a very few black hair lines and dots are apparent; underlying markings lavender-grey, not profuse (23.5 x 17.5; 24.6 x 18.2; 24 x 18 mm.)."

The nidification of *Tolmarchus* indicates close relationship with *Tyrannus* but not with *Pitangus* (*sulphuratus*) which builds a large, untidy globular structure with the entrance near the top (Belcher and Smooker, 1937:234). In the latest review of the Tyrannidae (Hellmayr, 1927) the genus *Tolmarchus* is far removed from *Tyrannus*, being placed next to *Pitangus*. From a morphological viewpoint alone, the relationship of *Tolmarchus* with *Tyrannus* seems to me at once apparent. The bill, particularly that of the Bahaman race (*bahamensis*), resembles that of *T. melancholicus*. The color pattern of *Tolmarchus*, especially the dark pileum and whitish tip of the tail, reminds one of our Eastern Kingbird (*T. tyrannus*). Incidentally, its rather harsh chattering notes are also reminiscent of this well known species. Nests found from May 14 to July 12.

Stolid Flycatcher, *Myiarchus stolidus dominicensis*

The nidification of the Stolid Flycatcher resembles that of others of the genus. Nests found in Hispaniola and on Gonave Island were placed in cavities in trees or cacti. One nest contained shed snake skin, a material often found in nests of the northern *M. crinitus*, and also

* Description of nests and eggs are supplementary to those given in Wetmore and Swales (1931) and in Bond (1936). Precise nesting dates pertain to nests, found in Hispaniola or on Gonave Island, that contained eggs unless otherwise stated.

noted in nests of *M. tyrannulus*, although not in those of *M. validus* and *M. barbirostris*, both of Jamaica, probably because snakes are almost extinct in Jamaica, where I saw only one snake (*Epicrates subflavus* Stejneger), which had been caught by a native near Morant Bay. Eggs (3 to 4) of the Stolid Flycatcher are strikingly marked. Except that they are, of course, decidedly smaller, they are like those of *M. (Hylonax) validus*. Nests of *Myiarchus* likewise resemble those of *M. (Hylonax) validus*.

In Haiti I have found *M. stolidus* nesting at an altitude of about 5,000 feet. The Jamaican race (*M. s. stolidus*) is, however, confined to the lowlands, being replaced in the mountains by *M. validus*. Nests found from May 9 to May 31.

Greater Antillean Pewee, *Contopus caribaeus hispaniolensis*

The West Indian pewees are usually placed in the genus *Blacicus*, but I am of the opinion that they should be included in the more widespread *Contopus*. They have been placed by systematists next to *Myiarchus*, but the nidification does not indicate close relationship.

Nests and eggs of the pewee from Hispaniola resemble those of the common Wood Pewee (*C. virens*) of eastern North America. The nests are saddled on the limbs of trees or bushes, often within reach of the ground. The eggs (2 to 3) are frequently heavily wreathed about the middle or widest part, a characteristic of those of *C. virens*. Nests found from May 28 to June 12.

Greater Antillean Elaenia, *Elaenia fallax cherriei*

The nidification of this flycatcher indicates conspecific relationship with the Jamaican *fallax*. The nests are bulky cups of moss, heavily lined with feathers, and are very different from those of either *E. martinica* or *E. flavogaster*. As far as known, both forms of *fallax* lay but two eggs. A single egg from Haiti measures 18.8 x 14.5 mm. Nests found in Haiti were situated from about 6 to 30 feet above the ground. Known breeding dates: May 12 (hatching) to June 4 (laying).

Eggs of the West Indian *Elaeniae* resemble those of *Empidonax*, a genus now placed in a different subfamily (*Myiarchinae*). And the Caribbean *Elaenia* (*E. martinica*) reminded me in the field of the Alder Flycatcher (*Empidonax traillii*), its song and call-note being much like those of this well known species.

Antillean Cliff Swallow, *Petrochelidon fulva fulva*

For an account of the nesting habits of *P. f. fulva* in Hispaniola see Wetmore and Swales (1931:319). This swallow lays two or three eggs.

As far as I am aware the only swallows in North or Middle America that build nests of mud and lay spotted eggs are those of the genera *Hirundo* and *Petrochelidon*, which are evidently related and

probably of Old World origin, although they are not placed together by Hellmayr (1935). Incidentally, it seems to me clear that if the South American swallow known as *Petrochelidon andecola* should prove to build a mud nest and to lay spotted eggs its inclusion in the genus *Petrochelidon* is correct. If, on the other hand, the nidification of this bird should prove to be like that of other American swallows it would indicate that it should be referred to the genus *Haplochelidon*, proposed for this species by Todd in 1929. Nests found from April 24 to July 6.

Golden Swallow, *Lamprochelidon euchrysea*

The nesting habits of the Hispaniolan Golden Swallow (*L. e. sclateri*) resemble those of *Iridoprocne* and *Callichelidon*. Some nests are built under the eaves of houses (at Furcy and at Kenscoff), others in tree cavities such as old woodpecker holes. Three white eggs are laid. Breeding dates: June 6 (egg and young) to June 12 (young).

Purple Martin, *Progne subis dominicensis*

This martin has been found nesting in Hispaniola in old woodpecker holes and under the eaves of houses, but eggs have not been collected on the island. Nests found from March to June.

White-necked Crow, *Corvus leucognaphalus leucognaphalus*

I found a nest of this crow near Bois Laurence on May 2. It was placed in a crotch of a pine which I could not climb. The eggs (3 to 4) were taken by Gundlach in Puerto Rico. They resemble those of other crows.

Palm Crow, *Corvus palmarum palmarum*

Nests and eggs of this locally abundant bird resemble those of other crows. Its eggs (4) are, of course, smaller than those of *C. leucognaphalus*. Nests found from April 24 to May 21.

Northern Mockingbird, *Mimus polyglottos orpheus*

The North and Middle American (including West Indian) genera of Mimidae lay immaculate greenish blue eggs, the exceptions, as far as known, being *Mimus*, *Nesomimus*, *Oreoscoptes* and *Toxostoma* (except *T. crissale*). In regard to eggs of *Toxostoma*, Oates (1905:86) states that, starting with *T. rufus* of the eastern United States, birds of this genus lay eggs that become progressively bluer as we proceed westward, the series culminating in the immaculate greenish blue egg of *T. crissale*. Eggs of the Mexican species (*T. guttatum* and *T. ocellatum*) have not been described.

The systematic arrangement of this family might well be modified by reference to nidification. Thus *Dumetella* would not be inserted between *Mimus* and *Toxostoma*, as was done in the 1931 A.O.U. Checklist, but would be placed next to the Mexican *Melanoptila*.

The Northern Mockingbird lays three or four eggs in Hispaniola. Nests found from March to July.

Pearly-eyed Thrasher, *Margarops fuscatus fuscatus*

Not definitely recorded from the mainland of Hispaniola, although known to inhabit Beata Island, off the south coast of the Dominican Republic. Nests have been found on other islands of the West Indies.

La Selle Thrush, *Turdus swalesi*

Nests of the La Selle Thrush are placed in bushes at low or moderate elevations above the ground. They are bulky cups of grasses, covered externally with moss so that they appear, until taken apart, to be constructed entirely of the latter material. The eggs are "robin's-egg blue," rather evenly spotted with greyish brown and lavender-grey. They are characteristic of *Turdus*, and are quite different from those of *Mimocichla*. Incidentally, *T. aurantius* of Jamaica, believed to be the nearest relative of *T. swalesi*, lays eggs strikingly similar to the putty-colored examples (see below) of *Mimocichla*. Nests found from May 20 (a deserted nest) to June 9 (nest under construction).

Red-legged Thrush, *Mimocichla plumbea ardosiaceae*

I feel very strongly that *Mimocichla* should be placed next to or near *Turdus*, although Hellmayr (1934) places it far from this genus, with the solitaires (*Myadestes*) in between. The most important generic characters of *Mimocichla*, separating this genus from *Turdus*, are the graduated tail and distinctive color pattern.

Nests found at high elevations in Haiti are constructed of grass and moss, and are virtually indistinguishable from those of the La Selle Thrush, but the eggs (2 to 3) are quite different. They are greenish white, heavily and handsomely marked with dark brown. Strangely enough, eggs from elsewhere in the West Indies have a putty ground color. Nests of the Red-legged Thrush, found at low elevations, are constructed almost entirely of grass. Nests found from May 14 to May 31.

Antillean Solitaire, *Myadestes genibarbis montanus*

The solitaire has not yet been found nesting in Hispaniola. For an account of the nidification of this species in Jamaica and in Dominica see Bond (1936:290, and 1941:373).

Palm Chat, *Dulus dominicus*

For an account of the nesting of this interesting bird see Wetmore and Swales (1931:347). (A life history study of the Palm Chat would be of considerable interest and comparatively simple to make since the species is found abundantly in and near Port-au-Prince and the large communal nests can be located with ease.) Breeds mainly from March to June (Wetmore and Swales, 1931).

Thick-billed Vireo, *Vireo crassirostris tortugae*

In habits, song, and nesting this vireo resembles the North American White-eyed Vireo (*V. griseus*), but the eggs (2 to 3) are generally more heavily marked than those of the northern species. The height of

the breeding season is apparently in March, since I found on Ile La Tortue as many as five nests that contained either eggs or young during the latter part of this month. The species is not known from Hispaniola proper, but is found virtually throughout the Bahama Islands (*V. c. crassirostris*).

Flat-billed Vireo, *Virco nanus*

The Flat-billed Vireo evidently lays only two eggs, which are nearly, or quite, immaculate. Measurements of one set were 19 x 13.4, and 18.2 x 13.3 mm. Nests found from May 19 (eggs about to hatch) to May 21 (eggs slightly incubated). On March 12 in northern Haiti, near Port de Paix, I secured a male in breeding condition—which would indicate that this vireo nests at an earlier date in this section.

The Flat-billed Vireo is related to and representative of *V. modestus* of Jamaica (Bond, 1934). Both species sing on the nest.

Black-whiskered Vireo, *Vireo altiloquus altiloquus*

Many nests of this vireo were found on Gonave Island in late May. Nests and eggs (3) resemble those of the North American Red-eyed Vireo. Nests found from May 19 (with young) to July 20.

Some time ago the nest and eggs of a vireo, believed to have been "*Vireosylva caymanensis*" (= *Vireo magister caymanensis*), were described by Savage English (1916:28). This is the only species of the *Vireosylva* group other than *V. a. altiloquus* among indigenous West Indian birds. English's record I consider open to question, since he made no mention of *V. crassirostris* and showed his unfamiliarity with the vireos by stating that "*Virco caymanensis* is very probably the real singer of the song attributed to *Melopyrrha taylori*." However, the nest he described was undoubtedly that of a vireo (probably *V. crassirostris*, since the nest was situated only three feet above the ground). Recently I received from Bonaco Island, Honduras, a nest and egg of *Vireo m. magister*, the only vireo known to inhabit this island. The nest resembles that of *altiloquus*, but the egg, possibly abnormal, is immaculate, except for some minute specks at the larger end.

Bananaquit, *Coereba flaveola bananivora*

The large globular nest of this abundant species is usually placed at a low elevation in bushes or among vines. The nest is utilized not only for breeding but also for roosting (Wetmore and Swales, 1931:364). I have never seen more than three eggs in a clutch. There is no definite breeding time; nests are found virtually throughout the year anywhere in the West Indies. Nests found in the study area from January to July.

Golden Warbler, *Dendroica petechia albicollis*

This Golden Warbler has not yet been found nesting. Nests and eggs that I have examined of other West Indian forms resemble those of northern Yellow Warblers.

Pine Warbler, *Dendroica pinus chrysoleuca*

This common warbler of the pine forests of Hispaniola has not as yet been found nesting on the island.

I have stated (1936:313) that the song of the Pine Warbler is "easily distinguishable" from that of *D. pityophila*. This is indeed true of the North American and Bahaman races, but in the spring of 1941, after visiting the haunts of *D. pityophila* earlier in the year, I heard the song of the Pine Warbler in the forests of La Selle, and I was forcibly struck with its resemblance to that of *D. pityophila*. Known breeding date: May 15 (female with newly formed egg).

Gray-breasted Ground Warbler, *Microligea palustris palustris*

Two nests of this warbler were found on the summit of Morne Tranchant (about 5,900 feet). Both were situated near the ground, one in a very dense bush, the other in a blackberry thicket. The eggs are unlike eggs of *Geothlypis*, believed to be the genus most nearly related to *Microligea*, being more like those of the Cuban warblers of the genus *Teretistris* in having a decidedly greenish background. Though of course much smaller than eggs of *Phaenicophilus*, they resemble them in color. I shot one of the birds on the nest, a most unpleasant thing to have had to do, but essential, since I had previously collected both this species and *M. montana* in this locality, and it was necessary to be absolutely certain of identification. Measurements of a set are 19.5 x 14.7 and 19.7 x 14.8 mm. Nests found from May 31 to June 1.

White-breasted Ground Warbler, *Microligea montana*

The nest and eggs are unknown. It would be interesting to compare them with those of the preceding form, since the two species are not geographically representative of each other. Specimens taken in the Massif de la Selle in early June were in breeding condition.

It is noteworthy that no Antillean warblers are known to nest on the ground as many Central and South American species do.

Antillean Euphonia, *Tanagra musica musica*

This species has been found nesting in St. Lucia (*T. m. flavifrons*) and in Trinidad (*T. m. intermedia*). The euphonia evidently breeds early in Hispaniola, for in Haiti I collected males with enlarged testes as early as April.

The nidification of *Tanagra* is not characteristic of the Thraupidae. The nests are more or less globular in shape and the eggs finch-like. Some South American species (e.g. *T. lanirostris*, *T. violacea*, *Chlorophonia cyanea*) habitually nest on the ground, in the side of a bank.

Hispaniolan Golden Tanager, *Spindalis dominicensis*

Seven nests were found. These were placed in bushes at low or moderate elevations (from 3 to 15 feet) above the ground. They are

composed entirely of dry grasses, are always rather loosely constructed, and are sometimes surprisingly small.

Eggs (2 to 3) of this species vary greatly in color and markings. Those of a set collected measure 23.4 x 16.6, 22.5 x 16.3, and 22.9 x 16.8 mm. Nests found from May 14 to June 10.

Black-crowned Palm Tanager, *Phaenicophilus palmarum*

Nests were found in low bushes three to six feet above the ground, but the majority of individuals undoubtedly build in trees. The nests are deep cups, not unlike those of the Scarlet Tanager (*Piranga olivacea*); they are neater and more strongly built than nests of *Spindalis*. The eggs (2 to 3) show much variation both in color and in size; measurements vary from 23.6 x 17.6 to 27.8 x 18.1 mm.

When examining a nest found on Morne Tranchant, I was astonished at the concern of one of the parent birds, presumably the female, which approached within a few inches of my hand, complaining vociferously, although at the time her eggs were fresh. The species is usually rather shy. Nests found from May 13 to June 8 (nest under construction). A nest, containing three young, that I found near Caracol in northern Haiti on April 28, 1928, almost certainly belonged to this species.

Gray-crowned Palm Tanager, *Phaenicophilus poliocephalus coryi*

I found about 15 occupied nests of this tanager on Gonave Island. They were situated at from 4 to 30 feet above the ground, and they resemble those of *Ph. palmarum*. The eggs (2 to 4) vary considerably in color. As with nests of the Scarlet Tanager, it is sometimes possible to see the eggs from below. Nests found from May 14 to June 26.

Chat Tanager, *Calyptophilus frugivorus tertius*

Although the Chat Tanager is common on Gonave Island (*C. f. abbotti*), no nests were discovered during May and June. The birds did not appear to be in full breeding condition but were found for the most part in pairs. Male Chat Tanagers (*C. f. tertius*) with much enlarged testes were, however, taken in the Massif de la Selle in early June. No certainly authentic nest was discovered, although a single nest, containing one addled egg (23.6 x 18.3 mm.) that I found on Morne Tête-bois-pin (also known as Morne Découverte) near Morne Tranchant, probably pertained to this species. This nest (found June 14) was situated in a fern about two feet above the ground, bordering a blackberry patch. There was a protesting pair of Chat Tanagers a few yards from the nest, so that it is likely that there were young nearby.

I believe that the genus *Calyptophilus* is related to the continental *Rhodinocichla*, the nidification of which is unknown.

Tawny-shouldered Blackbird, *Agelaius humeralis*

No nest of this well known Cuban species has been found in Hispaniola. Known breeding date: July 9 (young out of nest).

Village Weaver, *Ploceus cucullatus cucullatus*

An introduced species, locally common in Haiti. On one occasion, at Basin Generale, I observed over 70 nests in a single tree. For a description of eggs taken in Haiti see Bond (1941a:110). Nests found August 4.

Yellow-faced Grassquit, *Tiaris olivacea olivacea*

This finch nests at low elevations in bushes and trees and not infrequently on the ground, either under the side of a bank or in the grass of a roadside pasture. As with many common West Indian birds, nests may be found virtually throughout the year. Danforth (1929:374) recorded one that contained five eggs, in the Dominican Republic, but I have never seen a clutch of more than three of either this or the following species. Known breeding dates: from May (young on wing) to August.

Black-faced Grassquit, *Tiaris bicolor marchii*

This well-known species builds its nest in Hispaniola near the ground, in bushes or ferns or among the spines in the tops of pineapple plants (Christy, 1897:324). In the Bahamas (*T. b. bicolor*) I have found nests in the fronds of palms as much as 20 feet above the ground. Known breeding dates: from May (young on wing) to August.

Greater Antillean Bullfinch, *Loxigilla violacea affinis*

I found 17 nests of this bird in Haiti during May and June, every one of which contained three eggs. Wetmore and Swales (1931:438) report that Abbott received a nest (of *L. v. maurella*) containing six eggs from a native on La Tortue, but I have no doubt that these, as they suggested, represented two separate clutches. I might mention here that I never allow natives to bring me nests and eggs that they have found. I always require that they not only show me the nest *in situ* but also the parent bird on the nest.

Nests found in Haiti were placed either on the ground or as high as 10 feet above the ground, in bushes. Most of the nests were domed, with the entrance at the side, but some had the entrance near the top, and one nest, which contained a full set of eggs (3), was cup-shaped. But the nest is always bulky. It is composed in the mountains very largely of moss; in low arid sections, where moss is not available, of dry grasses. Measurements of a set of eggs of *L. v. affinis* are 20.8 x 16.8, 21.7 x 16.5, and 21 x 16.9 mm. All eggs examined had a very pale bluish-white background (not dull white as in those of the Lesser Antillean *L. noctis*). Nests found: *L. v. affinis*, from May 12 to June 25;

L. v. parishii, May 15; *L. v. maurella*, from March 19 (not "May 19" as stated by Wetmore and Swales, (1931:438) to June 20.

Antillean Goldfinch, *Loximitris dominicensis*

Though all nests that I have found of this species were situated in low bushes or small pines, I think it likely that many are placed high in the pines. They are very neat and compact cups composed entirely of moss. Eggs of one set taken measure 18.5 x 13.7, 18.2 x 13.8, and 18.2 x 13.5 mm. Eggs found from June 2 (eggs heavily incubated) to June 12 (fresh eggs).

White-winged Crossbill, *Loxia leucoptera megaplaga*

A small series that I collected near Morne Cabaio (southeastern Haiti) in June, 1930, had very small gonads. In the Dominican Republic, young that had recently left the nest were collected in March, so it would appear that this crossbill breeds very early in the year.

Grasshopper Sparrow, *Ammodramus savannarum intricatus*

Although nests have been found of both the Jamaican and Puerto Rican races, the nest of the Hispaniola race is still unknown. It is doubtless similar to those of other forms of this well-known species. A young bird in juvenal plumage was taken on February 1 (Wetmore and Swales, 1931:443).

Andean Sparrow, *Zonotrichia capensis antillarum*

No nest with eggs has been found of this race, which is known only from the Dominican Republic. The nest presumably resembles those of other forms of this widespread tropical American species. Female observed gathering nest material May 19 (Wetmore and Swales, 1931:446).

Most West Indian Fringillidae have eggs that are of little value in indicating relationship. A noteworthy exception is the egg of the Antillean Saltator; this is truly distinctive in color and markings, and agrees in these respects with eggs of extralimited species (namely *S. atriceps*, *S. maximus*, *S. coeruleus*, *S. orenocensis* and *S. aurantiirostris*).

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ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

JOSEPH GRINNELL'S PHILOSOPHY OF NATURE. SELECTED WRITINGS OF A WESTERN NATURALIST. University of California Press, Berkeley, 1943: 6 x 9¼ in., xv + 237 pp., 2 col. pls., 6 photos., 5 maps and figs. \$2.00.

The late Joseph Grinnell's many admirers will be glad to learn that the University of California has brought out in an attractive volume a collection of twenty-eight of his scientific papers. These appeared originally in a variety of publications, and many of them were quite inaccessible to the present generation of natural history students. The papers, which are arranged chronologically, cover the period from 1903 to 1936, and are well chosen to illustrate the work of this great naturalist at its best. The very titles challenge our attention: 'The Museum Conscience,' 'Conserve the Collector,' 'Sequestration Notes,' 'The Principle of Rapid Peering, in Birds.' There are 13 maps, diagrams, and pictures, three of them in color, and an ably written preface by Grinnell's student and successor, Alden H. Miller.

This volume reminds us that Joseph Grinnell was not only an unusually competent and active administrator, teacher, editor, and investigator, but also an original thinker and a clear and forceful writer.—J. Van Tyne.

GENERAL NOTES

Normal Flight of a Black Duck after Healing of Wing Fractures.—On December 5, 1942, while Kenneth H. Doan and I were in a blind on South Bass Island, Lake Erie, Ottawa County, Ohio, a Black Duck (*Anas rubripes*) alighted among our decoys, after first circling them in the wary Black Duck fashion. Its flight appeared normal in every respect. Upon retrieving this duck I noticed that its left wing was decidedly shorter than the right. Dissection revealed that the left humerus had at some time been fractured near the elbow, and in healing, the two segments of the bone had fused at an angle. Thus the humerus was shortened; the proximal segment pierced the skin and protruded at least a quarter of an inch. (Figure 1.) The hollow center of the bone thus exposed had been completely blocked with minute bone fragments, behind which was normal-appearing marrow. The edges of the skin around the exposed tip were entirely healed. At the point of fusion, where the bone was greatly enlarged, there was an arched projection of bone with a hollow center between it and the fracture. An old shot-gun pellet, presumably the one that broke the humerus, was embedded in the muscle beside the point of fracture.

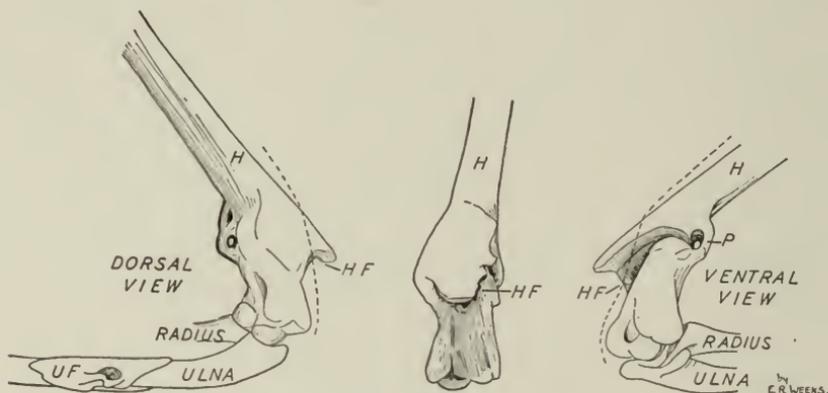


Figure 1. Healed bones of Black Duck wing.

H = humerus; HF = humerus fracture; UF = ulna fracture; P = arched projection of bone; dotted line = skin.

At some time, possibly when the humerus was broken, the ulna had also been fractured, obliquely, near the middle. This fracture had healed, leaving the bone normal in length, although somewhat enlarged at the point of fusion. The muscles and tendons surrounding the humerus and ulna were apparently in excellent condition, but were, of course, distorted because of the abnormal angle of the elbow joint. The fused portions of humerus and ulna appeared to be as strong as the remaining sections of these bones. The duck itself, although not fat, appeared to be in good physical condition. It seems remarkable that so mutilated a wing could function so well that there was no noticeable "limping" in the bird's flight.—MILTON B. TRAUTMAN, F. T. Stone Laboratory, Ohio State University, Put-in-Bay, Ohio.

Roseate Spoonbills Transported Northward by Ship.—Chester S. Lawton of the cable division of Western Union has reported to me an interesting case of Roseate Spoonbills (*Ajaia ajaja*) being accidentally transported far north of their normal range.

Captain Bredin Delap and Second Officer W. McGarva report that at sunset on the evening of January 18, 1943, while the cable ship *Cyrus Field* was in the Florida Straits (26° 56' N., 79° 36' W.; 25 miles offshore), three Roseate Spoonbills approached the ship from the southwest, circled it once, and flew away to the northeast. The weather was moderate, the wind in the southeast. The next morning at 7:00 A.M. (29° 32' N., 79° 45' W.; 67 miles offshore), three Spoonbills, presumably the same individuals, boarded the ship and perched on the lifeboat davits. The weather was then cloudy and squally, the wind in the south. The Spoonbills seemed very tired, and the men tried to feed them, but the birds would not touch food or water. During the day one of the Spoonbills was captured, taken below, and fed. At 5:00 P.M. the two free birds were accidentally frightened from the ship. By that time the wind was strong, and from the northwest. The birds seemed unable to regain the ship and were last seen flying southeast (31° 03' N., 79° 22' W.; 95 miles offshore). The third Spoonbill escaped shortly before noon the next day (January 20) in about the latitude of Charleston, South Carolina (32° 42' N., 76° 47' W.; 92 miles offshore).

The identification of the Spoonbills is conclusively demonstrated by photographs submitted by Captain Delap. Perhaps similar, but unrecorded, incidents would account for some of those extra-limital records of various species in ornithological literature which are now supposed to represent natural biological distribution.—**JOSSELYN VAN TYNE**, *University of Michigan Museum of Zoology, Ann Arbor, Michigan*.

The Little Brown Crane in Ohio.—Robert Goslin, of Columbus, Ohio, has recently sent to the National Museum for identification another small lot of bird bones from archeological excavations at the Feurt Village site in Clay Township, Scioto County, southern Ohio, a locality from which many vertebrate remains have been obtained. Among the forms represented I find a complete left humerus collected by Dr. Stanley Copeland, of Columbus, and a nearly complete pelvis secured by H. R. McPherson, of Columbus, that come from the Little Brown Crane (*Grus canadensis canadensis*). The occurrence of this bird in Ohio has previously been open to question. J. W. Aldrich of the Fish and Wildlife Service informs me that the only record he has seen is that of Oliver Davie, who says: "I mounted a specimen of this bird which was taken in the spring of 1884 from a flock of seven birds near Springfield, Ohio. It is a rare migrant in the state." (Nests and Eggs of North American Birds, 1898, page 121.) Aldrich tells me that he has not been able to find that this record had been confirmed by other students, and that it has not been currently accepted.

On comparison with modern skeletons of the Sandhill and Little Brown Cranes, the bones listed above are easily identified by their small size, in which they agree completely with the latter form. They thus make a substantiating record for the occurrence of the Little Brown Crane in Ohio.

From the Feurt excavations there come also three radii that from their large size are obviously the Sandhill Crane. The Indian hunters then, obtained both forms of these birds in this region in the fifteenth or sixteenth centuries. **ALEXANDER WETMORE**, *U. S. National Museum, Washington, D. C.*

Coots Killed Under Unusual Circumstances.—Although Coots (*Fulica americana*) becoming enmeshed in vegetation and strangling to death is probably only an occasional cause of mortality, the instance which I observed is of interest. While making brood counts and nesting observations on waterfowl in Mud Lake,

near Ruthven, Iowa, July 16, 1939, I found a dead Coot of between six and seven weeks of age suspended by the neck on a piece of reed grass (*Phragmites communis*). The lower one-third of the Coot's body was in the water. Just above and back of the bird was a large platform nest about 24 to 30 inches above the water, built by piling stalks on the base of a smashed clump of reed grass. The bird, using this as a roosting platform, had undoubtedly in jumping off the nest become snared in the loop of reed grass.

Another unusual cause of death among Coots was observed several times during the course of waterfowl investigations in Iowa marshes. On two occasions during the summer of 1939, and once during 1940, I came across Coots hanging from a barbed wire fence which crossed the marshland in Clay County known as Barringer's Slough. Upon closer examination I found that two of these birds had apparently hit the barbs on the wire, which were pointing upward at about 45 degree angles. The barbs tore into the skin of the lower neck, and the birds had swung once completely around the wire, and were thus fastened very securely to it. The other bird had not gone completely around the wire but had caught on a horizontal barb and had fallen over the wire to the side opposite the barb. How long the birds struggled before death overtook them is not known.

On another occasion, several Coots from a flock of about 25 or 30 flying low over the marsh were seen to strike the fence, but none was caught on the barbs. How many birds struck the fence for each one caught is problematical. It is conceivable that injury and death to birds from striking these wires might in a season reach numbers sufficiently large to make justification of the barbed wire across this waterfowl habitat highly questionable.—JESSOP B. LOW, *Illinois State Natural History Survey, Natural Resources Building, Urbana, Illinois.*

Greater Yellow-legs as a Fish-eater.—Most shore birds generally feed upon insects and other invertebrate life. The Greater Yellow-legs (*Totanus melanoleucus*) is quite adaptable, however, and occasionally an individual is found feeding upon a type of food that may be considered far removed from its normal diet.

On September 3, 1942, at Lac aux Morts (Lake Alice), Ramsey County, North Dakota, I observed a Greater Yellow-legs standing in about 2 inches of water and feeding upon fish. During the short period of 15 minutes that this bird was under observation, it consumed eight small minnows. The bird caught the fish at right angles to its bill, then skillfully turned the fish so that the head was swallowed first.—CLARENCE COTTAM, *Fish and Wildlife Service, Chicago, Illinois.*

Purple Sandpipers at Richmond Beach, Ohio.—About 30 miles east of Cleveland the Grand River empties into Lake Erie at Fairport Harbor. The town of Fairport is on the east, the village of Richmond on the west. A large turning-basin for ore boats has been dredged out at the mouth of the river, and in order to protect this basin from the prevailing currents, which would soon fill it up with sand, a huge stone pier has been built out into Lake Erie for several hundred feet. Since the lake's outlet is to the east of the pier a long sand beach, known as Richmond Beach, has gradually formed to the west. The pier itself is made of large blocks of stone laid without mortar joints, and has many large cracks and crevices. The sides slope downwards to about water level, where the base extends outward on each side for about four feet forming flat stone strips which are covered with algae. On these four-foot strips and on Richmond Beach itself, other observers and I have made a number of records of the Purple Sandpiper (*Arquatella maritima*) since 1937—which are, I believe, the only modern records for this bird in Ohio. They are as follows: one sandpiper seen on December 27, 1937, and one on January 2, 1938 (James Akers); four seen on November 13, 1938 (Mr. and Mrs. M. B. Skaggs, Isabelle Hellwig, and Ralph O'Reilly); two, November 19, 1938 (Mr. and

Mrs. M. B. Skaggs, Vera Carrothers, and Margarette Morse); three, November 20, 1938 (James Akers); one, December 27, 1941 (Arthur Fuller); three, December 31, 1941, and one, November 27, 1942 (Raymond Hill).

I have carefully checked these records with the observers. Skaggs informs me that he and his companions observed the sandpipers with glasses, in good light, at a distance of about 25 feet, and noted the characteristic dark coloration of head and breast, yellow at base of bill, and yellowish-orange legs. The description tallies with Akers' and Fuller's observations and with my own.

On December 31, 1941, I had one of the three sandpipers seen that day under close observation for over an hour, and took 35 feet of 16 mm. colored film, using a three-inch telephoto lens, set at distances of from 12 to 25 feet. I have shown this film to J. Van Tyne and some of his associates at the University of Michigan, who agreed in identifying the movie "specimen" as a Purple Sandpiper.—RAYMOND W. HILL, 3316 Kenmore Road, Shaker Heights, Cleveland, Ohio.

Glaucous and Great Black-backed Gulls at the Western End of Lake Erie.—While the rest of the lake is still jammed with ice, the thaws and westerly winds of early March commonly bring open water along the shallow western end of Lake Erie. As the shore-fast stacks and sheets of ice slowly disintegrate, flocks of gulls gather to feed on the winter-killed fish in the cracks of the ice and in the muddy pools at the shore.

During the two or three weeks that these conditions usually last, I have seldom failed in the last three years to find at least one Great Black-backed Gull (*Larus marinus*) and (though less frequently) one or two Glaucous Gulls (*Larus hyperboreus*), among the hundreds of Herring Gulls (*Larus argentatus smithsonianus*) and Ring-billed Gulls (*Larus delawarensis*).

These two northern gulls have been considered rare in this region, and though other observers and I made regular sight records, their occurrence in Michigan was not proved by specimens before 1943. Our seeing these birds so regularly during the last three winters, I believe, is only partly explained by the fact that we knew when and where to search. The evidence points to an increase in numbers of both species, especially of the Black-backed. In previous years the Glaucous might have been overlooked frequently, but it seems unlikely that so conspicuous a bird as the Black-backed could have been missed often.

Although similar conditions seem to attract both gulls in their greatest numbers, there are interesting differences in their behavior here. The Black-backed is more regular than the Glaucous; it is the most wary of the gulls seen here; it has never appeared before a freeze-up in Lake Erie, and it is seldom seen after the ice has vanished from the lake; it is rarely seen away from the open lake; birds which look fully mature outnumber immatures 7 to 1. In contrast, the Glaucous may appear at any time from the onset of winter to the end of April; it may be approached at least as easily as a Herring Gull; it has been seen on several occasions along the marshes, estuaries, and rivers near the lake, and on one occasion an individual was seen feeding on skinned muskrat carcasses in a field; individuals vary widely in amounts of buff in the plumage, and every one observed closely enough to discern this character had the dark-tipped mandible instead of the orange-red mark of the fully adult bird.

The Glaucous Gull, which had been observed eight times in seven years, beginning in 1934 (L. W. Campbell, *Birds of Lucas County*), was seen four times in 1941, four in 1942, and four in 1943. Before 1941, no more than one bird was seen on one day, but two were observed on April 13, 1941, and two on March 21, 1942. Although one was seen as early as November 29 (1936), and one as late as June 6 (1937—specimen taken at Little Cedar Point, Ohio, by Campbell), most have appeared between mid-January and mid-April. In all these observations we have eliminated the possibility of confusion with albino Herring Gulls by direct

comparison with individuals of this species present at the same location. Campbell and I took a subadult Glaucous Gull, the first Michigan specimen, at Halfway Creek, Erie Township, Monroe County, February 27, 1943.

The Great Black-backed Gull was first noted in this region on March 3, 1928, and a total of 13 were recorded in 12 years (Campbell). No more than one was seen in a day until January 8, 1939, when two appeared at Little Cedar Point, Lucas County, Ohio. Then, early 1940 brought 4 records and the winter of 1940-41, 9 observations, with a maximum for one day of 5, on January 4 at Erie Beach, Monroe County. In early 1942, 11 were seen, with a peak of 6 on March 15 at Erie Beach. In early 1943, 26 were noted, with the high point on March 7, when 11 were counted in the eight miles of shore between Bolles Harbor and North Cape, Monroe County. The earliest date for Black-backs is December 22 (1940), when two were seen after an unusual thaw had cleared the lake of ice following an earlier freeze-up. The latest—the only April record—is April 18 (1942). I took an adult Black-backed Gull, the first for Michigan, along the beach of Erie Township, Monroe County, March 21, 1943.

This specimen, and the February 27, 1943, specimen of the Glaucous Gull, were placed in the University of Michigan Museum of Zoology.

The observations included in this report were restricted to week-ends. All figures neglect possible duplications between different days, but are corrected for such duplications in any one day. The territory covered fairly regularly extends from Little Cedar Point, Lucas County, Ohio, north about 12 miles airline to Bolles Harbor, Monroe County, Michigan. Between these two extremes it includes several miles of the lower Maumee River and the irregular shoreline of Maumee Bay. Other observers who contributed to these data are William Anderson, Mr. and Mrs. Fred E. Stearns, and John Stophlet, all of Toledo.—HAROLD MAYFIELD, 3311 Parkwood Avenue, Toledo, Ohio.

The Great Gray Owl as a Predator on Pocket Gophers.—On June 9, 1941, I observed a Great Gray Owl (*Scotioptex nebulosa nebulosa*) in the Bridger Mountains, about 20 miles northeast of Bozeman, Montana. The locality was in the upper Canadian Zone, at 7,000 feet elevation. The day was cloudy and dark, with occasional spatters of rain. The owl's presence was first given away by the squawking of a Steller's Jay (*Cyanocitta stelleri*), which chased the owl from tree to tree and finally into a stand of dense lodgepole pine and Douglas fir, where the owl was lost to sight.

At 1:15 P.M. I saw the owl in a 25-foot Douglas fir at the edge of a small mountain meadow. Its perch was near the end of a branch about 12 feet from the ground. Within a few minutes the owl made three swoops from this perch, apparently without catching anything. On the fourth swoop it hit the ground with considerable force and in a minute or two flew away with a dead pocket gopher (probably *Thomomys talpoides*) in its talons. An attempt to follow its flight was unsuccessful, and after searching the immediate area for a possible nest I returned to the original meadow. I was astonished to find the same owl, to all appearances, sitting in the same position on the same perch. It again made several swoops, and nine minutes later flew away with another pocket gopher. Fourteen minutes later it was back on the same perch. By 4:30 P.M. the owl had thus caught a total of four gophers and one mouse. The mouse was eaten on the ground where it was caught, but all the gophers were carried away.

The four gophers were caught in the same spot. The first caught was probably heard digging by the owl, which gave every indication of listening to some sound before swooping. Inspection of the spot while the owl was away revealed that the owl had apparently broken through the thin roof of one of the feeding runways of the gopher's burrow. Lack of turf (due to constant tunneling by the gophers in this area) would make such an action easy. The other three were probably caught

as they attempted to plug that break in the tunnel with dirt. Though pocket gophers are chiefly solitary animals, the young gophers are active and still in the parental burrows at this time of year in the Bridger Mountains.

The owl was not wary, but it would fly if I approached to within 40 feet, and then return to the same perch. Apart from this it appeared oblivious of my presence. It seemed to have no difficulty in seeing in the daylight. No sound was made by it at any time.

On July 4, 1941, I again saw a Great Gray Owl flying through an open space in the forest, at 1:00 P.M. when the sun was shining brightly. The location was three miles away from that described above, but in a similar situation. H. B. Mills reports seeing this species in the Bridgers on August 9, 1942, and also in Yellowstone National Park on October 8, 1934. Saunders (*Pac. Coast Avifauna*, 14, 1921:68) reported the Great Gray Owl in Montana as only a winter visitor, but Weydemeyer (*Condor*, 34, 1932:139) reported young on July 4, 1931, from eastern Lincoln County in the northern part of the state. Bent (*U. S. Nat. Mus. Bull.* 170, 1938: 219) has already pointed out that this owl may regularly breed within the limits of the United States. Though no nest has been discovered in the Bridger Mountains it would seem likely that the Great Gray Owl is a permanent resident there.—C. A. TRYON, JR., *Department of Zoology and Entomology, Montana State College, Bozeman, Montana.*

Plague of Mice as Food for Short-eared Owls.—Snyder and Hope (*Wilson Bulletin*, 50, No. 2, 1938:110-12) gave a detailed account of an influx of Short-eared Owls (*Asio flammeus*) into the Toronto region during the late winter of 1935-36 when meadow mice (*Microtus pennsylvanicus*) occurred there in unusually large numbers. After examining 1,078 pellets collected under a roost in that area, they found about 72 per cent of the individuals were meadow mice, and about 27 per cent were deer mice (*Peromyscus* spp.), the remaining 1 per cent being house mice and small birds.

A congregation of Short-eared Owls occurred simultaneously with a high *Microtus* population in central New York during a later winter. Between December 31, 1941, and March 5, 1942, from 2 to 14 Short-eared Owls roosted in a white pine grove near the village of Perry City in Schuyler County, New York. Meadow mice were unusually abundant in this area and formed a large part of the contents of 142 pellets collected under this roost at the end of the winter. Following are the results of the examination of the 142 pellets:

Animals represented	Number	
<i>Microtus pennsylvanicus</i>	124	(82.1%)
<i>Mus musculus</i>	18	(11.9%)
<i>Peromyscus leucopus</i>	5	(3.3%)
<i>Pitymys pinetorum</i>	3	(2.0%)
<i>Blarina brevicauda</i>	1	(0.7%)

The owls usually emerged from the pine roost at about 3 P.M. each day. As if on a given signal, they would fly out from the pines and start beating back and forth over the adjacent pasture, scanning the snow for mice. On February 9, four Short-eared Owls were seen crossing and recrossing the pasture, while a fifth sat on a nearby fence post with a *Microtus* in one foot. Sometimes they hovered over a particular spot in the snow with a quivering motion of the wings and body; then they would plummet downward with the wings held high overhead and their feet extended as they dropped on the snow. On February 24, 14 owls were flushed from this roost.—PVT. JOHN K. TERRES, *U. S. Army, Peekskill, New York*, and E. W. JAMESON, JR., *Department of Zoology, Cornell University, Ithaca, New York.*

Diving of a Long-billed Marsh Wren.—The "Rice Pond" on Coleraine Plantation, western Charlton County, Georgia, provides one of the best rail and marsh wren habitats in that general region.

On January 16, 1941, Frederick V. Hebard, John W. Burch, and I were listing and collecting birds there. In the middle portion of the pond where the water was knee deep there were thick patches of "maiden cane", the most prevalent plant. Along the edge of a mat of this vegetation a Long-billed Marsh Wren (*Telmodytes palustris*) was wounded, and Burch and I spared no effort to catch it. In the dark water among the cane stems, this bird deftly eluded our finger tips by diving—after the manner of some waterfowl—at each attempted grasp. Considering the time beneath the surface, and the fact that it always emerged very close by, it is highly probable that the wren clutched the bottom growth. More than a minute passed before it was captured. The skin, identified by Harry C. Oberholser of the Cleveland Museum, is referable to typical *palustris*.

This is the first incident I know of diving among the Troglodytidae.—ROBERT NORRIS, 1408 North College Avenue, Tifton, Georgia.

The Alaskan Longspur in Ohio.—On a recent examination of specimens in the U. S. National Museum, I found a specimen of the Alaskan Longspur (*Calcarius lapponicus alascensis*), taken at Columbus, Ohio, February 19, 1875, by Dr. J. M. Wheaton. This bird, a male, has the light edgings of the dorsal feathers extensive, and pale in color, and the concealed chestnut of the hindneck also light in color, both distinctly lighter than in true *lapponicus*. The bird is cataloged as No. 203,070 U.S.N.M. and came to the Museum with the collection of Pierre Louis Jouy. So far as I am aware, this is the first example of this race to be reported from the State of Ohio.—ALEXANDER WETMORE, U. S. National Museum, Washington, D. C.

Neglected Sources of Data.—The current preparation of a paper on the food and habits of the Belted Kingfisher has called to my attention an unfortunate situation that I have noticed before. There are, scattered throughout the country, manuscript reports of valuable studies made by workers leaving for service with the armed forces, by candidates for advanced degrees in colleges and universities, or by investigators now deceased. Often an investigator learns only by chance of such studies even when they are in fields closest to his own. It would therefore seem desirable that special effort be made to bring attention to worthwhile material of this kind. Some universities (e. g., Cornell) publish abstracts of doctoral theses, a helpful practice, although many workers obviously fail to consult this source. Another means by which unpublished information (especially theses) may be circulated is through University Microfilms, Ann Arbor, Michigan. This agency, for a nominal fee, not only provides 35 mm. film copy, but also publishes a catalog of items photographed and sends library cards to participating institutions. Such publicity speeds research progress and helps to avoid needless duplication of effort. Two ornithological examples that illustrate the situation follow:

Gould, Victor Eugene. 1934. A monograph of the Belted Kingfisher, *Megaceryle alcyon* (Linnaeus). MS. 309 pp., plus summary, bibliography, and illustrations. (Gould died in 1934 before revising this paper for submission to the Graduate School of Cornell University. A copy of the manuscript is in the hands of Harrison F. Lewis, Chief Migratory Bird Officer, Ottawa, Canada.)

Manuel, Canuto G. 1931. The relation of gulls and terns to the commercial fisheries of Saginaw Bay, Michigan, with particular reference to the Common Tern, *Sterna hirundo* Linnaeus. MS. 180 pp., illustrated. (Doctoral thesis. Copies are in the University of Michigan Library and in the library of Carl L. Hubbs, Museum of Zoology, Ann Arbor, Michigan.)—KARL F. LAGLER, Department of Zoology, University of Michigan, Ann Arbor, Michigan.

EDITORIAL

We take this occasion to thank Edward A. Mc Ilhenny for his recent generous gift toward the expenses of publication of the *Bulletin*. For more than forty years a member, and for several years a Life Member of the Club, Mr. Mc Ilhenny has long demonstrated his sincere and active interest.

With the hope of making our section on Bibliography more useful, we introduce in this issue a subject classification. The present arrangement is only tentative, and we shall welcome your comments and your suggestions for improving it. Reprints of this section are available at a small cost. Since a number of our members subscribe for these to clip and file in their own bibliographies, the titles from each issue of the *Wilson Bulletin* are now to be included in the bibliographic section of the following issue.

The Club is indebted to Katie Roads, Leslie D. Case, and George M. Sutton for gifts of series of back numbers of the *Bulletin*. There is a steady demand for these, and we are very glad to replenish our stock whenever members find that they have runs or even single numbers which they no longer need.

George B. Thorp and his Endowment Committee report a total of ten new Life Members added in 1942-1943. They ask us to inform the members that any who wish to become Life Members during the year will be allowed credit for 1943 dues already paid.

ORNITHOLOGICAL NEWS

Wilfred H. Osgood, Alexander Wetmore, and John T. Zimmer have joined with six outstanding taxonomists in other fields of zoology to form a General Council on Zoological Nomenclature to replace, for at least the duration of the War, the International Commission on Zoological Nomenclature, which can, of course, no longer function. A printed set of by-laws may be obtained from Osgood at Field Museum.

William Vogt, of the Office of the Coordinator of Inter-American Affairs, has been awarded a Guggenheim Fellowship for the preparation of a book on Peru's guano birds, based on three years' study which he recently carried on as naturalist to the Peruvian Guano Administration.

OBITUARY

LEONHARD STEJNEGER, distinguished herpetologist and ornithologist, died in Washington, D. C., on February 28, 1943, at the age of 91. During later years Stejneger devoted himself entirely to herpetology, but between 1871 and 1905 he published many important contributions to ornithology and became an acknowledged authority on the birds of the North Pacific. From 1884 to 1889 he was Assistant Curator of Birds in the United States National Museum.

ALTHEA R. SHERMAN, well known Iowa ornithologist, died April 16, 1943, at her home in National. She will be especially remembered for her remarkable nesting studies of the Flicker, Screech Owl, Sparrow Hawk, and Chimney Swift. The earliest of these, which were among the first such studies made in this country, were published in 1910 and 1911. Miss Sherman was also a bird artist of real ability, and shared with Louis Agassiz Fuertes the distinction of showing her work in 1919 at the first American Ornithologists' Union exhibit of bird paintings. A member of the Wilson Club since 1902, Miss Sherman was made an Honorary Member in 1929.

WILDLIFE CONSERVATION

Conservation Education

Two recent articles by Aldo Leopold should be read by every member of the Club. Each can be read in a few minutes; each deserves long reflection. The following quotations are but samples, not summaries, and will not spoil the fun of reading the complete articles.

From "Land Use and Democracy" (*Aud. Mag.*, 44, Sept.-Oct., 1942: 259-265):

"Conservation is our attempt to put human ecology on a permanent footing. Milk-and-water education has convinced people that such an attempt should be made, and they have told their government to act for them. Some other force must now persuade them to act for themselves.

"Money-minded people think they are acting when they pay taxes. This halucination, during the 'defense' period, nearly cost us the war. It will cost us our natural resources if we persist in it.

"To analyze the problem of action, the first thing to grasp is that government, no matter how good, can only do certain things. Government can't raise crops, maintain small scattered structures, administer small scattered areas, or bring to bear on small local matters that combination of solicitude, foresight, and skill which we call husbandry. Husbandry watches no clock, knows no season of cessation, and for the most part is paid for in love, not dollars. Husbandry of somebody else's land is a contradiction in terms. Husbandry is the heart of conservation.

"The second thing to grasp is that when we lay conservation in the lap of the government, it will always do the things it can, even though they are not the things that most need doing.

"The present over-emphasis on game farms, fish hatcheries, nurseries and artificial reforestation, importation of exotic species, predator control, and rodent control is here in point. These are things government can do. Each has an alternative, more or less developed, along naturalistic lines, *i.e.*, management or guidance of natural processes. Research shows these alternatives to be, in general, superior. But they involve husbandry, which government can do only on its own lands. Government lands are a minor fraction of our land area. Therefore government neglects the superior things that need doing, and does the inferior things that it can do. It then imputes to these things an importance and an efficacy they do not merit, thus distorting the growth of public intelligence.

"This whole twisted confusion stems from the painless path, from milk-and-water education, from prolonging our reliance on vicarious conservation." (p. 262.)

From "Wildlife in American Culture" (*Jour. Wildlife Manag.* 7, 1943:1-6):

"Ornithology, mammalogy, and botany, as now known to most amateurs, are but kindergarten games compared with researches in these fields. The real game is decoding the messages written on the face of the land. By learning how some small part of the biota ticks, we can guess how the whole mechanism ticks.

"Few people can become enthusiastic about research as a sport because the whole structure of biological education is aimed to perpetuate the professional research monopoly. To the amateur is allotted only make-believe voyages of discovery, the chance to verify what professional authority already knows. This is false; the case of Margaret Nice proves what a really enterprising amateur can do. What the youth needs to be told is that a ship is a-building in his own mental dry-dock, a ship with freedom of the seas. If you are a pessimist, you can say that this ship is 'on order'; if an optimist you can see the keel." (p. 5.)—F. N. H.

Winter Feeding

"Few pleasures are more fascinating than watching birds feeding at window-shelves and at stations near our houses . . . But let us be sincere with ourselves and not count this feeding as a virtue nor take credit for our generosity. The statement of the National Audubon Society that 'wildlife is at the weather's mercy during periods of subnormal winter temperatures and snow' is without foundation in fact. The birds do very well without us. Nature has taught them how and

where and in what latitude they can best feed themselves. The greatest consideration we can show to birds is to protect their natural environment. When this is impossible, the best feeding of birds is done by natural plantings. What birds need most is *protection from interference*.

"The bird feasts that we spread often set up false conditions . . . We learn little of the balance of nature when we observe it through a pane of glass. . . .

"But if you have already taught birds to abandon their wild ways be sure to continue to feed them until the coming of spring. In the event of an ice storm which covers ground and bark and standing seeds with a hard coating of ice, grain and other food scattered widely over the countryside may save many birds—particularly if an unseasonable ice storm should come in the spring after the migrating birds have arrived from the south." (Rosalie Edge, "Conservation for Victory," *Emerg. Cons. Com., Ann. Rep.*, 1942, Publ. 88, April, 1943:26.)

Mrs. Edge's example of the ice storm would seem to come very close to the Audubon Society's account of the effects of "subnormal" weather, and in any case couples poorly with the flat statements of her opening paragraph. Nevertheless, if she may here—as elsewhere—be criticized for driving a generality too far, she has a factual starting point which she has not hesitated to bring forward, even though the facts may be displeasing to many of her readers. The necessity for winter feeding of songbirds has been increasingly questioned of late. There can be little doubt that artificial winter feeding is being greatly over-emphasized as a conservation measure. In short, it is well to examine critically the idea of winter feeding, but it is too soon to consider the question settled. Meanwhile, remember Mrs. Edge's good advice: when you do start to put out feed next winter, don't stop until spring.—F. N. H.

Small Arms Ammunition for Civilian Use Rationed in Canada

Because of a two-thirds reduction, as compared with 1942, in the amount of necessary metal available for the manufacture of small arms ammunition for civilian use, the Wartime Prices and Trade Board of Canada has issued an Order, effective on March 24, 1943, which sets up rationing regulations to ensure that the reduced supply of such ammunition goes to essential users.

A spokesman for the Board pointed out that the supply of copper alloys is limited and that since such materials are required for both munitions for war purposes and ammunition for civilian use, curtailment of output of ammunition of the latter type is now necessary to safeguard the flow of materials for direct war use.

The Order divides Canada into remote areas and settled areas, as defined therein, and names eight classes of non-military "essential users" of small arms ammunition, including police; guards of commercial establishments; licensed trappers; prospectors; persons who rely on the hunting of wild game and birds for food; persons who require ammunition as a means of protecting live stock, poultry, and crops; gun clubs with special written permission to obtain ammunition; and certain defense units not organized under the Militia Act but furnished with written permission to obtain ammunition. Essential users resident in remote areas may purchase necessary ammunition without special formality, but those resident in settled areas may purchase ammunition only upon their completing and filing certificates of essentiality and, in some cases, obtaining the approval of their local ration board. Purchases of ammunition for the Dominion Government or for the government of any province are not affected by the order. Persons who desire to hunt for sport or for a non-essential food supply may not purchase ammunition for those purposes, but may use any ammunition that they may have had in their possession when the order became effective.—Harrison F. Lewis.

WILDLIFE CONSERVATION COMMITTEE
Frederick N. Hamerstrom, Jr., Chairman

ORNITHOLOGICAL LITERATURE¹

SYSTEMATICS AND THE ORIGIN OF SPECIES, FROM THE VIEWPOINT OF A ZOOLOGIST.

By Ernst Mayr. Columbia University Press, New York, 1942: 9 x 6 inches, xiv + 334 pp.; 29 figs. \$4.00.

This outstanding book is based on the Jesup lectures delivered at Columbia University in March, 1941, and commences with an introduction by Dobzhansky, a geneticist noted for his interest in speciation and geographical variation.

The avowed purpose of the book is to outline the change from the old "static" species concept to the "dynamic" species concept of the modern systematist. The great significance of the polytypic species and the role of geographic variation in evolution are not properly appreciated by biologists or even by taxonomists, and Mayr undertakes to expound their importance and, by inference, their fascination.

The first two chapters are an excellent exposition of elementary taxonomic procedure. The next two are an equally interesting treatment of the phenomena and aspects of geographical variation. The fifth is perhaps the most controversial, since it deals with the "new," "dynamic" or "biological" species concept. This leads naturally to a discussion of the polytypic species, the helpful concept of the super-species, and the important distinctions between allopatric and sympatric species (excellent terms, criticizable only on the grounds of etymological hybridity). The proof of geographic speciation is excellent, and the value of the superspecies concept in this connection is fully brought out. The systematist must remember that geographic speciation has been constantly denied.

Two summary definitions are worth quoting. In Mayr's view "species are groups of actually or potentially interbreeding natural populations, which are *reproductively isolated* from other such groups." "A new species develops if a population which has become geographically isolated from its parental species acquires during this period of isolation characters which promote or guarantee reproductive isolation when the external barriers break down." I hope that these definitions will arouse the interest and curiosity of readers, who will then read the book to discover their validity.

A chapter on non-geographic speciation is quite brief, since this is still a very controversial field. The ecological race, the sibling species, and the biological race are concepts which should particularly interest American ornithologists, for they define a field which is still "wide-open" with many common North American birds. They should read Mayr's discussion of the malarial mosquitos of southern Europe, where most of the species and races cannot be told apart as museum specimens!

Every chapter is replete with a wealth of illustration. Most of the cases are ornithological, and the author naturally prefers examples from Melanesia and Polynesia, on whose birds he is the world's authority. But he does not hesitate to give case histories in other groups of animals, and displays a breadth of knowledge of animals, genetics, and the literature of systematics which arouses admiration and respect, especially when we recall that he is not writing in his native language. There is more tolerance, less over-positive statement, than in his earlier writings. On a few occasions he boldly criticizes monographic studies in groups of animals other than birds, and revises the authors' conclusions to suit his own ideas; he has already been challenged at least twice.

The final chapter discusses the higher categories of classification, and is a sane and practical approach to the concepts of genus and family. Here and there are very courteous references to the A. O. U. check-list as "rather conservative," and suggestions as to the unnecessary number of genera and species, with most of which the reviewer is in hearty accord.

Mayr's book is the most comprehensive treatment in English of the new science

¹ For additional reviews see pages 87 and 125.

of speciation. Interestingly and clearly written, it arouses thought and reflection, and one returns to reread an earlier chapter. This review, at least, has not been dashed off. The reviewer is definitely a disciple of the new species concept; he is a systematist who has believed for years in the importance of the polytypic species and the role of geographic variation in the evolution of new species; he has deplored the lack of understanding in geneticists and experimental biologists.

What will this able book accomplish? First and foremost, it should help systematists to be better systematists, to abandon purely mind-made systems of putting animals into a series of cubbyholes of different sizes. The general biologist should be impressed with the weight of evidence which a competent expert like Mayr can marshal for the importance of geographic variation. Some may complain that their pet group of animals has been neglected. Others will feel that experimental research has been slighted; it happens to be particularly difficult or impossible with birds. Others again may say that they still do not know how new species are evolved; our author does not claim to settle it. There is one difficulty inherent in systematics, as Mayr, I feel sure would be the first to admit. Systematics is a subjective field in two respects: (1) No written words and charts can take the place of knowledge in the field of the birds themselves or of the study of museum series. (2) On Mayr's own definition of a species, the impossibility of proof by experiment reduces the test of reproductive isolation to a question of individual judgment and authority rather than of fact. If systematists would only accept and face these two handicaps, their work would receive more consideration from other biologists and inspire more respect and less irritation from amateurs.—LUDLOW GRISCOM.

WILDLIFE REFUGES. By Ira N. Gabrielson. MacMillan, New York, 1943: 6 x 9¼ in., xiii + 257 pp., 32 pls., 17 figs. \$4.00.

Wildlife conservation has come a long way since the time when restrictions on the kill were considered the complete solution. As a part of this development, the function of refuges has changed from that of saving individuals to one as much concerned with saving and managing habitats so that more individuals can be produced and supported by the land. A number of attendant values, as well as an appreciation of the limitations, of refuges have also come to be better understood. Examples of the former are contributions to flood- and erosion-control and supplying seasonal work and recreation to the people living nearby; of the latter, competition between different species on the same refuge, and destruction of habitats if refuges are allowed to become over-crowded. Methods of developing and handling refuges have also been more thoroughly worked out.

The first fifth of "Wildlife Refuges" expands these ideas under the headings: history, purposes, values and limitations, types, and management of refuges; about three-fifths deals with the refuges administered by the Fish and Wildlife Service; other federal, state, and private refuges in this country, Canadian and Mexican refuges, a bibliography, and an index make up the rest of the book. Although waterfowl are stressed, there is much that pertains to big game, upland game birds, non-game birds, and fur-bearers.

As Director of the Fish and Wildlife Service, Gabrielson has an unusually detailed knowledge of the whole refuge movement. This, coupled with his ability as a biologist, gives his judgments an authority which few others could claim. His examples of land treatments, and of the solution of disagreements between cooperating agencies, give one a better understanding of the actual mechanics of refuge development, and serve as the best sort of precepts.

Gabrielson's enthusiasm for the necessity and effectiveness of the work of his Service has caused that work to be better and sooner done; if carried over too extensively into his writing, however, this spirit may hinder his readers in appraising the results of the refuge program. There is some evidence that this may have

occurred. To cite the most obvious example: in speaking of the development of the nine-foot channel through the Upper Mississippi Refuge, he says (*italics mine*), ". . . after consultation with the Service, the Army Engineers so modified construction plans that the area, far from being destroyed, *has been* vastly improved." (p. 193) The examples which are to substantiate this accomplished improvement read: The first pool "*is becoming* a fine waterfowl resort . . ."; in the later pools "*indications* of the same development are seen. Only a few of the pools *are yet* sufficiently vegetated to be attractive . . . The wildlife value of the Upper Mississippi Refuge is now entirely dependent on the operation of the dams. *If* they are so managed as to minimize water fluctuations and to limit winter drainage of the pools, this area *will become* a major wildlife habitat of the midcontinent." (p. 193) There are less important faults, such as the placing of maps and illustrations, without page references, far from the descriptive texts. In places the writing shows evidences of haste.

These flaws should not blind one to the value of the book. "Wildlife Refuges" will be interesting to the layman and a useful reference work for the professional conservationist. There is no other single book on the subject, and this one, if not up to Gabrielson's best, is still a good job.—F. N. Hamerstrom, Jr.

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REPORT OF THE MEMBERSHIP COMMITTEE

During 1942, as a result of the combined efforts of the officers, the Membership Committee, and various members of the Club, 172 members were added to the Wilson Ornithological Club: 7 Life, 7 Sustaining, 26 Active, and 132 Associate Members.

Members of the Committee and others whose efforts added to the Wilson Club rolls during the year were Roger Tory Peterson, 14; George B. Thorp, 8; John T. Emlen, Jr., Joseph C. Howell, Thomas G. Scott, and Ruth D. Turner, 6 each; A. B. Brooks, 5; J. W. Aldrich, Virginia S. Eifert, Gordon Fredine, Z. P. Metcalf, William Montagna, Aretas A. Saunders, and Wayne Short, 4 each; Daniel L. Leedy and Burt L. Monroe, 3 each; James L. Baillie, David Damon, Mrs. Jack Hagar, H. W. Hann, A. Sidney Hyde, George H. Lowery, M. B. Skaggs, and Wendell Taber, 2 each; William C. Baker, Edna Becker, Logan Bennett, James H. Bruns, B. W. Cartwright, Roland C. Clement, Clifford V. Davis, Murl Deusing, John H. Fales, Franklin C. French, A. F. Ganier, F. N. Hamerstrom, Jr., Charles O. Handley, Jr., George B. Happ, Dorothy Hobson, William Jenner, Victor E. Jones, Herbert Kaufman, Karl Maslowski, Clara Alma Moore, Theodora Nelson, Eugene P. Odum, Frederick L. Ott, John Pearce, W. E. Scott, P. R. Sime, Mabel Slack, Charles F. Walker, and James B. Young, one each.

The following officers also assisted in adding new members during 1942: Maurice Brooks, Olin Sewall Pettingill, Jr., George Miksch Sutton, Gustav Swanson, and Josselyn Van Tyne.

Respectfully submitted,

RICHARD LEE WEAVER, *Chairman*

December 31, 1942

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EDWARD MC IHENNY SIMMONS, now attending Newman High School in New Orleans, has studied natural history all his life under the direction of his grandfather, Edward Avery Mc Ihenny. He has a considerable library covering ornithology, mammalogy, and general natural history subjects, and is an Annual Member of the American Museum of Natural History and of the National Audubon Society, a Life Member of the American Ornithologists' Union, and the American Society of Mammalogists. Home address—Avery Island, Louisiana.

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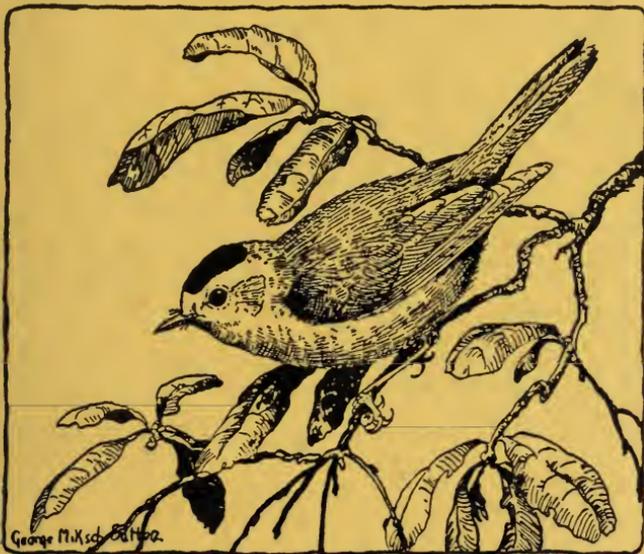
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Southampton Island, 1929

George Miksch Sutton del.

RED-THROATED LOON BRINGING FOOD TO ITS YOUNG

THE WILSON BULLETIN

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No. 3

THE WING MOLTS OF ADULT LOONS: A REVIEW OF THE EVIDENCE

BY GEORGE MIKSCH SUTTON



ADULT loons are generally believed to undergo two molts a year—a postnuptial and a prenuptial. Opinions differ as to whether both these molts are complete, however; and a careful comparison of published statements and examination of specimens has led me to suspect that there is but one really complete molt per year; that the so-called 'complete prenuptial molt', may be only a molting of body plumage concomitant with a much delayed 'postnuptial' molting of remiges; that certain individual loons may undergo a complete postnuptial molt on or near their breeding grounds, whereas other individuals may, as a result of delayed nidification, be obliged to move southward in full breeding dress; that, in short, the whole molting program may vary so greatly that, unless one can catch and mark a loon in the late summer flightless stage of the molt, and capture the same bird a few months later, again in a flightless stage of the molt, one has no way of being certain that an individual loon ever accomplishes a *complete* molt in late summer or fall, and another *complete* molt the following spring.

In the fall of 1929, while I was on Southampton Island, Hudson Bay, I was impressed with the fact that many young Red-throated Loons (*Gavia stellata*) and Pacific Loons (*Gavia arctica pacifica*) did not leave their nesting ponds until about the middle of September. One brood of young Red-throated Loons lingered as late as September 23, keeping a hole about 15 feet in diameter open in the ice (Sutton, 1932:20). Here the parent birds, which brought fish regularly from salt water a mile or so away, were obliged to alight and take off as best they could until the young birds were strong enough to fly to the sea.

When did those parent Red-throated Loons reach the flightless stage of their post-nuptial molt? Obviously not in the summer of 1929. They had to have their remiges *on them* all that summer. Their first set of eggs had been destroyed, perhaps by an Arctic fox, so their brood was late. Nor was their case exceptional. Many other pairs were as late as they. In their well ordered tundra world it was as

normal for them to be delayed as it was for the foxes and lemmings to be at or near a peak of abundance that year.

Those parent loons may have begun their postnuptial molt immediately after getting their young safely to sea. They may even have completed it before moving southward from Hudson Bay. But it would not surprise me to learn that they reached their wintering grounds in virtually complete breeding plumage, passed slowly into winter body plumage, and eventually completed this postnuptial molt by dropping their frayed, faded remiges about the time the prenuptial molting of the body feathers began. Witherby (Witherby *et al.*, 1940: 112 ff.), Bent (1919:47 ff.), and other writers make it quite clear that molting loons as well as loons in full breeding dress are found on the wintering grounds. A bird in new breeding plumage, with partly grown remiges, would certainly appear to be in the last stages of a complete prenuptial molt—that is obvious. What disturbs me is that we do not know that this same bird lost all its remiges the preceding fall. We are only guessing. It would be easy enough to discuss *the possibility* of two complete molts per year with a great series of molting specimens at hand; less easy to account for two molts; impossible to *prove*, from the specimens alone, that a given individual actually accomplishes them. Why should loons have them? Do loons need two sets of remiges per year while ducks, geese, and swans do not? Both groups are water birds, have the same body-temperature problems, much the same migration problems, near the same degree of feather wear; hence they might be expected to be clothed similarly. There is plenty of evidence to show that loons do go through a flightless period; no evidence, so far as I know (and I have examined loons in a good many collections), that they molt their wings feather by feather as hawks, for example, do. But the question is (as at the outset): Do they molt all the remiges at once, and hence become flightless, *twice* a year? Authors have been assuming too much: because flightless birds have been taken in the fall and also in the spring, they have assumed that all loons have two complete molts per year.

The loons are a small and homogeneous order. The fact that breeding range, general program of migration and nesting are much the same throughout the order makes it easy to believe that the four species molt similarly, though this is not necessarily the case. Let us see what various authors have to say about the molts of the four species of loons.

Gavia stellata. Bent (1919:77) states that adult Red-throated Loons have "two annual molts; a partial prenuptial molt, involving at least all of the feathers on the forepart of the body. . . . I have seen the beginning of this molt as early as December 28, but usually it is accomplished during March and April; and a complete postnuptial molt, during the latter part of the summer, produces the adult winter plumage [which] . . . is often not complete until late in the

season. I have seen birds in very much worn plumage and only partially molted in December; this plumage is worn for a comparatively short time and the molt into it is often incomplete and sometimes not accomplished at all. I have seen a bird in full spring plumage in October and another, in the same month, in regular winter plumage with the full, rich red throat of the nuptial plumage. Fall adults are scarce in collections and, if we had them in large series, we might be surprised to know to what extent old birds retain part or all of their spring plumage during the fall." Forbush (1925:28) says that adults "apparently have a complete prenuptial molt and a complete postnuptial molt." Witherby (Witherby *et al.*, 1940:127) says that the winter plumage is "acquired by complete moult Oct.-Dec. Primaries, primary-coverts and secondaries are moulted simultaneously but wing-coverts normally. . . . Another moult takes place March-May, . . . but material is insufficient to decide if remiges are moulted again as in autumn."

As I have pointed out above, the Red-throated Loon's postnuptial molt is certainly not always a late summer phenomenon. Breeding birds get their young ones out to salt water as promptly as they can; but if nesting is delayed it appears that molt is also delayed—until fall or later. Witherby (1940:123) says concerning this matter: "dates of assumption of summer and winter plumage vary greatly; traces of summer plumage may still be retained in January, and in March or April all stages from full winter to three-quarters summer plumage may be seen together." In a series of 12 adults collected August 3 to September 17, 1897, by the Mc Ilhenny Expedition in the vicinity of Point Barrow, Alaska, 11 showed "no molt whatever"; one female, collected September 17, had completed the molt, though the primaries still retained "portions of the sheaths" (Stone, 1900:6).

Gavia arctica pacifica. Bent (1919:69) states that the postnuptial molt of the Pacific Loon is complete, that the prenuptial molt "involves practically all the contour feathers"; whereas Witherby (Witherby *et al.*, 1940:22) describing the closely related *G. a arctica*, says that "specimens available do not show moult of remiges" in the postnuptial molt, "though this may occur," and is sure that the prenuptial molt, which takes place February to May, is complete, the primaries, primary-coverts, and secondaries being then molted simultaneously. Forbush (1925:27) flatly asserts that both molts are complete.

According to what I witnessed on Southampton Island, I should say that most Pacific Loons have no time for a flightless period in late summer. They are busy flying in with fish for their young until fall. Whether they molt near their breeding ponds I cannot say. I did not record the species in 1929 after September 27; saw no shed feathers about the breeding ponds; neither saw nor heard of a bird in flightless condition (Sutton, 1932:14). I should say that the postnuptial molt could not well have started before October 1 in most

individuals. Just where the birds were by that date is a question. Probably they were on their way south. Since the winter home of the Pacific Loon is said to be "the Pacific coast of North America from Puget Sound to Lower California" (Peters, 1931:35), one thinks of the fall migration from Southampton Island as a long flight, or series of flights from lake to lake perhaps, across western Canada; and one wonders whether that trip may not customarily be taken before the remiges are molted. It is, I believe, significant that of 49 adult specimens collected July 5 to September 20, 1897-98 by the McIlhenny Expedition to Point Barrow, Alaska, only four had molted their remiges. These four were in "full winter dress" (Stone, 1900:5).

Gavia immer. Concerning the Common Loon, Bent (1919:52) says: "The adult winter plumage . . . is worn for only a short time, as in the second year bird; specimens in this plumage are very scarce in collections and it is difficult to find one that is not either molting into it or out of it; the postnuptial molt into it begins sometimes by the last of August, but sometimes not until October; and the prenuptial molt out of it may begin in November or later in the winter and may not be completed until spring. Apparently some individuals, perhaps very old birds, do not assume this winter plumage at all, for I have seen birds in fully adult breeding plumage in September, October, and November." Forbush, (1925:17, 18) uses this passage from Bent almost verbatim. Witherby (1940:115) believes that the winter plumage "is acquired by complete moult Aug. (sometimes July) to Jan. Primaries, primary-coverts and secondaries are molted simultaneously but wing-coverts and innermost secondaries normally. Sometimes some old summer body feathers, wing-coverts and innermost secondaries are retained until next moult. . . . Another complete moult similar to that of autumn takes place Feb.-May."

These statements make it clear that an adult Common Loon is molting three-quarters of the time. For a short period, in summer (part of May, all of June, part of July) they are apt to be in complete breeding dress. The rest of the time they are in more or less mixed plumage. But when is the postnuptial molt, which begins "sometimes July," finished? May not the dropping of the remiges often be delayed until the following winter or spring?

In this connection it is probably significant that published records of flightless molting *Gavia immer* are so few. Forbush (1925:18) tells us of one he picked up at Nantucket on March 12, 1921. J. B. May (1930:412) describes several examined by him in Massachusetts April 1 to 4, 1930, and reports one "in the gray plumage" shot by Sidney Chase at Nantucket on February 21, 1892. There is apparently no record of a flightless Common Loon found in late summer or fall. Have flightless late summer *Gavia immer* been handled repeatedly but not reported because they were considered in no way unusual? Or have ornithologists continued merely to assume, without investigating the

matter thoroughly, that all loons go through a flightless stage at the nesting lake as soon as the young are abroad?

Gavia adamsii. "The seasonal molts and plumage of the adult [Yellow-billed Loon] are, evidently, practically the same as in the common loon. . . . The molt into the winter plumage is very irregular and much prolonged, and the plumage is worn for only a short time. . . . [Collett, 1894] refers to a specimen taken on September 22 in which the molt had begun, others taken in October and November in transitional stages, and one taken on October 5 in which the summer plumage was almost entirely retained. . . . The two molts are so prolonged and so irregular that they may almost be said to overlap" (Bent, 1919:62). Witherby (1940:118) says of the postnuptial molt that there are "very few moulting examples available," but that the Yellow-billed "appears to moult" as in the Common Loon, that is, completely; he seems sure that the prenuptial molt is complete.

It is evident that individuals of the species may complete a late summer postnuptial molt on or near the breeding grounds since an adult bird was collected by the Mc Ilhenny Expedition at Point Barrow, Alaska, on September 29, which had "new wings . . . only half grown" (Stone, 1900:5); but it is quite believable that, had this individual lived, it would not have molted its remiges again the following spring.

REMARKS

The above brief review has been presented not as proof that adult loons molt their remiges only once a year, but rather to show that further careful observations must be made before we can be sure that they molt their remiges twice a year. Of great importance is the recording of all adult loons known to be in flightless condition as a result of molt. Ornithologists who happen to live near nesting lakes of *Gavia immer* should observe the birds carefully in late summer and early fall, ascertaining whether they are actually flightless at any time, and checking on the observation by gathering molted remiges. A technique of capturing loons for examination and banding needs to be worked out.

It may be years before an adult loon, flightless because of molt, is captured and banded (or marked in some other way), and captured 6 to 8 months later, again in flightless condition because of molt. Until that feat is accomplished we may well refrain from statements that imply two *complete* molts per year in any Gaviiform species.

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MINNEAPOLIS, MINNESOTA

AUTUMN FEEDING AND FLOCKING HABITS OF THE MOURNING DOVE IN SOUTHERN MISSOURI

BY A. STARKER LEOPOLD

DURING the course of several years' hunting in south-central Missouri, some observations on the autumn habits of the Mourning Dove (*Zenaidura macroura*) have been accumulated that seem worth recording. The dove is not an abundant bird in the Ozark uplands, but from 1939 through 1942 I have taken 234 Mourning Doves during legal shooting periods, nearly all in one locality three miles southeast of West Plains, Howell County. Records of each trip have been kept in a hunting journal, and these form the basis for the following notes.

FEEDING HABITS

It has been pointed out by Moore and Pearson (1941), and noticed by many others, that Mourning Doves do not scratch for their food; since they are unable to cling to upright stalks and twigs, they are limited, with occasional exceptions (Bent, 1932:408), to the selection of food lying available on the surface of the ground. There are constant adjustments in the fall feeding habits of doves, apparently conditioned by the changing availability of surface foods. The following examples illustrate how the birds adapt their foraging in accordance with the limitations imposed by weak legs and feet.

In the accompanying table are enumerated the principal crop contents of the doves killed during this period. Quantitative analyses of crop content were not made, but all the most prominent foods are recorded. It will be seen that during September of 1939, and of 1940, the birds fed mostly on foxtail (*Setaria viridis*), which often grows abundantly in corn fields, and is admirably suited to the foraging needs of doves. The seeds ripen in August and almost immediately fall to the ground, where they are readily available until the fall rains have washed them into the soil. After this has occurred the doves turn their attention to other foods as they become available, including barnyard grass (*Echinochloa crusgalli*), pigweeds (*Amaranthus*, sp.), ragweed (*Ambrosia artemisiifolia*), dove weeds (*Croton* sp.), and various cultivated crops indicated in the table, all of which ripen somewhat later, but like foxtail shed their seeds onto the ground, either naturally or during processes of crop harvest. In September of these years, however, foxtail was the most important food. This plant has been elsewhere reported as a prominent dove food: Dutcher (1903) found as many as 6,400 seeds in one crop; and Knappen (1938) found foxtail to be the dominant July and August dove food in the southeast.

In 1941 and 1942, however, due perhaps to changed conditions of rainfall or temperature, there was no foxtail crop in this area, and the doves had to adjust their September feeding accordingly. Wheat, bar-

TABLE 1
PRINCIPAL CONTENTS OF THE CROPS OF 234 MOURNING DOVES KILLED IN THE
VICINITY OF WEST PLAINS, HOWELL COUNTY, MISSOURI

Date	No. of birds	Principal crop contents
1939		
Sept. 10	6	Foxtail (<i>Setaria viridis</i>)
Sept. 14	8	Foxtail
Sept. 16	6	Foxtail
Oct. 7	5	Foxtail
Oct. 15	4	Mostly soybeans and cowpeas; some ragweed (<i>Ambrosia artemisiifolia</i>), smartweed (<i>Polygonum</i> sp.), pigweed (<i>Amaranthus</i> sp.), and foxtail
Oct. 31	7	Corn, cane, barnyard grass (<i>Echinochloa crusgalli</i>)
1940		
Sept. 2	5	Mostly wheat; some foxtail
Sept. 8	17	Foxtail
Sept. 10	3	Foxtail
Sept. 22	13	Dove weed (<i>Croton</i> sp.)
Sept. 26	7	Foxtail and barnyard grass
Sept. 29	2	Dove weed
Oct. 4	3	Cowpeas and corn
Oct. 17	2	Ragweed, barnyard grass and pigweed
1941		
Sept. 6	10	Wheat, dove weed
Sept. 7	5	Wheat
Sept. 14	20	Wheat, pigweed
Sept. 28	10	Cane, barnyard grass
Oct. 3	8	Mostly cane; smartweed in two crops
Oct. 4	16	Millet (<i>Setaria italica</i>)
Oct. 5	14	Cane; a little smartweed and pigweed
1942		
Sept. 2	9	Wheat, millet, barley and dove weed; traces of corn
Sept. 5	15	Wheat, barley and millet
Sept. 12	4	Mostly millet; a little wheat
Sept. 16	11	Cane; traces of pigweed, red (?) clover
Sept. 18	24	Cane; traces of pigweed in three crops

ley, and millet (*Setaria italica*) were gleaned from the summer stubbles until the later weeds and crops ripened. Winter wheat, which ripens in June, largely meets the summer needs of doves, and is mentioned by Bent (1932) as a universally favorite food. But the limited supply of waste grain on the ground diminishes by late summer, and the doves readily turn to other foods when they can be had. In foxtail years this change is made in August, but when the foxtail fails to make a crop, it is September before other suitable foods appear in quantity.

The change to a newly available source of food may occur very quickly. On September 5, 1942, a concentration of approximately 200 doves was found in a wheat stubble, and the crops of 15 captured birds were filled largely with wheat. A week later, on September 12, practically no birds remained in this stubble, and it was September 16 before

I again found the local population, this time in a field of standing cane a half mile from the wheat field. All the birds were feeding on fragments of cane seed, which were dropped to the ground by thousands of blackbirds as they fed on the upright heads. The almost complete shift of the doves from wheat to cane, occurring apparently between September 5 and 12, was made possible in this instance by the "threshing" of the seeds by blackbirds. Cane is an important fall and winter food here, as it is in Alabama (Moore and Pearson, 1941), but is normally available to doves only after cutting.

Interestingly enough, Korean lespedeza (*L. stipulacea*), which has been widely introduced in southern Missouri during the past decade and is now a favorite quail food, is apparently not used by doves. It has not been found in any of the crops examined, even of birds taken during October when the seeds are lying abundantly on the ground. Either doves find it unpalatable (suggesting another limitation on the utilization of foods besides availability), or they have not yet learned to use it.

FLOCKING HABITS

In August, the doves are widely distributed over the agricultural sections of Howell County, only the very favorable feeding grounds attracting concentrations of any consequence. At that time the flocks are loosely organized, behaving as Bent (1932:409) has described: "As we watch a number of doves feeding in a stubble field we soon see that there is no very strong tie binding together the members of the company—no such bond as holds together a flock of sandpipers. . . . The doves are spread out over the ground . . . feeding . . . like grazing cattle. . . . The flock when alarmed, instead of moving off as a unit, breaks up and the birds retreat individually or in pairs."

However, with the first cold rains in September some of the doves migrate, and a gradual change becomes apparent in the social relations of the remaining birds. Large concentrations form on a few of the best feeding grounds, and practically all the birds assemble at one or another of these favored points. By October 1 there are no doves in three-fourths of the late summer range, and the total population of a whole valley may congregate on one farm, or even in a single field. The flocks tend to cling together more closely. A small number of doves winter in this region, and the wintering birds are found almost entirely in concentrations of 50 or more individuals, usually on bottomland fields. Strays and small isolated flocks occur, but are unusual.

During the autumn period, when some of the doves are migrating and the remainder are forming into the typical winter concentrations, I have often observed particularly well-organized flocks of 10 to 20 birds whose members have, in my experience, always proved to be adult males. These male flocks fly in close formation, very much like sandpipers, to use Bent's comparison, and the birds are wary and hard to approach. Flushing or even shooting will not cause one of these units to

break up more than momentarily. On October 15, 1939, four birds were killed out of such a flock, and gonad examination proved all to be adult males, the testes averaging over 6 mm. in length, which is twice the size of testes in young birds. On October 3, 1941, two birds were shot from a similar flock of 12, and these also were adult males. This flock was seen two days later with 10 members, which would suggest some degree of stability in its make-up. The earliest date on which I have observed a male flock was September 16 (1942), and one of these birds also proved to be an adult. Therefore, in addition to increasing gregariousness among the doves as fall progresses, there seems to be a partial segregation of adult males into small, closely united flocks. All adult males are not found in such flocks, for even in mid-October many have been killed along with females and young.

SUMMARY

The autumn feeding and flocking habits of Mourning Doves were studied in south-central Missouri from 1939 through 1942.

Mourning Doves, being unable to scratch or to cling to vertical stalks, select their food from seeds available on the surface of the ground. The periodic adjustments in their fall feeding habits are apparently conditioned by changing availability of surface foods.

Wheat fulfills the Mourning Dove's needs until the stubbles become nearly exhausted. The birds then change to foxtail if a crop has been produced; if not, they make shift on the stubbles until the later weeds and crops ripen.

Mourning Doves apparently reject Korean lespedeza, although quail prefer it.

Part of the local Mourning Doves migrate, and an increasing degree of gregariousness is evident among the remaining birds. Winter concentrations begin to form on the best feeding grounds in September.

There is a tendency toward sexual segregation among the wintering doves, some of the adult males forming into separate flocks.

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NESTING HABITS OF THE COMMON REDPOLL¹

BY LAWRENCE I. GRINNELL

IN June and July, 1940, I visited Churchill, Manitoba, with Ralph S. Palmer, to study and photograph nesting birds. "Churchill stands at the junction of two life zones. It is precisely at the limit of tree growth, where the spruce forest dies out on the arctic tundra and both types of biological association are in contact. The country south of the townsite is bare, mossy tundra. . . . Fronds of juniper, crowberry, and lowly willow . . . compose the principal shrubby elements of the flora. Dwarf spruces . . . stand widely scattered or grouped. . . . Inland, the trees increase in number and in size, especially on warm, well drained declivities and along the river, where the bush is more or less continuous" (Taverner and Sutton 1934:8). Between June 2 and July 22, I made a detailed study of the nesting habits of the Common



Figure 1. Observation and photographic blind on platform placed near Redpoll nest. Churchill, Manitoba.

Redpoll (*Acanthis l. linaria*). The study was concentrated mainly within a mile radius of camp (two small cabins situated two miles southeast of Churchill), but several trips in search of Redpolls were made further afield, the whole study area extending from a point near

¹The writer makes grateful acknowledgment to Ralph S. Palmer for the accompanying photographs and for help in collecting the data; also to Arthur A. Allen for invaluable advice and guidance.

the grain elevator in Churchill five miles eastward to the Gravel Pit, the highest elevation (about 100 feet) in the neighborhood. We made detailed observations, mostly from blinds, on three female Redpolls with eggs or nestlings, on 17 days, for a total of 46 hours, including all hours of the day from 3 A.M. to midnight: one nest between June 10 and 17, a second between July 10 and 20, and a third between July 17 and 21.

PRE-NESTING REDPOLLS

From June 2, when we first recorded Redpolls, to June 10, we saw Redpolls daily but not abundantly: several solitary birds, a few pairs, an occasional flock of seven or less. In town they were usually perched on the top branches of the still bare dwarf willows (3 to 6 feet in height), or feeding on the ground near houses. Out near camp, during this period, Redpolls were more numerous among the thin lines or small clumps of dwarf Black Spruces than among the willows fringing the ponds of the open tundra. When perching they generally occupied a conspicuous position, 6 to 10 feet up, on a spruce top or on the tip of a prominent branch. A favorite feeding place was on the ground, just below the ridge of Churchill's water pipe-line, on its lee (south) side, where they fed on dry grass seeds. They were often in more or less close association with Tree, White-crowned, Gambel's and Savannah Sparrows, and Horned Larks. We recorded fewer Hoary Redpolls (*Acanthis hornemanni exilipes*) than Common Redpolls (about one Hoary to every 25 Common). In 1931, Taverner and Sutton (1934:73) found the two forms about equally abundant at Churchill; in 1930 the Hoary occurred in "somewhat smaller numbers" than the Common.

NESTS

We made intensive efforts to find Redpoll nests, and it was surprising in view of the relative abundance of Redpolls that we found only nine of the season's nests. (We found 13 Redpoll nests from previous seasons.) Taverner and Sutton (1934:74) reported "roving bands" of Common Redpolls, which were probably "non-breeding individuals and birds on incubation relief." The nine nests contained a total of 33 eggs. Three nests were deserted before the eggs hatched or before the young were fledged. The nests with parent birds still present were all Common Redpoll nests. Of the total 33 eggs discovered, 24 (72 per cent) hatched; 13 of these 24 nestlings (39 per cent of the total number of eggs) survived up to nest-leaving time. This survival percentage corresponds to the 40 per cent obtained by Kendeigh (1942) near Cleveland, Ohio, for large numbers of nests of two other small Fringillids, the Song and Chipping Sparrows.

The 22 nests (both new and old) were placed 3 to 7 feet above the ground, in either dwarf trees or shrubbery on the open tundra. Five of the nine 1940 nests were in trees or shrubbery at the edges of lakes or ponds. The kind of nest tree was noted for 21 nests: 12 were built in dwarf spruces, 5 in dwarf willows, 3 in dwarf birches, one in a dwarf larch. The exact positions of 14 nests were noted: 9 saddled on more or less horizontal branches, 5 built in crotches. Using four categories, excellent, good, fair, and poor, the concealment of five (out of 19 nests for which degree of concealment was noted) was excellent. These were



Figure 2. Redpoll nest, saddled on bough, showing willow down used in the bulk of the nest structure.

all placed in dwarf spruces, most of them saddling a horizontal bough, shaded and concealed by another horizontal bough directly above. The concealment of one was good, of eight, fair, of five, poor. The poorly concealed nests were almost all built during June in deciduous bushes, such as dwarf willows or birches, before the leaves had matured. We found no nests in the dense bush, and none on the ground, though Jourdain reported (Witherby *et al.*, 1938:66) that exceptionally Redpolls nest in grass tussocks.

The shortest distance between any two active nests was about a hundred yards, though one active nest was placed in a dwarf spruce within a foot and a half of an old nest. Taverner and Sutton (1934:73)

found Hoary and Common Redpolls nesting within a stone's throw of each other.

In all nine of the 1940 nests, the bulk material was chiefly dried grasses, though in one nest, small twigs had also been used. Brown or white Willow Ptarmigan (*Lagopus lagopus albus*) feathers were used in the lining of eight nests, plant-down in five, hair in one, and lemming fur in one. The measurements of seven of the 1940 Redpoll nests are given in the accompanying table.

MEASUREMENTS OF SEVEN REDPOLL NESTS

	Range	Average
Diameter		
Top interior	4½ - 6 cm.	5.1 cm.
Top exterior	8 - 10 cm.	8.7 cm.
Depth		
Inside	3 - 4 cm.	3.2 cm.
Outside	5 - 8 cm.	6.1 cm.
Weight	10.8 - 26.7 gm.	17.8 gm.

EGG-LAYING, INCUBATION, AND BROODING PERIODS

In Alaska, Dice (1918:130) found the egg-laying interval to be one day; I found it to vary from one to two days, though one day was more usual. I was able to obtain accurate data on the incubation periods of only two sets: one, a set of five, hatched in 10 days (July 2 to 12); the other, a set of three, hatched in 10 or 11 days (July 10 to July 20 or 21). Jourdain (Witherby *et al.*, 1938:66) also found the incubation period to be 10 or 11 days. I determined the length of the brooding period at one nest: 11 or 12 days, July 11 to 22. Incubation and brooding were performed by the female; Dice (1918:130) states that "apparently the male has no function in the home life of the Redpoll other than to fertilize the eggs" (though I found, as reported below, that the male sometimes fed the nestlings).

NESTLINGS

The activity of the adult female sometimes extended from about 3 A.M. to 10:30 P.M. Tables 1 and 2 give the average attentive periods (time at the nest) and inattentive periods (time away from the nest) and average feeding intervals for the three nests and for different times of day. The attentive periods of the female at the nest ranged from a minimum of less than a minute to a maximum of one hour, 24 minutes (an average of 22.8 minutes); periods away from the nest ranged from a minimum of less than a minute to a maximum of one hour, 16 minutes (an average of 20.9 minutes).

TABLE 1

ATTENTIVENESS OF FEMALE COMMON REDPOLLS, CHURCHILL, MANITOBA, 1940

	No. of Periods at Nest*	Total Time at Nest	Av. Length of Period at Nest	No. of Periods off Nest*	Total Time off Nest	Av. Length of Period off Nest
Nest 1 (June 10-17)	25½	5 hrs. 50 min.	13.7 min.	26	4 hrs. 25 min.	10.2 min.
Nest 2 (July 10-20)	15½	11 37	44.9	18	7 33	25.2
Nest 3 (July 17-21)	16½	4 29	16.3	15½	8 43	33.7
All Nests	57½	21 hrs. 56 min.	22.8 min.	59½	20 hrs. 41 min.	20.9 min.

* Including fractional periods at beginning and end of observation time, which are counted as half-intervals.

TABLE 2

AVERAGE FEEDING INTERVALS FOR COMMON REDPOLL NESTLINGS, CHURCHILL, MANITOBA, 1940

<i>Intervals by Nest</i>			
Nest 1 June 10-17, nestlings aged 0 to 8 days	17 min.		
Nest 2, July 10-20, nestlings aged 0 to 10 days	36		
Nest 3, July 17-21, nestlings aged 6? to 11? days	20		
Average for all nests	24 min.		
<i>Intervals by Three-hour Periods</i>			
3-6 A.M.	8 min.	12-3 P.M.	19 min.
6-9	28	3-6	20
9-12	29		
Morning average	21⅔ min.	Afternoon average	19½ min.

Between 3 and 6 A.M., the female was busily engaged in search of food for the young, and was usually at the nest only momentarily, for feeding and nest cleaning. The feeding intervals (8 minutes) from 3 to 6 A.M. were very short as compared with other times of day. The female stayed very close at the nest between 6 A.M. and noon, feeding the young on the average every 28 minutes. Between noon and 3 P.M., the average period away from the nest was appreciably longer than the average period at the nest: 29 minutes as compared with 17. The average feeding interval during these hours was 19 minutes. The average attentive period at the nest from 3 to 9 P.M. was 18 minutes, close to the total average attentive period (21 minutes); but from 9 P.M. to midnight, the maximum average attentive period was reached: 80 minutes. It is to be assumed that the female remained continuously at the nest from midnight to 3 A.M., though the nests were not under observation during those hours.

Nest 1 was observed from June 10, when it contained one egg and 3 young from less than a day- to a day-old, to June 17. The female spent 57 per cent of the total hours she was observed (10 hours, 15 minutes) at the nest. Nest 2 was observed from July 10, when it contained 5 eggs (two of which hatched on the two following days) to July 20. The female spent 60 per cent of the total hours she was observed (19 hours, 10 minutes) at the nest, though she was seen to do no actual brooding on either July 18 (observed 1:30 to 3:30 P.M.) or July 19 (observed 1:55 to 3:55 P.M.).



Figure 3. Female Redpoll preening.

On July 20, she was absent from the nest during the entire 70 minutes of observation (1:20 to 2:30 P.M.). Nest 3 was observed from July 17, when it contained 5 young about 6 days old, to July 21, when the young were fledged. The female at this nest spent only 34 per cent of the hours she was observed (13 hours, 12 minutes) at the nest. The average feeding interval at this nest was 20 minutes, as compared with 36 minutes for Nest 2 and 17 minutes for Nest 1.

Dividing nestling period into three stages: early (age one to four days) middle (5 to 7 days), and late (8 to 10 days), the average interval between feedings was found to be 38, 23, and 19 minutes, respectively. Nestlings were fed sometimes by regurgitation, as in the closely related Pine Siskin (Dales and Bennett, 1929:76),



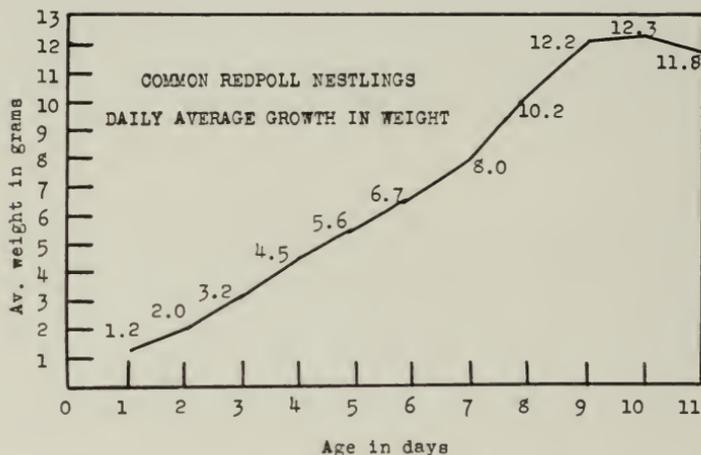
Figure 4. Female Redpoll cleaning nest.



Figure 5. Redpoll nestling, aged 11 days, just before first flight.

sometimes directly. Feeding was usually performed by the female, but occasionally, and contrary to the findings of Dice (1918:130) in Alaska, the nestlings were fed by the male. Frequently the male fed the female at the nest. The female, before accepting the food from the male, opened and shut her bill rapidly several times, and while taking the food, she vibrated her wings continuously; Gross (1938:255) mentions this behavior as characteristic of the Eastern Goldfinch also. After accepting the food, the female regurgitated and fed the young. In the case of a rosy-breasted male and its mate, one parent would come alone to the nest, feed the brood of five, then fly off; the other parent would come almost immediately afterward and also feed the brood.

Nests were frequently cleaned by parent birds, usually immediately after feeding the young; the parent sometimes swallowed the excreta, sometimes carried them away.



The chart shows the daily average growth in weight of the nestlings. The figures given for ages one to seven days are the average weights of four to six nestlings; weights for ages 8 to 11 days are weights of single individuals. By far the greatest percentage gain in weight occurred on the second, third, and fourth days (increases of 66, 60, and 40 per cent respectively); no gain in weight was recorded on the tenth and eleventh days.

Most female Redpolls found on nests were not very shy. They generally allowed an approach to within three or four feet (sometimes to within two feet) before flushing. When flushed, they usually flew away at once to a considerable distance. Sometimes, however, if an intruder was standing near the nest when a female returned with food, she would perch in a conspicuous spruce top and utter the nasal, questioning *tu-wee* note.

SUMMARY

The nesting habits of the Common Redpoll (*Acanthis l. linaria*) were studied at Churchill, Manitoba, from June 2 to July 22, 1940.

Common Redpolls were relatively abundant. Nine of the season's nests were found, containing a total of 33 eggs. Seventy-two per cent of the eggs hatched; 39 per cent of the eggs resulted in fledglings.

Placement and structure of the nests are described.

The egg-laying interval varied from one to two days, though one day was the more usual. The incubation period was 10 to 11 days; the nestling period, 11 to 12 days. Incubation and brooding were performed by the female.

The active day sometimes extended from 3 A.M. to 10:30 P.M. The attentive and inattentive periods ranged from less than a minute to over one hour, averaging respectively 22.8 minutes and 20.9 minutes.

The maximum activity (feeding and nest cleaning) occurred between 3 and 6 A.M.; the maximum brooding (except from midnight to 3 A.M., when the nests were not observed) between 6 A.M. and noon, and between 9 P.M. and midnight.

Nestlings were fed usually by the female, sometimes by regurgitation, sometimes directly. They were fed occasionally by the male.

According to the stage of nestling development, average intervals between feedings were: 38 minutes (age one to four days); 23 minutes (age 5 to 7 days); and 19 minutes (age 8 to 10 days).

The nests were frequently cleaned, usually immediately after the young were fed.

Daily increase in weight of nestlings is recorded.

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BIRD WEIGHTS AS AN AID IN TAXONOMY¹

BY DEAN AMADON

IN recent years several ornithologists have pointed out that bird weights are a valuable aid in many problems. Among general papers on this subject may be mentioned those by Mrs. Nice (1937, Chap. 3; and 1938); Baldwin and Kendeigh (1938); and Zedlitz (1926). All of these, as well as most other writers that have dealt with this subject, have been interested primarily in physiological problems, such as daily, monthly, and seasonal weight rhythms; weight changes during growth; and weight as related to various aspects of metabolism. Referring to such studies, Baldwin and Kendeigh (1938: 458) write: "A surprisingly large number of records of the weight of birds is required before reliable interpretations can be made." Unfortunately such statements have led to a general belief that in taxonomic work, where it would indeed be unusual to have a large series of weights available for each of the forms included in any given study, weights are too variable to be useful. A few taxonomists have published weights of birds, but usually only as an incidental part of their studies. The present paper summarizes and compares the various methods in common use for measuring general size,² and attempts to evaluate weight as an index of general size, and as a standard for use in comparing the relative dimensions of parts, organs, and appendages. The importance in taxonomy of such an index and standard may be summarized as follows:

1. *For direct comparison of variations in general size.* A kind of variation in birds very frequently used by taxonomists to distinguish geographical forms is a difference in general size (measured in various ways). A number of subspecies are based solely on this difference, and a still larger number are based on this difference plus other distinctions such as color. Of 27 subspecies of non-passerine birds which I have discussed in recent papers, 6 are based solely upon differences in general size (as reflected in measurements of appendages); 8 upon size and color; 11 upon color alone; and 2 upon differences in proportions. Subspecies of passerine birds are less often based on size variation, but this may be due to the greater difficulty in detecting such variation in small birds. Very frequently a species shows geographical size variation even though it is too slight, too gradual (altitudinal or latitudinal clines—"Bergmann's Rule"), or too irregular in distribution to justify the naming of subspecies. Mayr (1942:37) lists several instances of such variation.

¹ I am greatly indebted to Ernst Mayr for his careful revisions of the manuscript.

² Alternative but less commonly employed terms are "total size" and "basic size".

2. *As a standard of comparison for measurements of parts and appendages.* The usual "taxonomic" measurements of birds—lengths of wing, tail, culmen and tarsus—are all taken from appendages. Observed variation in such dimensions may indicate variation in general size, independent variation in the appendages themselves, or a combination of the two. For example, two subspecies, A and B, might have the following measurements:

	Tail	Wing	Tail/Wing Ratio
A	50	75	2/3
B	50	100	1/2

If A and B are the same in general size, the variation in wing length and in tail/wing ratios is entirely due to B's having a longer wing. Knowing this, a biological explanation may be sought; perhaps B is more migratory or lives at higher altitudes. But if B, in general size, is larger than A by one-third, then wing length is correlated with general size, and an explanation for the variation in relative tail length may be sought. It thus becomes apparent that we usually cannot fully evaluate the biological significance of geographical variation in measurements of appendages without first relating these measurements to general size.

LINEAR INDICES OF GENERAL SIZE

The following linear indices of general size have been used or proposed by taxonomists working with birds:

1. *Total length.* This would be a very useful index of general size except that in birds it cannot usually be taken with reasonable accuracy, because: (a) birds' necks are relatively long and curved, and the longitudinal axis of the head meets that of the neck at an angle. The success with which this curvature is eliminated in measuring total length is affected, both by the technique of the observer and by the condition of the specimen, to such an extent as to make this measurement extremely variable; (b) as usually defined, total length includes tail length, and the tail often varies in size independently of other measurements; (c) the length of the neck and head (especially the bill portion) not infrequently varies independently of other measurements, very noticeably in such long-billed genera as *Hemignathus* of the Drepaniidae. A "body length," obtained by subtracting tail length from total length (and in long-billed genera, by subtracting also the bill length) would provide a more reliable index than total length.

When taken from museum skins, total length is even more subject to error, since such specimens are little more than tubes of skin whose length varies with the amount of stuffing put in and the amount of stretching which occurs in skinning. However, when the size differences to be measured are comparatively large, total length taken from

selected skins may prove useful. Chapman (1940:422, 426) used it with worthwhile results in his study of *Zonotrichia*, by "selecting when possible, series prepared by the same collector," and even concluded that total length when taken from such selected skins is more reliable than when taken, by various collectors, from birds in the flesh.

2. *Body length*. To provide a standard measurement that can be taken more accurately than total length, Chapin (1929:8) proposed 'length of body', defined as: "the distance in a straight line from the anterior surface of the shoulder to the vent, or, if the bird is already skinned, to the tip of the small bone (pubis) which extends down in the belly wall close to the vent." I know of only one collector who has recorded this measurement for any considerable number of specimens, and apparently no one has used it in a published study. Though it may well prove to be useful in restricted problems, 'length of body' is not a generally acceptable index of general size. The feathers interfere with the taking of this measurement, especially in birds with long, dense plumage. It cannot be taken from skins, and would be rather difficult to take from live birds. Collectors would probably prefer to take it from the skinned bodies of birds, but then comparison of measurements taken from skinned birds with those taken from unskinned birds would introduce a further element of error. Finally, there are many birds so large that this measurement could not be taken with any dividers of a size usually available.

3. *Measurements of appendages*. Lack of a good index of general size has obliged some ornithologists to use one appendage as a standard of comparison for another. Such a practice is in general unsatisfactory because, though one appendage is often correlated with another—for example wing and tail lengths frequently increase or decrease proportional amounts—each appendage often varies independently of other measurements. Though it cannot be assumed that in any given case the size of an appendage is correlated with general size, however defined, the usual measurements, especially wing and tail lengths, seem, more often than not, to be at least partially correlated with it. When it is stated that one subspecies is larger than another, usually only measurements of appendages are given as evidence of the difference. As a rule the taxonomist has noted that specimens of one race appear to be or are obviously larger in "general size," but has made no actual measurement of the general size. Sometimes it is evident that one appendage is more closely correlated with "general size" than another. Thus in comparing races of *Zonotrichia capensis*, Chapman (1940: 424-427) found a pronounced increase in wing length without a proportionate increase in tail length, which he found to be more or less correlated with general size (defined as total length). He was, then, able to use tail length as a rough measure of the relative increase in wing length. But obviously the use of a consistently reliable index of general size as a basis of comparison would be preferable to the

use of measurements of appendages, whose apparent correlation with general size or with each other is sometimes deceptive.

4. *Measurements of hind-limb.* Although the femur, the tibia, and the tarsus are segments of an appendage, there is evidence that their measurements are frequently correlated with "general size." Linsdale (1928:311) has shown graphically that in the Mariposa Fox Sparrow (*Passerella iliaca mariposae*), variation in length of tibia roughly parallels variation in weight. Since he found length of femur and tarsus to be closely correlated with that of tibia, their variation also would, in this subspecies, parallel variation in weight. Hence he used length of tibia as an index of general size and expressed all other measurements in terms of it (p. 357). Miller (1941:358) found inter-racial correlation of tarsus and weight in the genus *Junco*. These findings suggest that the hind-limb segments of birds sometimes follow Wolf's Rule (bones tend to increase in size in proportion to increases in the weight they support). Yet length of hind-limb is obviously affected by other factors, such as habits of the species; and related species of about the same general size, as shown by weight, differ noticeably in length of hind-limb. The tarsus is the only longer hind-limb segment that can be measured in museum skins. It is often rather difficult to measure accurately, especially in species in which the tarsus is short or feathered. Consequently, length of hind-limb segments is usually not a satisfactory index of general size.

5. *Measurements of skeleton.* Several measurements which give a reliable index of general size can be taken from the trunk skeleton of birds. Engels (1940:367 ff.) used two such measurements in his study of the thrashers (*Toxostoma*). He emphasized the difficulties and fallacies which usually attend studies of variation in the proportions of appendages when differences in general size are ignored (p. 368). But relative scarcity of bird skeletons in collections will often preclude the use of measurements taken from them in avian systematics.

Thus we see that all the usual measurements employed by bird taxonomists are linear measurements, either too variable to be reliable indicators of general size, or unobtainable in large series. When they are *apparently* correlated with general size, it is impossible to determine how close the correlation is without recourse to some direct measurement of general size. When an estimate of general size must be based on linear measurements, body length (defined as total length minus tail length, and in special cases, minus bill length) is usually the most reliable, unless series of skeletons of the forms to be compared are available.

WEIGHT AS AN INDEX OF GENERAL SIZE

Precision of weight as an index. Since birds are three-dimensional objects, mass or volume as an index of general size would seem more logical than linear measurements. In such irregularly shaped, feather-

clad objects, volume cannot be directly measured, but weight is easily recorded. It is an index of the mass of a bird and an indirect index of its volume, since closely related birds, such as are usually compared in taxonomic studies, may be assumed to have the same specific gravities. But even in the comparison of distantly related groups, weight is the best available index of general size. In comparing diverse avian types as, for example, herons with quail or songbirds, or with members of other classes, to use a linear dimension would obviously not yield valid results. But the comparative size of organs such as the brain, heart, or pituitary, can be determined by using ratios derived from the weight of the organ as compared with the total weight of the bird.

Differences in general size of solids will always be reflected more accurately by an index such as weight, which is proportional to the mass or volume of the object, than by any single linear measurement (as a simple example: in two cubes with edges respectively 2 and 3 units, the difference in volume is 19 times as great as the difference in edges). Table 1, which gives the absolute and relative differences in wing length, body length, and weight for subspecies of *Nycticorax caledonicus*, *Chen hyperborea* and *Pinicola enucleator*, for species of *Cacomantis*, and for male and female of *Accipiter fasciatus vigilax*, shows that the same is true for weights of birds as compared with their linear

TABLE 1
COMPARISONS OF ABSOLUTE AND RELATIVE DIFFERENCES IN WING LENGTH,
BODY LENGTH, AND WEIGHT

	Wing Length (mm.)	Body Length (mm.)	Weight (gm.)
<i>Nycticorax</i>	Diff: 7.6 %		Diff: 17.9%
<i>caledonicus caledonicus</i>	2♂: 291,304 (298)		1♂: 884 (884)
<i>caledonicus mandibularis</i>	10♂: 267-290 (277)		3♂: 700-800 (750)
<i>Chen</i>	Diff: 4.7%	Diff: 8.9%	Diff: 49.5%
<i>hyperborea atlantica</i>	20♂: 430-485 (450)	13♂: (675)	13♂: 3175-4735 (3626)
<i>hyperborea hyperborea</i>	45♂: 395-460 (430)	12♂: (620)	17♂: 1815-2835 (2425)
<i>Accipiter</i>	Diff: 13.9%	Diff: 15.5%	Diff: 77.3%
<i>fasciatus vigilax</i>	5♀: 273-287 (278)	5♀: (231)	5♀: 459-502 (477)
<i>fasciatus vigilax</i>	10♂: 237-253 (244)	8♂: (200)	10♂: 240-309 (269)
<i>Cacomantis</i>	Diff: 16.4%	Diff: 10.6%	Diff: 26.5%
<i>p. pyrrophanus</i>	9♂: 139-145 (142)	7♂: (115)	7♂: 43.5-55.8 (48.2)
<i>variolosus addendus</i>	17♂: 116-126 (122)	12♂: (104)	8♂: 34.0-42.0 (38.1)
<i>Pinicola</i>	Diff: 9.9%		Diff: 35.4%
<i>enucleator leucura</i>	♂*: 116-128 (?)		5♂: 70-83 (?)
<i>enucleator eschatosus</i>	37♂: 106-115 (111)		9♂: 52-61 (?)

Percentages are amounts by which the larger member of each pair exceeds the smaller in each measurement. (Since the mean was not given for some of the measurements of *Pinicola*, the percentages for this species were calculated from the averages.) Figures in parentheses are the means of the measurements.

* Number of specimens not stated.

measurements. The measurements given in the table are from the following sources: *Nycticorax* (Amadon 1942a:4-5); *Chen* (Kennard 1927:88-89); *Accipiter* (specimens in Amer. Mus. Nat. Hist.); *Cacomantis* (specimens in Amer. Mus. Nat. Hist., in part recorded by Amadon 1942b:16, 20); *Pinicola* (wing lengths from Griscom 1934:7; weights from Van Tyne 1934:530). The body length was found by subtracting tail length from total length; this measurement was taken from skins in the case of *Accipiter* and *Cacomantis*; from birds in the flesh (by Kennard) in *Chen*. In the three genera for which body lengths are given, the difference between forms as compared in this measurement is, as was to be expected, markedly less than the difference in their weights. The same is true here of wing length as compared with weight, but since wing length may vary independently, subspecies may differ in mean length of wing though not (or to a less significant extent) in weight. When wing length is correlated with general size (however defined), forms will often be more sharply differentiated by weight, despite its somewhat greater variability (see below) than by wing length. The two races of *Pinicola* compared in the table seem to be an example of this; Van Tyne (1934:530) has commented on the marked difference in the weights of these two races.

Since differences in general size seem to be reflected more accurately and sensitively by weight than by linear dimensions, it should be possible by a comparison of weights to detect differences in general size which are too slight to produce a measurable difference in linear dimensions. Data to test this probability are scarce, but Mayr (1931:668-669) has published weights and linear measurements of *Melanocharis* (Dicaeidae) which are suggestive. In *Melanocharis versterii maculiceps*, females are significantly larger than males in both wing length and weight; in *Melanocharis longicauda captata*, the wing lengths of the sexes do not differ appreciably, but the females are significantly heavier. The measurements of the two forms are shown in the accompanying table. To determine whether the differences in weight in *M. l. captata* and in both weight and wing length in *M. v.*

	<i>M. v. maculiceps</i>				<i>M. l. captata</i>							
Wing (mm.):	6 ♂	59.0-64.0	(61.8)	5 ♀	66.0-71	(69.0)	7 ♂	64-67	(65.9)	10 ♀	64-67	(65.5)
Weight (gm.):	5 ♂	12.5-15.5	(14.0)	5 ♀	16.5-20	(18.5)	6 ♂	13-15	(13.9)	6 ♀	14-16	(15.4)

maculiceps are statistically significant in view of the rather small size of the samples involved, the "t test" was used (Simpson and Roe 1939:207 ff.). In all three cases this test indicated that the observed differences are almost certainly significant (less than one chance in a hundred that they are not, in each case). The slight difference in the wing lengths of males and females of *M. l. captata* is, of course, not significant.

Blanchard (1941:10-11), in her study of *Zonotrichia leucophrys*, found no significant difference in the lengths of wing, tail, or other

appendages in the two races *pugetensis* and *nuttalli*. Yet she found *nuttalli* to be significantly heavier; for males the difference was 2.59 grams or about 10 per cent of the total weight. Blanchard interpreted this to mean that the lengths of the appendages are not correlated with general size in these subspecies, but it seems equally possible that even if such correlation exists, the difference in general size is too slight to be detected in the appendicular measurements.

An example of the opposite type of variation in which two subspecies differ in the lengths of appendages but not in weight was published by Grinnell (1926:406-408). In comparing two races, *Sitta carolinensis aculeata* and *S. c. alexandrae*, of the White-breasted Nuthatch, he found that although *S. c. alexandrae* weighs no more than *S. c. aculeata*, all of its appendages—wing, tail, culmen, tarsus and hind toe—are, on the average, significantly longer.

Variability of weight. Although weight is in many respects the most logical and sensitive index of general size available, it is affected by several factors such as variation in the amount of fat present, and the contents of the alimentary system. Hence many have assumed that weights are too variable to be useful in taxonomic work, but the few taxonomists who have actually used weights in their studies have not found this true. Miller (1941:255) writes, "Despite the numerous factors which affect the weights of birds. . . , the moderate variability of this measurement, compared with that of mammals, makes it fairly reliable." For the weights of 100 males of *Junco oreganus montanus*, collected during the breeding season, he found that: "The coefficient of variability was 5.2 per cent, which is about twice that of wing length but equal to that of some of the toe and bill measurements." Linsdale (1928:312), after discussing the factors other than geographical variation which affect weights of the Fox Sparrow, concluded: "The exact amount of the effect of each of these factors has not yet been determined, but it is thought that they have little effect on the means of large series." Regarding geographical variation in weight he said (p. 315): "It is easily seen that the average body-weight of these samples is a useful characteristic, to be used along with others for making racial distinctions."

The relative variability of weights is best determined by computing the coefficient of variability V (Simpson and Roe, 1939:122). Results for a number of bird forms are given in Table 2.

The species represented in the table are a mere handful, and all of them are passerines. Since the variability of linear dimensions seems to be much the same for all groups of birds, it is very likely that the variability of weights will also prove to be fairly constant. Some of the extraneous factors influencing weights may, however, be more marked in some groups than in others. Van Tyne has pointed out to me that seasonal fluctuation in the amount of fat present is greater in some

species and groups than in others. Y. Hagen (1942) in an extensive paper on bird weights, which became available after the present one was in press, gives considerable information on this question. Since he was working with a local collection, his discussion of weights as related to taxonomy is little more than suggestive.

TABLE 2

SAMPLE VALUES OF THE COEFFICIENT OF VARIABILITY (V) FOR BIRD WEIGHTS

Species	Number	V	Authority
<i>Junco oreganus montanus</i>	100 breeding ♂	5.2	1
<i>Zonotrichia leucophrys nuttalli</i>	17 breeding ♂	6.54	2
<i>Zonotrichia leucophrys nuttalli</i>	28 wintering adult ♂	8.55	2
<i>Zonotrichia leucophrys nuttalli</i>	19 wintering immature ♂	4.28	2
<i>Zonotrichia leucophrys nuttalli</i>	21 wintering immature ♀	7.25	2
<i>Zonotrichia leucophrys pugetensis</i>	43 wintering adult ♂	8.75	2
<i>Passerella iliaca brevicauda</i>	30 ♂	6.21±0.54	3
<i>Passerella iliaca brevicauda</i>	18 ♀	8.41±0.95	3
<i>Passerella iliaca mariposae</i>	38 ♂	5.60±0.45	3
<i>Passerella iliaca canescens</i>	16 ♂	5.33±0.64	3
<i>Pachycephala schlegelii obscurior</i>	13 adult ♂	5.07	4
<i>Pachycephala soror klossi</i>	11 adult ♂	4.16	4
<i>Ptiloprora g. guisei</i>	18 ♂	6.41	4

Authorities: (1) Miller, 1941:255; (2) Blanchard, 1941:120, 121; (3) Linsdale, 1928:313; (4) Mayr, 1931:665, 672 (raw data, calculation mine).

The variability of volumes or weights will, to some extent, represent the cumulative variabilities of the linear dimensions of the object, and will inevitably have a larger value than that of any one linear dimension. It is usually advisable to use the cube roots of weights rather than the weights themselves as a standard of comparison for linear measurements (see below). Extracting the cube roots has the effect of reducing the variability to a value comparable with that of linear dimensions. For example, available weights of *Pachycephala soror klossi* have a V of 4.16; for the cube roots of the same weights V is only 1.38; V for the wing lengths of the same sample is 1.55.

USES OF WEIGHTS IN ANALYZING MEASUREMENTS

The measurements usually used by the avian taxonomist are all of appendages. Since the independent variation of appendages is often masked by variation in general size, the general size factor must somehow be eliminated. The simplest method of doing this is to express the appendicular measurements in terms of (that is, as a ratio or percentage of) general size, thus transforming the general size in the forms to be compared to the common base 100. The transformed measurements may then be compared with the assurance that the differences observed are independent of general size.

When weight is used as the index of general size, as is advocated here, it is not valid to compare ratios derived from linear measurements divided by weights. As noted above, weights vary in proportion to the cube of the linear dimensions, and this distorts the value of the ratios. The distortion could be corrected either by cubing the linear measurements or by taking the cube root of the weights. Since the object is to compare linear dimensions, the first alternative is not acceptable. Furthermore, the approximation to volumes (or weights) by cubing linear dimensions has inherent difficulties, the most important one being that the error of the measurements is thereby increased (cubed). The opposite is true when cube roots are extracted. This was illustrated above for weights of *Pachycephala soror*. The cube root of weight may be considered to be of the same magnitude as a linear index of general size,³ but more reliable and usually less variable, since it is a generalized quantity (like weight itself), which is independent of variation in body form or proportions. For example, in a comparison of the relative length of intestine in a pelican and a quail to show correlation of length of intestine with food habits, ratios derived by taking length of intestine over weight (or cube root of weight) would constitute a basis for significant comparison, whereas use of any linear measurement, such as body length, in species of such different body form, would give misleading results.

The method of calculating the ratio of any given linear measurement to cube root of weight will vary according to the completeness of the data available. The simplest method is to take the ratio of the measurement (e. g., wing length) over the cube root of weight for each specimen; the mean of the series is then taken. When working with published data, however, such detailed individual measurements and weights will rarely be available. It is then necessary to base the ratio upon available means or averages of the measurements. If the weights and linear measurements are taken from different individuals, and especially if different localities are involved, the specifications for the samples should be fully stated as well as the reasons for considering them to belong to a population homogeneous as to size. Sumner (1920), who was working with abundant, laboratory-raised material of *Peromyscus*, illustrates several satisfactory methods of dealing with statistical material, of which the most precise is that involving the use of regression coefficients.

³ Although Teissier (1931) used cube root of weight in a study of relative growth in the mealworm, the only use of this quantity in the analysis of linear measurements of vertebrates up to the present time, so far as I know, is that of Romer and Price (1941:7 ff.) in their monograph on the Pelycosaur. For these fossil reptiles, no actual weights, of course, were available. An estimated relative weight factor or weight index was ingeniously obtained by assuming that the average area of the vertebral centrae in a given species, since the vertebrae supported the animal's weight, would be proportional to its weight (Wolf's rule). The cube roots of these weight indices were then taken and used as a standard of comparison for measurements of the skull, and various bones of the body and limbs, with valuable results.

After the mean ratio (linear dimension over cube root of weight) for each population included in the study has been secured by any acceptable statistical method, the ratios for the various populations may be directly compared. Comparison is facilitated if all the ratios are multiplied by the factor necessary to increase the largest to 100. The relative magnitude of the dimension in the various populations can then be read off directly as percentages.

The following examples are given to illustrate the use of cube root of weight in analyzing measurements of birds:

1. *Wing/tail proportions in the Fox Sparrow.* The Fox Sparrow is of interest because in the northeastern subspecies, which breeds from Newfoundland to Alaska, the wing is considerably longer than the tail, while the reverse is true in several races of the California and Great Basin mountains. Subspecies of the intervening areas of the west are more or less intermediate. A considerable variation in general size (as shown by weight) occurs among these races, and it has not yet been demonstrated whether the difference in tail/wing ratio is the result of increase in relative tail length or decrease in relative wing length in the southern races. To determine this, the general size factor was eliminated by expressing the measurements as ratios of

TABLE 3

COMPARISON OF ABSOLUTE AND RELATIVE WING AND TAIL LENGTHS IN EIGHT
SUBSPECIES OF THE FOX SPARROW (*Passerella iliaca*)

	Wing	Tail	Weight	Wing Ratio	Tail Ratio
<i>P. i. iliaca</i>	88.5 mm.	71.7 mm.	40.7 gm.	97.9	77.3
<i>P. i. altivagans</i>	81.2	76.1	30.9	98.5	89.9
<i>P. i. sinuosa</i>	81.0	73.1	32.5	96.6	84.9
<i>P. i. schistacea</i>	80.4	80.6	28.9	99.7	97.3
<i>P. i. fulva</i>	80.8	82.2	30.1	98.8	97.9
<i>P. i. brevicauda</i>	83.4	84.3	34.4	97.6	96.1
<i>P. i. monoensis</i>	82.8	85.0	31.3	100.0	100.0
<i>P. i. stephensi</i>	83.4	85.2	34.5	97.5	97.0

The ratios were derived by taking: wing \times 8.198 over cube root of weight; tail \times 7.985 over cube root of weight (the numerical factor given for the numerator being the one necessary to increase the largest included ratio to 100).

cube root of weight. In Table 3, these ratios are given for eight subspecies, together with the absolute measurements. The weights are from Linsdale (1926:314) and Wetherbee (1934:60). Other measurements are from Swarth (1920:182). All data are for males. Because available weights of *P. i. iliaca* included both sexes, I have corrected them on the basis of Linsdale's statement that males of this species average 2 per cent heavier than females. Since the present objective is primarily to illustrate a method, it has not seemed necessary to repeat here the specifications of the samples upon which Table 3 is based. The weights of *P. i. iliaca* are from specimens trapped in New England (Wetherbee); the wing and tail lengths of this subspecies are from

four Alaskan specimens, but since they agree quite closely with measurements taken from eastern specimens, as published by Wetherbee and others, it seemed acceptable to use a ratio based on samples from even such widely separated localities, the geographical variation involved, if any, being negligible in comparison with the inter-racial variation to be analyzed. For a number of races Swarth gave measurements taken from several series collected at separate localities; in such cases I used the largest sample in the table.

Comparison of the relative wing and tail lengths given in Table 3 immediately reveals certain things which the absolute measurements do not. The eastern race, *P. i. iliaca*, is seen to have a longer wing only because its general size, as shown in weight, is larger; relatively, its wing is no longer than that of the other races. In fact, wing length is closely correlated with general size, as shown in weight, in all eight races. The tail of *P. i. iliaca* is much shorter, and that of *P. i. altivagans* and *P. i. sinuosa* considerably shorter, relative to weight, than the tails of the other five races. Swarth believed *P. i. iliaca* to be more closely related to *P. i. altivagans* than to *P. i. sinuosa*, and it is interesting that the relative tail length does not agree exactly with this division. The other five races were placed by Swarth in a "schistacea group" because of resemblances in color and in other characters, and this grouping receives additional support from the fact that relative tail length is almost the same in these five races. Though *P. i. monoensis* exceeds all the other races in relative length of both appendages, the difference, as compared with other members of the *schistacea* group, is so slight that we may assume that it is not significant. The general conclusion is that the geographical variation observed in tail/wing proportions of the Fox Sparrow is to be ascribed to variation in the relative length of tail. Clearly it is necessary to know this before attempting to find a biological explanation of the change in proportions.

2. *The cuckoos of the genus Cacomantis.* Out of eight subspecies of two closely related species of this genus, seven were found (Amadon, 1942b:17-20)⁴ to have a wing/tail ratio of about .96, but in the eighth (*C. variolosus addendus* of the Solomon Islands) the ratio was only .88. Weights, which were available for *C. v. addendus* and for one of the other forms (*C. p. pyrrophanus* of New Caledonia), made possible an analysis of this difference in wing/tail proportions:

	Wing	Tail	Wing Ratio	Tail Ratio
<i>C. v. addendus</i>	121.8 mm.	138.8 mm.	92.78	100.00
<i>C. p. pyrrophanus</i>	142.2	148.3	100.00	98.62

The ratios were derived by taking: wing \times 2.56 over cube root of weight; Tail \times 2.42 over cube root of weight.

⁴This reference may be consulted for the size of samples, weights and other detailed data used here. The methods used in that study needed improvement by transforming the ratios to the base 100; it would also have been better to use mean ratios derived from linear measurements and weights taken from a series of individuals, and to exclude the specimens for which weights were not available.

It is evident that relative tail length is essentially the same in the two, and that the difference in wing/tail proportions has been produced by a change in relative wing length. Since it is *C. v. addendus* that differs from all the related forms studied, we may assume that it, and not *C. p. pyrrophanus*, has changed, but there are no life history data available to suggest whether the relative shortening of the wing in *C. v. addendus* is correlated with habits.

3. *Relative weights of Snow Geese.* In his study of the Snow Geese, Kennard (1927) stated that the Greater Snow Goose is "a much stockier and more heavily built bird" than the Lesser Snow Goose, and published weights and measurements to illustrate this difference, which he considered an important part of the evidence supporting his contention that the two are distinct species. However, Kennard failed to point out that a difference in weights greater than the difference in linear dimensions is to be expected, even when the body forms of two birds to be compared are alike. If the cube roots of the weights are used, a valid comparison designed to test Kennard's conclusion can be made. Analysis of his data for adult males shows that the Greater Snow Goose exceeds the Lesser by 10.5 per cent in wing length, 8.9 per cent in body length and 14.3 per cent in cube root of weight. The greater difference in the cube root of the weights does indicate that the Greater Snow Goose is a "stockier" bird than the Lesser, but the disparity is seen by this method to be too slight to be necessarily considered a specific character, for subspecies may differ in body proportions just as they do in other morphological characters.

In the examples given here, the significance of the difference in ratios is apparent; when necessary, the significance of such difference can be determined by various statistical tests similar to those recently elaborated by Reeve (1940) for studies of allometric variation in proportions.

RECORDING OF WEIGHTS

The greatest difficulty in the use of weights in systematic work is the fact that they cannot be taken from study skins. Recording of weights on specimen labels should be made a routine part of museum collecting. This has long been done at the Museum of Vertebrate Zoology under the progressive leadership of the late Joseph Grinnell and at a few other institutions such as the University of Michigan Museum of Zoology. Weights should also be recorded during banding work. In order to increase the value of weights for taxonomic studies and for the still more stringent requirements of physiological studies, information recorded for each bird weighed should include locality, date, time of day, sex, status of species (migrant or resident) and (if the specimen is collected) the contents of the alimentary system, size of gonads, and amount of fat present.

In publications on the taxonomy of birds, weights should be given

whenever available, preferably in a way which will permit them to be individually correlated with measurements of appendages. Perhaps the only paper in which this has been done for large numbers of specimens is Mayr's report (1931) on the birds of the Saruwaged and Herzog Mountains of New Guinea. Weights should be recorded in grams, but when the cube root of weight is used, the relative values sought are unaffected by the unit or system of measurement employed, provided it is the same in all the forms to be compared.

SUMMARY

A reliable measurement or index of general size is needed in avian taxonomy both as a direct measure of differences in general size and as a standard of comparison for measurements of appendages.

Linear indices of general size are usually either too variable to be reliable, or are not available in sufficiently large series to be of general use. Weight has moderate variability and reflects differences in general size more sensitively than do linear measurements.

When used as a standard of comparison for linear measurements, the cube root of weights should ordinarily be used.

The use of weights in taxonomic studies is demonstrated.

Weights of birds should be recorded whenever possible, to aid in taxonomic and other problems.

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SOME PHYSIOLOGICAL VARIATIONS IN THE
BLACK-CAPPED CHICKADEE

BY EUGENE P. ODUM

IN addition to field observations already reported (Odum, 1941-42), I carried out, in 1939-40, a series of laboratory experiments on Black-capped Chickadees (*Penthestes atricapillus*) at the Huyck Preserve, Rensselaerville, New York.* Birds were "borrowed" from their natural environment for short periods of laboratory study, and returned uninjured to the field. Since the purpose was to measure the normal wild condition as nearly as possible, birds were kept captive no longer than necessary, never longer than overnight. All birds were banded with colored and numbered bands.

The Black-capped Chickadee provides an especially favorable subject for combination field and laboratory study, since it is easily trapped, is present throughout the year, and since short laboratory confinement seems not to affect its normal behavior out-of-doors or its lack of fear towards man. The measurements made so far only scratch the surface of possible physiological work with this species. The following variables were studied: wing and tail lengths, weight, body temperature, heart rate, breathing rate, and muscle tremors. The latter three variables were measured simultaneously with a special apparatus, the cardio-vibrometer, which has been described elsewhere (Odum and Kendeigh, 1940; Odum, 1941). Simple statistical analysis was made when data seemed to warrant it. Since many samples were small, special formulas for small samples were employed in determining standard errors (see Arkin and Colton, 1939).

DISTINGUISHING OF SEXES

Although colored alike, the sexes in the living Black-capped Chickadee can be easily distinguished during the nesting season by behavior and by the presence of a "brood patch" in the female. At other seasons there is apparently no consistent difference in plumage or behavior, though males appear to be slightly larger, as earlier workers have recorded. The maximum wing lengths (measured with the primaries flattened against the ruler) of 36 Black-capped Chickadees measured in this study ranged from 61 to 69 mm. The sex of 22 was determined by breeding behavior. Of these, 13 were males, and their wings measured consistently more than 64 mm.; 9 were females, and their wings measured consistently less than 65 mm. Consequently, careful wing measurement was an aid in sexing: in the 14 birds whose sex had not been determined by behavior, wing measurements of 66 mm. or more were taken as indicating males; those of 63 mm. or less, females; the sex of

* I am indebted to the officers of the Edmund Niles Huyck Preserve for the opportunity to conduct the experiments, and to S. Charles Kendeigh for critical reading of the manuscript.

birds with wing measurements between 66 and 63 mm. remained undetermined. Tail length varied from 60 to 65 mm., but because of the large overlap in measurements and variation in length due to wear, tail measurements were not an aid in sexing.

BODY WEIGHT

Weight records are summarized according to sex and season in Table 1. Average figures for the Black-capped Chickadee at Gates

TABLE 1
BLACK-CAPPED CHICKADEE WEIGHTS IN GRAMS

		Jan/Feb		Mar/Apr		June		Total		Standard Deviation
		No.	Av.	No.	Av.	No.	Av.	No.	Av.	
Rensselaerville, N. Y.	Male	21	12.4	7	12.7	7	11.4	35	12.2	± 0.68
	Female	8	11.9	5	11.6	5	10.8	18	11.5	± 0.70
	Both sexes	29	12.2	12	12.2	12	11.2	53	12.0	± 0.75
	Sex difference		0.5		1.1		0.6		0.7	± 0.20
Gates Mills, Ohio	Both sexes	36	11.5	42	11.1	10	10.4	88	11.2	± 0.95
	Locality difference		0.7		1.1		0.7		0.8	± 0.15

Mills, Ohio (Baldwin and Kendeigh, 1938), are included for comparison. In order to minimize daily fluctuations, all Rensselaerville weights were taken in the late afternoon, at or near the theoretical maximum in the daily rhythm of weight. Three things of general interest seem to be indicated by these data:

1. Males averaged heavier than females at all seasons investigated (a fact also reported by Baldwin and Kendeigh, 1938). The average difference (0.7 gms.) is statistically significant, since it is more than three times as large as the standard error (0.2 gms.). However, because of the considerable overlap and general variability, weight in this species is not a reliable means of distinguishing sex.

2. Rensselaerville chickadees weighed more than Gates Mills birds. The difference (0.8 ± 0.15 gms.) is easily significant provided we assume that the sex factor and daily rhythm factor are eliminated in the averages; and the difference is to be expected since Rensselaerville has the more northern climate. There appears to be a gradual southward decrease in size as indicated by wing measurements in the Black-capped as well as in the Carolina Chickadee, *Penthestes carolinensis* (see Todd and Sutton, 1936), and there is presumably also a north-south weight gradient, although this has not yet been demonstrated.

3. No difference was found between average winter and average spring weights. January and April records on the same individuals also failed to show any significant difference. But the difference between winter and June weights is significant (1.0 ± 0.19 gms.). Since most

June weights represent birds feeding young it is not known whether the decrease is correlated only with season or is perhaps partly the result of strenuous feeding activities. Seasonal variation in weight is well known, most passerines being heavier in winter than in summer (Nice, 1938; Baldwin and Kendeigh, 1938). In the generalized curve (based on a number of species) given by Baldwin and Kendeigh (1938), weight decreases 7 per cent from January to April and 11 per cent from January to June. Zedlitz (1926), however, has reported that certain European Paridae (*Parus* [*Penthestes*] *atricapillus borealis*, and *P. palustris*) as well as the Magpie (*Pica pica*) are exceptions to this general rule. The White-breasted Nuthatch (Baldwin and Kendeigh, 1938) and Tufted Titmouse (Nice, 1938) seem to show comparatively little seasonal variation in weight. From incomplete data on American chickadees it seems that the seasonal weight rhythm may not be so pronounced as in many other passerines, but since there is a complexity of factors affecting weight, far more data are needed before significant conclusions can be drawn. It should be emphasized that a few weight records from scattered localities are of no value in this connection; large series of weights from local populations are needed.

HEART AND BREATHING RATES

Methods. Because of the great variability of the heart and breathing rates in small birds it is necessary to determine some sort of stabilized rate—a standard or “basal” rate—if useful comparisons are to be made. The basal heart and breathing rates are defined as the average rates when the bird is in a post-absorptive (though not starved) condition, in darkness, away from human presence, and at a controlled (or specified) temperature. The same apparatus and general procedures as described in an earlier publication (Odum, 1941) were used to determine basal rates for the study birds. The individual to be tested was captured in the late afternoon, weighed and measured, kept in the dark for two to three hours, then placed on the sensitive perch within the temperature control chamber. By a simple technique previously described (Odum, 1941), it was easy to get the birds to remain voluntarily on the perch indefinitely, in darkness, and entirely free from outside disturbances. Figure 1 is a flashlight photograph of part of the experimental apparatus, showing a Chickadee resting on the perch crystal in the temperature chamber. The bird is sleeping in the typical pose assumed at lower air temperatures, that is, with head turned back, bill buried in scapular feathers, and feathers fluffed out (the same pose as that observed out-of-doors). The recording apparatus and earphones (in order to keep informed of the bird's general behavior) were in another room. After allowing half an hour or more for the bird to become adjusted to the conditions, records were made at about 15-minute intervals for the next several hours. Thus, all records were made between 8 P.M. and 12 P.M.,

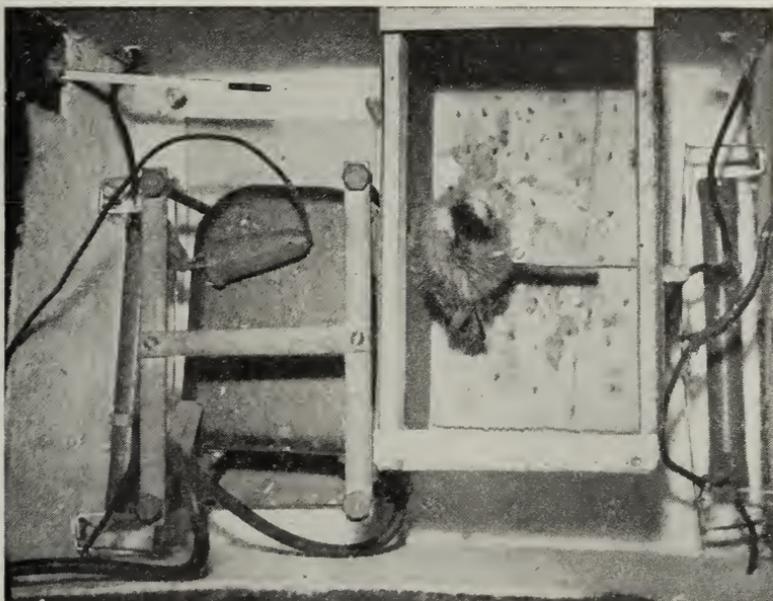


Figure 1. A flashlight photograph of a Black-capped Chickadee sleeping on the perch attached to the piezo-electric crystal (left) within the temperature chamber. The bird has its head turned back, bill buried in scapulars, and feathers greatly fluffed out.

three to seven hours after the last feeding and during the normal roosting time, the period that has previously been found most satisfactory for basal-rate determination. Birds were tested at three temperatures— $90 \pm 1.5^{\circ}\text{F}$. (32.2°C .), $70 \pm 2^{\circ}\text{F}$. (21.1°C .), and $43 \pm 2^{\circ}\text{F}$. (7.5°C .)—each individual usually being tested at two temperatures successively; 90° was thought to be approximately thermal neutral (temperature at which to expect the lowest rate of metabolism); 43° was selected as the lowest conveniently obtainable temperature; 70° is an intermediate point and the usual value of “room temperature.” Unfortunately, the low temperature could not be duplicated during the summer.

In analyzing the graphic records and computing averages, I used the standardized procedure previously described (Odum, 1941). Since breathing rate is relatively slower than heart rate, the number of readings for breathing rate were fewer than those for heart rate, but the averages cover the same period of time. Thirty-four determinations of basal heart and breathing rates, taken from 14 individuals (of which four were measured twice), are given in Table 2. Whereas statistically, this is a small number of records, it is so far the largest series for adults of any wild species to be obtained under comparable controlled conditions.

Sex differences. Since most of the birds studied were males, no conclusion can be drawn regarding the sex factor in heart and breathing rates. Differences, if any, are probably small. Consequently, the sex factor is ignored in most of the following discussion.

Variability. It is interesting to analyze variability since it is a notable characteristic of the heart and breathing rates in small birds. In Figure 2, the variations (during a period of 36 seconds) in the heart rate of a typical individual under the controlled conditions described above are given in detail; readings taken during and between each

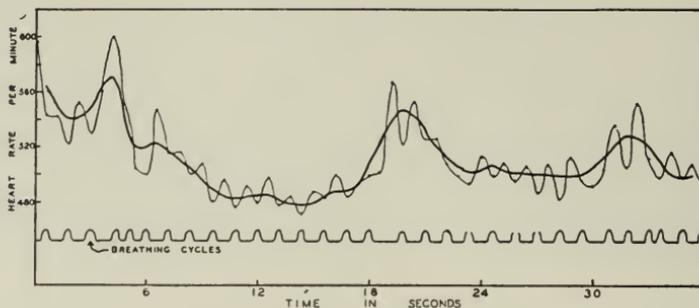


Figure 2. Inherent variations in the heart rate of a typical Black-capped Chickadee (male, June 21). Variations correlated with breathing are superimposed on large oscillatory variations (smoothed curve).

breathing cycle are plotted together with a smoothed curve (representing three "oscillatory" variations), to show the two types of inherent variation in heart rate characteristic of the study birds: 1. Variation which is correlated with the inflation and deflation cycle of the lungs, the heart rate usually decreasing slightly at the peak of the inflation part of the cycle and increasing between cycles. (In mammals, on the contrary, heart rate usually increases during inflation and slows down during deflation—Anrep, Pascual, and Rössler, 1936.) 2. "Oscillatory" fluctuations (Odum, 1941), a more pronounced, slower, and rhythmic (though not usually regular) type of variation. Oscillatory fluctuations may sometimes be related to pauses in breathing (removal of the inhibitory influence of lung inflation mentioned above), or to the action of periodic muscle tremors,¹ but frequently there is no apparent cause (though they are presumably correlated in some way with vagus periodicity). The degree of oscillatory fluctuation varies considerably with individuals; often it can be detected by ear. Inherent

¹ Tremors are defined as coordinated, semi-rhythmic partial muscle contractions or changes in muscle tone which, when pronounced, produce visible shivering. See Odum, 1942:618 or 1941:312.

variations are of interest for at least two reasons: first, they indicate that the heart rate is rarely uniform, and second, a series of readings should be taken in order to avoid any confusion of inherent variations with variations resulting from external factors.

TABLE 3
VARIATION IN HEART AND BREATHING RATE IN BLACK-CAPPED CHICKADEES

	Number of Individuals	Average Coefficient of Variation
A. Intra-individual Variation		
Heart rate: at 90°F.	13	4.53
at 43°F.	12	5.53
Breathing rate: at 90°F.	13	8.50
at 43°F.	11	5.91
B. Inter-individual Variation		
Heart rate: at 90°F.	13	12.50
at 43°F.	12	6.36
Breathing rate: at 90°F.	13	13.10
at 43°F.	11	7.60

In Table 3 the variation in the regular sample readings is indicated by means of coefficients of variation, which simply give a picture of the variation around the mean values. Winter and spring records are combined in order to bring out the effects of temperature and individual variation. Several points of interest are indicated as follows: 1. Heart rate varied somewhat more within the individual at 43° than at 90°, apparently because of the action of periodic tremors. At 90° no tremors were recorded, but at 43° short tremor periods often occurred, accompanied by heart rate fluctuations. The relation of tremors to heart rate and temperature regulation has been discussed elsewhere (Odum, 1941; 1942). 2. Variation in heart rate between different individuals was greater at 90°, a possible indication that 90° is not a good thermal neutral point. 3. Breathing rate, both intra- and inter-individually, was more variable at 90° than at 43°, probably because of the function of the breathing rate in heat loss as explained below. 4. Breathing rate seemed to be slightly more variable generally than heart rate, especially at high temperatures. 5. Basal rates for both heart and breathing were more constant within the individual than between individuals, indicating that both may be considered individual characteristics, as in man. Accordingly, in testing the effect of various factors it is better to use the same individuals if possible. If different individuals are used a larger series is desirable.

Effect of temperature on heart and breathing rates. Average basal rates for all individuals which were tested at the three temperatures during winter and spring are plotted in Figure 3. The principal points shown by these data seem to be: 1. As would be expected, heart

rate increased with a drop in air temperature. The increase seems to be less between 70° and 43° than between 90° and 70°. In winter the average increase in heart rate between 90° and 43° was about 10 per cent, indicating a high tolerance of low temperatures. As can be seen from Table 2, every individual showed a distinct increase in heart rate when changed from a high to a low temperature, although the degree of response varied. 2. It was surprising at first to find that the breathing rate was higher at 90° than at 70° or 43° (a seemingly opposite

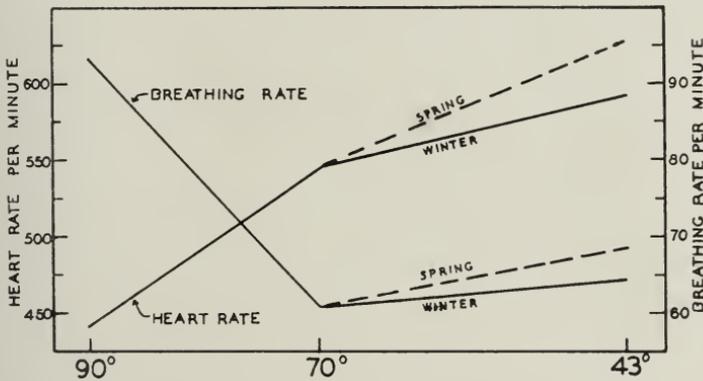


Figure 3. Average standard heart and breathing rates of Black-capped Chickadees at three air temperatures (°F.) during winter and spring. The lines connecting the averages do not necessarily follow the trends (actually unknown) between temperatures. Records at 70°F. are scanty and therefore their averages are not strictly reliable.

response from heart rate). All individuals showed this reaction (Table 2). The explanation is apparently not hard to find, however. Since the lungs and air sacs are one of the principal means of heat loss in birds, the breathing rate is an important part of the heat loss mechanism. Kendeigh (1939) has shown that an abrupt increase in water loss occurs at about 100°F. in both adult and nestling House Wrens; an abrupt increase in breathing rate also occurs in that species at the same temperature (Odum, 1941). In the English Sparrow, however, this critical point is lower—about 85° (Kendeigh, 1934:322). In Black-capped Chickadees the pronounced increase in breathing rate (presumably correlated with increase in water loss) apparently begins somewhere between 70° and 90°; 90° is, then, above the critical point. This explains both the high rate and great variability of breathing at this temperature (Table 3); some readings ran as high as 140 per minute, though at the same time the heart rate was low.

As to the internal mechanism, acceleration of breathing at high temperatures might be reflexive (occurring before a rise in body temperature, as in the dog) or central (that is, due to direct stimulation by

blood temperature rise, of hypothalamic temperature regulation centers). Actual measurement of body temperature of the study birds would have produced many unwanted disturbances, but judging from previous experiments and the low level of heart rate recorded at those temperatures, it would seem unlikely that air temperatures as low as 80° or 90°F. would in this species produce a rise in body temperature. Perhaps, therefore, acceleration of breathing at high temperatures in the Black-capped Chickadee begins reflexively, and this mechanism is augmented by the central "panting" mechanism whenever the body temperature rises. The acceleration of breathing which occurs at low temperatures, on the other hand, can probably be ascribed to increased metabolism and the well-known carbon dioxide mechanism.

The difference in behavior of birds at different temperatures was also striking. At both 43° and 70° (in summer as well as in winter) birds invariably assumed the pose shown in Figure 1, but at 90° the birds did not fluff out their feathers or turn their heads back (the means usually employed to decrease heat loss). Individuals were also more restless at 90°, moving slightly every minute or so, indicating that they were not so comfortable as at the lower temperatures.

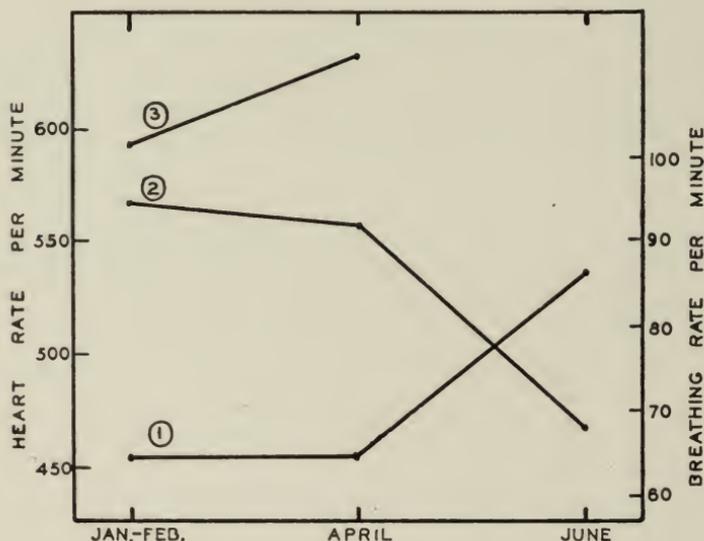


Figure 4. Basal heart and breathing rates at three seasons. (1) Heart rate at 90°F. (2) Breathing rate at 90°F. (3) Heart rate at 43°F.

Effect of season. Seasonal variations in heart and breathing rate are shown in Figures 3 and 4 and Table 2. Because of the small amount of data, only limited comparisons can be made. The basal heart rate at

90° was higher in June than in winter or spring. The average increase was 89 ± 25.1 beats per minute. The difference was also significant when males only were compared. Higher heart rate in summer as compared with the rate in winter at the same temperature is probably correlated with increased metabolism, since basal heart rate is often a good index to metabolism. Kendeigh (1934) found that in English Sparrows the rate of metabolism (as indicated by percentage weight loss) was greater in summer than in winter.

The breathing rate at 90°, on the other hand, was lower in June than in spring or winter (Figure 4). This is undoubtedly related to more rapid heat loss in summer, which may result, at least in part, from less dense plumage and lower weight (Kendeigh, 1934:335). In other words, the critical point previously mentioned (temperature at which breathing shows an abrupt increase) shifts upward in summer, and 90° air temperature no longer results in a high rate of breathing.

Examination of Figure 3 suggests that heart rate may begin to increase in the spring, especially at 43°, since readings for April were usually higher than winter averages. As already pointed out, differences are perhaps more likely to be significant if readings from the same individual are compared. Accordingly, four individuals that had been measured in winter were again tested in April under the same conditions, and the probable significance of the differences was calculated. In April, basal heart rate was significantly higher in all four individuals at 43°, but in only two at 90°. Furthermore, when all data were pooled (irrespective of individual) in order to obtain a large number of readings, the average spring increase at 90° was 16 ± 10.4 (probably not significant), whereas the increase at 43° was 52 ± 11.7 (probably significant). Thus the heart-rate/temperature curve is flatter in winter than in spring (Figure 3).

Discussion. The following generalizations seem to be justified: At intermediate air temperatures, though not at high temperatures, heart rate and breathing rate probably vary directly with each other, and inversely with the temperature. As far as present information goes, basal heart rate may be considered an index to heat production; breathing rate is also related to heat production, but at temperatures above thermal neutral it becomes a rough index to heat loss in birds (as well as in certain mammals). Consequently, the measurement of these vital rates and determination of critical points may reveal much about the bird's response to environmental conditions and its limits of tolerance. The differences between species in these respects may help to explain differences in behavior and distribution. For example, the critical temperature at which breathing shows an abrupt increase is about 100°F. in House Wrens but is appreciably lower in English Sparrows and in Chickadees in winter. Seasonal differences are also striking. In Chickadees the critical point just mentioned seems to shift upward in summer, downward in winter. Likewise, heart rate levels change with the season.

being higher in summer (when the heart rate is presumably correlated with a higher rate of metabolism) and lower in winter. As previously reported (Odum, 1941-42), survival time without food is much higher in winter than in summer. In winter, decrease in heart rate, in metabolism, and in heat loss enable the Chickadee to resist low temperatures. That is, food and shelter are by no means the only considerations in survival. Kendeigh, for example, found that the House Wren, even when food and shelter were amply provided in large cages (where the birds lived successfully through the summer), was unable to survive

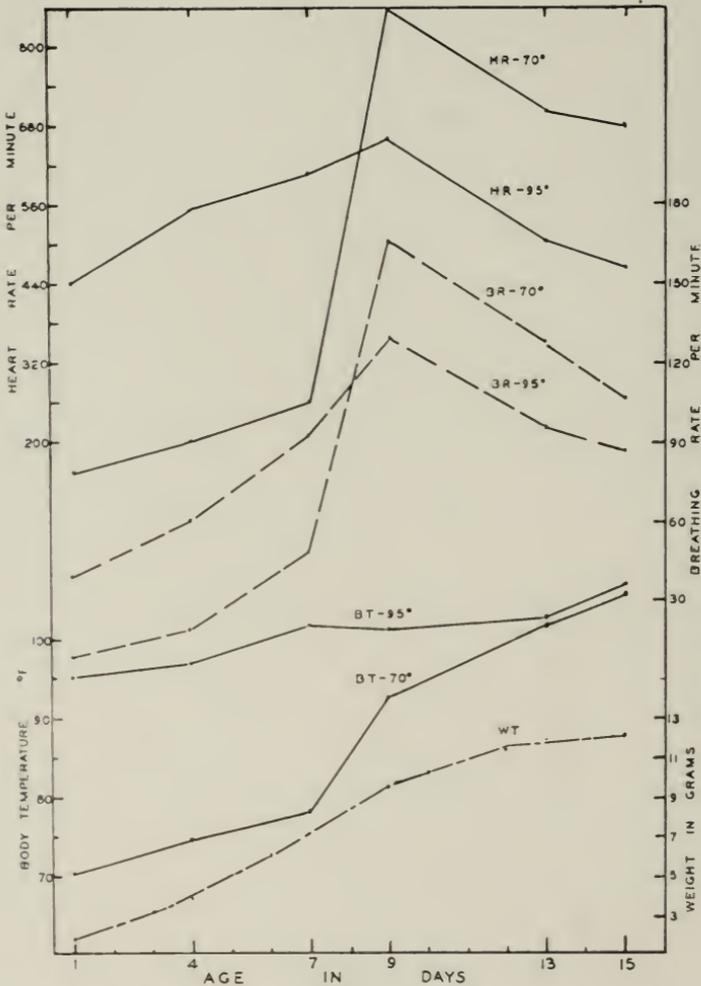


Figure 5. Heart rate (HR), breathing rate (BR), body temperature (BT), and weight (WT) of six ages of nestling Black-capped Chickadees at two air temperatures (95°F. and 70°F.).

northern Ohio winter conditions, presumably because they were unable to make the proper physiological adjustments to temperature. It should be remembered, of course, that the basal rates studied in this paper are but outward manifestations (or net results) of complex internal responses. Seasonal changes, for example, are probably ultimately related to endocrine changes.

DEVELOPMENT OF NESTLINGS

Data on heart rate, breathing rate, body temperature, each at two air temperatures (95°F. and 70°F.), together with the body weight of six ages of nestling Black-capped Chickadees are plotted in Figure 5 for easy comparison. Physiological development of the nestling Chickadee seems not to differ in any important respect from that of the House Wren (Kendeigh, 1938; Odum, 1941) even though the adults may differ. Consequently, only a few points need be mentioned here: 1. As in other altricial species, the Chickadee changes from a cold-blooded to a warm-blooded organism during its nest life. The transition is gradual, but changes are more rapid during the middle third of the 16- to 18-day nest life. Between seven and nine days, the two curves for body temperature (at 70°F. and 95°F.) approach each other (Figure 5, and the two curves for heart rate, as well as those for breathing rate, cross, strikingly illustrating the reversal in the response to temperature. 2. Nestlings (unlike adults in winter) have heart rate and breathing rate closely correlated at the two temperatures used in this study; 95° is for nestlings, therefore, probably below rather than above the critical point in the functioning of the heat loss mechanism. 3. The range of basal heart and breathing rates in nestlings is relatively great when different ages and temperatures are considered, illustrating the great sensitivity of nestlings to small changes in air temperature. 4. The highest heart and breathing rates were recorded at about nine days; muscle tremors were also most intense at this age. As described elsewhere (Odum, 1942), the heat production mechanism seems to develop more rapidly than the ability to control heat loss. At nine days, the feather covering of the nestlings is still poor; consequently, heat loss is poorly controlled, and this probably accounts for the high heart and breathing rates.

SUMMARY

Wing and tail lengths, body weight, body temperature, heart rate, breathing rate, and muscle tremors (the latter three variables being measured with the cardio-vibrometer) of wild Black-capped Chickadees were studied.

Wings ("maximum measurement") varied from 61 to 69 mm., with wings of males as a rule longer; hence wing measurements were an aid in sex distinction. Tail measurements varied from 60 to 65 mm., and were not an aid in sexing.

Males averaged 0.7 ± 0.2 gms. heavier than females. Rensselaerville (New York) birds averaged 0.8 ± 0.15 gms. heavier than Gates Mills (Ohio) birds, when records from the same months were compared. The study birds weighed less in June than in winter, but weight differences between winter and spring were not significant.

There are two types of inherent, more or less rhythmic, variation in heart rate, one correlated with breathing, the other probably of variable cause.

Basal heart and breathing rates were measured at three temperatures, 43° , 70° , and 90°F . With rising temperature heart rate decreased, but at 90° breathing rate increased; this acceleration (probably reflexive) is undoubtedly related to the special role of breathing rate in the control of heat loss, 90° being above the critical temperature, especially for Black-capped Chickadees in winter.

Heart rate probably may be considered a rough index to heat production, and breathing rate a rough indicator of heat loss.

Heart rate was consistently and significantly higher in summer, and usually higher in spring, than in winter. Breathing rate, on the other hand, at 90° was lower in summer than in winter. These changes indicate an important seasonal adjustment of basic physiological rates (including the rate of metabolism), and are undoubtedly significant in the species' successful adaptation to changing seasonal conditions.

Physiological development of the nestlings was similar to that of the House Wren. Weight increase followed a sigmoid curve. Temperature regulation was established gradually, the most rapid changes taking place during the middle third of nest life. A peak in both heart rate and breathing rate was reached at about nine days of age, after which both decreased as the control over heat loss became more effective.

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GENERAL NOTES

Herring Gull attack on normal Golden-eye.—On several days prior to April 11, 1943, an American Golden-eye (*Bucephala clangula americana*) fed by diving in the breaking waves in front of our home on the east shore of Put-in-Bay Harbor, South Bass Island, Ohio. The bird was a young male in changing plumage and therefore readily distinguishable from its fellows. I saw him in flight several times, and he appeared to be normal in every respect.

On the evening of April 11 he again appeared in front of our home, feeding about 50 feet offshore at the point where the huge waves began to curl and break. He usually waited until a wave was about to break over him before he dived. While he was diving, an adult Herring Gull (*Larus argentatus smithsonianus*) came flying along the shore, swooped down and attempted to grasp the duck with its bill. The duck escaped capture with a quick dive. This was repeated several times until finally the gull succeeded in obtaining a firm hold near the base of the duck's right wing. Both birds began to struggle furiously, the duck attempting to dive, the gull to drag the duck toward shore. Occasionally both birds were almost submerged by the breaking waves. After about two minutes the duck broke free and dived, coming up some 100 feet away, and the gull again attacked. The duck escaped by diving, and swam under water for several yards. On appearing at the surface he flew away. The gull started in pursuit, and coming up with the duck, made repeated though unsuccessful attempts to knock it down into the water. The duck began to out-distance the gull, which then gave up the chase. I have seen Herring Gulls attack wounded or dying birds but never before have I seen one attack an apparently normal individual.—MILTON B. TRAUTMAN, *F. T. Stone Laboratory, Ohio State University, Put-in-Bay, Ohio.*

Vermilion Flycatcher at St. Marks, Florida.—Observations made during the past three years at the St. Marks National Wildlife Refuge, St. Marks, Florida, indicate that the Vermilion Flycatcher (*Pyrocephalus rubinus mexicanus*), is less rare—at least in northwestern Florida—than the single record from earlier years would indicate.

On December 26, 1940, while making a Christmas bird census, D. V. Gray and L. S. Givens observed a Vermilion Flycatcher, and collected it the following day. The specimen was identified by H. L. Stoddard of Thomasville, Georgia. According to A. H. Howell's "Florida Bird Life" (1932:327), the only other record of this species for Florida was a bird collected at Tallahassee on March 25, 1901, by R. W. Williams. In mid-December, 1941, and during the first week of January, 1942, a Vermilion Flycatcher was again observed on the St. Marks Refuge, by H. L. Stoddard. On December 10, 1942, Givens observed a female Vermilion Flycatcher there; and on December 24, while making a Christmas bird census, he saw an adult male and collected a female (probably the same bird seen December 10). In the same general location Givens again observed an adult male and female on January 1, 1943. These two birds were seen repeatedly at the Refuge throughout the winter of 1942-43. The last record was of a male seen by Givens, J. J. Lynch, and Clarence Cottam, not far from headquarters, on March 14, 1943.—LAWRENCE S. GIVENS, CLARENCE COTTAM, and DONALD V. GRAY, *U. S. Fish and Wildlife Service.*

A wren singing the songs of both Bewick's and the House Wren.—On April 18, 1943, at my home in the northern part of Columbus. I was surprised to hear a wren singing the songs of both the House Wren (*Troglodytes aedon*) and of the Bewick's Wren (*Thryomanes bewicki*). The bird uttered the notes of one species for a few minutes, then changed to the notes of the other. Each song seemed perfectly characteristic of the species indicated. I heard the bird sing

only one of the two principal types of Bewick's song: the one which has been whimsically transcribed as "Eat a piece of che-ee-eeze!"

After singing for several minutes from three perches in the tree tops, the bird dropped to the ground, where I obtained a fairly satisfactory view of it, although the obstructing stems of shrubbery in which it was foraging prevented critical study. In appearance, it seemed a typical Bewick's Wren, with a conspicuous, whitish superciliary line, white tips to the outer tail-feathers, and the characteristic "tail-wobbling" habits, except that the tail seemed a trifle shorter than that of the average Bewick's Wren, and the flirting of the tail was not so free. Unfortunately my attempt to collect the bird was unsuccessful.

Two possible explanations readily present themselves: (1) the bird was a hybrid, and (2) it was a Bewick's Wren with the ability to mimic the House Wren. Without the bird in the hand, the question must remain a matter of speculation.

The ranges of the two species, geographical and ecological, overlap only to a slight extent. At Columbus, the House Wren is abundant, Bewick's infrequent. It is under such conditions, namely, where one of two species in question is rare in a given locality, the other abundant, that hybridism seems to occur most frequently, since an individual of the rare species then has less opportunity of finding a mate of its own kind. The Blue-winged Warbler (*Vermivora pinus*) and the Golden-winged Warbler (*Vermivora chrysoptera*) are a case in point. I have listened critically on many occasions to songs of the Bewick's Wren and have never heard one which varied far from the usual types. They were always characteristic and never showed the faintest suggestion of mimicry.—EDWARD S. THOMAS, *Ohio State Museum, Columbus.*

Notes on a Captive Redstart.—From June 13 to 30, 1942, I studied the growth and activities of a juvenile Redstart (*Setophaga ruticilla*) that I captured when it flew from its nest in an isolated 25-foot Norway maple (*Acer platanoides*) located about 75 feet from a wooded park in Washington, D. C. The nest was situated 15 feet above the outside traffic lane of a principal street, on a small branch that sloped steeply upward. An old Redstart nest, apparently of the previous year, occupied a similar site a few feet away in the same tree. The recent nest, when first discovered May 28, contained eggs; on June 4, it contained two eggs and one small young; and on June 13, two young, which flew from the nest when nearby leaves were touched. While I was photographing the two young on the ground, a heavy thunder storm began. One fledgling flew to a perch on a protected branch, but the other remained exposed to the weather. The parent Redstarts, which had been fluttering excitedly about attempting to lead the young to cover, went away. I took the wet young bird home and retained it for study until June 30, when I released it because of the failure of my mealworm supply.

Growth. At 10 days of age, the rectrices, whose tips were barely visible beyond their coverts, began to break out of their sheaths. The yellow patches on the tail feathers became completely exposed on the twentieth day. The remiges seemed to grow at equal rates. At 13 days of age, the yellow areas of the wings first appeared as narrow wing-bars, showing about one mm. beyond the greater primary coverts. These yellow patches were fully visible at 26 days of age, projecting 8 mm. beyond the coverts; the distal secondary was 45 mm. long at 16 days of age and measured 47 mm. on all succeeding days.

Post-juvenile Molt. At 22 days of age the slate gray juvenal plumage of the occipital and dorsal tracts was being replaced in quantity by olive-green first-winter plumage. The underwing coverts, yellow in color, also began to appear at this time; previously the underwing areas had been naked. The post-juvenile molt was thus begun before the juvenal plumage was fully acquired. According to Dwight (*Annals N. Y. Acad. Sci.*, 13, 1900:288), the post-juvenile molt of the Redstart does not include the flight feathers.

Calls. A loud, vigorous chip and a lower, but still extremely noisy, chipping food call comprised the vocal efforts heard during the study period. From about 14 days of age, the formerly indefinite chipper began to conform to the song pattern of the adult: an ascending, increasingly loud *chip-chip-chip-chip-chirp*. The bird snapped its bill occasionally, especially when being fed.

Feeding Habits. I fed the Redstart mealworms in quantity (it would accept 4 or 5 an hour) until all available sources were exhausted. Mushy egg yolk, mashed commercial turtle food (largely ant pupae and small bivalves), and canary "vitamin" seed mixture were offered as alternates.

On several occasions the Redstart squeezed itself through the bars of its cage in order to beg food from a captive juvenile Cardinal. At these times, each bird would beg food from the other, with open mouth and quivering wings, until tired.

At 16 days of age, the young Redstart keenly watched a house fly as it flew about the cage, but made no attempt to catch it. Though the Redstart occasionally picked up small fragments of food, it at first showed no interest in mealworms crawling before it. But at 25 days of age, after several vain attempts, it caught and ate one worm. It would not follow a worm, however, when the worm moved out of reach. The bird seemed able to recognize the several foods offered it, preferring mealworms, dead or alive, above all. Egg yolk was usually acceptable, but vitamin and turtle foods were consistently refused. Upon release at the edge of its home woods, it immediately picked at minute dots on nearby leaves and made a circular flight in weak pursuit of a passing gnat.

Flight. In contrast to juvenile Cardinals studied in captivity, the extremely buoyant flight of the young Redstart was amazingly expert. The Cardinals, for almost a week after leaving the nest, were able to fly only along straight, sometimes slightly climbing, routes when escaping capture. Invariably, blind collision with a wall or other barrier terminated their flights. The Redstart, however, from its first attempt, apparently selected its next perch and then landed accurately upon it. On the first day out of the nest, it was seen to look over its shoulder, squirm about to secure a good footing, and then spring into the air to land on a perch a foot behind and above it. On the second day it could climb at a 45° angle on flights of 6 to 15 feet. By the ninth day out of the nest, it could hover expertly and even when hovering, move backward a few inches in the air. (These habits became established in Cardinals only when they were several weeks older.) At this age, it would dart about, hummingbird-like, hovering at several points, in a cage one cubic foot in size.

"Crawfishing." For a period of two or three days after capture I noted a peculiar habit, best described as "crawfishing," whenever the bird was lifted from its perch and placed on a flat surface. It would extend its wings as far forward as possible, draw in its head, spread its tail, and run rapidly backwards until halted by collision or until (after moving 2 or 3 feet) it became tired. The exact reason for this reaction was not apparent, but it seemed probable that it was in some way connected with an instinct to withdraw into the nest when the feet are not in a perching position. It did not seem purely a question of balance. This reaction was not tested upon soil or a rough surface, and I saw no evidence of it when the birds were originally captured and photographed on a lawn. The habit was less apparent on the second day out of the nest, and it stopped by the fourth.

Intelligence. In addition to its apparent deliberation before flying, the superior intelligence of the Redstart was illustrated by its ability to search for an opening in its cage and to make its way out. Whereas captive Cardinals and Quails would remain perched or repeatedly and blindly attempt exits through openings obviously too small, the Redstart made no futile attempts but searched until it found a practical way of escape. Such an escape route, once discovered, was tried persistently without further searchings until it was blocked. Undoubtedly, more formal experiments would reveal similar superiority of the Redstart, over Cardinals and Quails at least, in escaping from simple mazes.—GEORGE A. PETRIDES, *American University, Washington, D. C.*

Cowbird carrying away and eating a bird's egg in the evening.—On May 28, 1943, I was looking out of a window of my house near Ann Arbor and saw a female Cowbird (*Molothrus ater*) flying toward the house from a field of tall grass and winter wheat about 40 feet away. When the bird was about 10 feet from the house, flying about a foot above the ground, a small white oval which it was carrying in its beak dropped to a small patch of hard clayey soil. It was a small white egg, similar in size and color to the egg of the Song Sparrow. The Cowbird alighted, punctured the shell with its beak, and began to sip the albumen. After a time she removed the yolk whole, swallowed it, and then finished sipping the albumen. By this time the shell had broken into two pieces, and one piece had rolled a few feet down a slight incline. The Cowbird ate the part of the shell near her, then moved down the slope and finished the other. I carefully examined the ground after she had flown away but failed to find any trace of shell. I noticed a male Cowbird within three or four feet of the female while she was puncturing the egg and eating its contents, but he flew away before she had finished eating the two pieces of shell. This incident occurred at about 5:15 P.M. E.S.T., though Hann (*Wilson Bulletin*, 53, 1941:220) has reported that Cowbirds regularly remove an egg of the host "during the forenoon," usually of the day before laying their own egg.—ADA L. OLSON, *University of Michigan Museum of Zoology, Ann Arbor.*

Abnormal feather loss by Cardinals.—Some years ago George Miksch Sutton recorded (*Oologist*, 34, 1917:216) a specimen from Texas of a Cardinal (*Richmondia cardinalis*) with completely featherless head. Amelia R. Laskey tells me of two occurrences of baldness among the 1,621 Cardinals she has banded over a period of 12 years at Nashville, Tennessee. They were females, banded (1) August 20, 1936 (recorded as "almost bald"; plumage normal when taken again in December), and (2) July 10, 1939 ("head bald, except for crest"; not taken again). Milton B. Trautman has reported (*Univ. Mich. Mus. Zool. Misc. Publ. No. 44*, 1940:397) some late summer Cardinals with completely bald heads at Buckeye Lake, Ohio. He tells me further that most of these were observed between mid-August and mid-September, though he once noted an individual with pronounced feather loss by July 4.

Recently I observed an extreme case of this kind and was able to learn something of the attendant circumstances. A male Cardinal was banded December 26, 1934, by Thomas H. Weller at his home in Ann Arbor. On July 20, 1941, it appeared at my home (three-quarters of a mile to the northeast) and has since lived in the neighborhood. It feeds at my window feeding shelves, and I can observe it closely and regularly. Early in June, 1942, I noticed that it was losing feathers from the head. By late June, the head, except for two or three crest feathers, and the upper neck were bare. On July 3 the bird was a "vulture Cardinal" such as Sutton has described, with the head covered only with dark gray, wrinkled skin. I saw no other indication of parasites or disease, and the bird's behavior was normal. Its appearance, though rather repulsive, apparently did not interfere with nesting activity, for on August 7, it brought a full-grown young to the shelf and fed it. On September 1, when it reappeared, after a two week's absence, feather growth had begun again about the base of the culmen. This continued, spreading back over the head and neck, until, by September 28, the normal feathering was entirely restored. The bird stayed through the winter and spring, and this year, its tenth summer at least, it has remained perfectly normal in appearance and has not yet (August 12) begun the regular post-nuptial molt.

Thus we have a record of a Cardinal at least eight years old, losing all of the feathers from its neck and head in June, remaining bald, but living normally through the whole summer, growing a complete new set of head feathers in 28 days, and remaining fully feathered during at least the following 10½ months.—JOSSELYN VAN TYNE, *University of Michigan Museum of Zoology, Ann Arbor.*

Gambel's Sparrow in Kentucky.—During the winter of 1942–43 we trapped 17 sparrows (*Zonotrichia leucophrys*) on Meade Avenue one-half mile south of Louisville in Jefferson County, Kentucky—12 immatures and 5 adults. Four of the adults were typical White-crowned Sparrows (*Z. l. leucophrys*) with the superciliary stripe extending only to the eye, but in the fifth, a bird banded on January 6, 1942, the stripe extended all the way to the bill, the diagnostic character of Gambel's Sparrow (*Z. l. gambeli*). At the time we banded the bird we noted that it was always alone while feeding and was the only individual of the species to visit a high feeding tray. Since the bird had returned for the second winter, it was probable that it wintered regularly in Kentucky with our usual flock of White-crowned Sparrows. We have had returns of six White-crowned Sparrows during the last two winters—which would indicate that at least some members of this flock return to the same spot in Jefferson County year after year; repeats during December, January, late March, April, and May indicate that individuals tend to remain through the winter in the same location (except possibly during February and early March, for we have found no White-crowned Sparrows then).

The Gambel's Sparrow noted above was collected on December 21, 1942, and is in the collection of the University of Louisville. As far as we have been able to ascertain, no earlier record of this western subspecies has been published for Kentucky.—HARVEY B. LOVELL, *University of Louisville, Louisville, Kentucky.*

A bald Song Sparrow.—On February 26, 1932, a male *Melospiza melodia* in normal plumage arrived at Columbus, Ohio, and I banded him ten days later. From his prompt ejection of two residents in possession (one a yearling, the other a two-year-old of a markedly non-aggressive nature), I assumed that the newly banded male had nested there before. On May 24, when his first young were five days out of the nest, his forehead, chin, cheek, lores, and part of the crown were bare of feathers. On June 9, I found his second nest, and I then noted that his head was entirely bare except for a small tuft on the crown. I did not see him again that season, but in 1933, he arrived on March 2 in perfect plumage. A few days later he was driven off by the destruction of cover on the study area.—MARGARET M. NICE, *5708 Kenwood Avenue, Chicago, Illinois.*

IMPORTANT GIFT TO THE LIBRARY

The Wilson Ornithological Club Library has just received a valuable gift from R. M. Barnes, of Lacon, Illinois, for 33 years editor of *The Oologist*. The gift includes 725 copies of natural history magazines, most of them published by amateur naturalists during the last century. Some journals published but a single number, others lasted several or even many years, but all have since become rare items. Certain of these are now of hardly more than antiquarian interest, but a number of them contain the early contributions of men who became well known ornithologists. Their early records of contemporary wildlife conditions are now carefully studied in the attempt to reconstruct a picture of the former numbers and distribution of American birds.

Mr. Barnes, realizing long ago the value of these publications, began to collect them, and in 1915 he published in *The Oologist* an extensive bibliography of such journals by Frank L. Burns, former editor of *The Wilson Bulletin*.

The Wilson Club Library already contained the beginnings of a collection of these journals, but progress was slow until Mr. Barnes added his support to our project. The Club is thus further indebted to Mr. Barnes who had already given it his steady support as a member for 35 years.

EDITORIAL

War conditions again prevent our holding an Annual Meeting. The election of officers will be carried out by mail as was done last year. We have not yet been notified of the appointment of the Nominating Committee, but that may be expected shortly, and we shall be glad to forward to that committee the suggestions and opinions of members sent in our care.

Annual Meetings have always been of vital importance to the growth of the Club. There is real danger that the Club may lose ground during the war unless our members give the Club special support in its membership campaign and in its publishing and other activities.

We are sorry to report that the pressure of his duties in the U. S. Army Air Corps has caused George Miksch Sutton to resign from his position as President of the Club. His place is taken by Vice-President S. Charles Kendeigh of Champaign, Illinois.

ORNITHOLOGICAL NEWS

Our Associate Editor, Frederick N. Hamerstrom, Jr., has joined the U. S. Army Air Corps and is now at Randolph Field, Texas, where he is doing research in aviation physiology.

The 1943 annual meeting of the American Ornithologists' Union has been canceled, but the Council will meet in New York, on October 20, to transact necessary business.

Following the death of Bayard Christy, founder and editor, *The Cardinal* has ceased publication. The Audubon Society of Sewickley Valley (Pennsylvania) had published the journal under Christy's distinguished editorship since January, 1923.

OBITUARY

NORMAN A. WOOD, Emeritus Curator of Birds in the University of Michigan Museum of Zoology, died at Ann Arbor, September 7, 1943, at the age of 86. He had been a member of the University faculty for 48 years and had done extensive field work on birds and mammals in Michigan, North Dakota, Florida, and China.

WILLIAM E. SAUNDERS, dean of Ontario ornithologists, died in London, June 28, 1943, at the age of 82. A very active and skillful field naturalist, his remarkable knowledge not only of birds but also of mammals and plants was widely recognized. He was President of the Wilson Ornithological Club in 1912 and 1913.

BAYARD H. CHRISTY of Sewickley, Pennsylvania, died June 20, 1943. He will perhaps be best remembered as founder and editor (through all of its 21 years) of *The Cardinal*, for it reflected so well his unusual ability as a writer and editor, his knowledge of birds, his interest in history, his zeal and courage as a wildlife conservationist, and his high scientific standards.

JAMES MOFFITT, Curator of Birds and Mammals in the California Academy of Sciences, was killed in an airplane crash at Dutch Harbor, Alaska, on July 2, 1943, while serving with the U. S. Navy. He had published extensively on game birds, especially water fowl, and was an authority on the geese of North America.

ORNITHOLOGICAL LITERATURE

ECOLOGY AND MANAGEMENT OF THE MOURNING DOVE, *Zenaidura macroura* (LINN.), IN CASS COUNTY, IOWA. By H. Elliott McClure. Agric. Exper. Sta. Iowa State College Research Bull. No. 310, 1943:355-415.

Thirty months were spent on the study reported in this bulletin: during 1938 and 1939 visits were made every other day to all nests on the 160 acres in Lewis, Cass County, Iowa, and on 60 acres on farms and other sites near Lewis; during 1940, nests on 10 acres in Lewis and 5.5 acres of farms were visited every day. In all, "nearly 4,000 nestings" were recorded. Bands were put on 1,643 young from 4 to 9 days old; some young were raised by hand; "several" of these later bred in cages.

Of the 36 tables in the bulletin, a full 10 are devoted to the trees in which the Mourning Dove nested; but they give little information beyond the fact that except for evergreens, which were especially favored, most of the trees "were used in accordance with their abundance" (p. 373). The Doves benefited from Robins as nesting neighbors because of the latter's aggressiveness toward enemies, but suffered from over-abundance of English Sparrows, which "usurped the available nest sites," especially on the farms. The chief known causes of nesting losses were unfavorable weather, Blue Jays, fox squirrels, and cats. The percentage of eggs (we are not given the actual numbers) to produce successful young (young that reached the age of 14 days) was 54, 44, and 38, respectively, for the 3 years, averaging 45 per cent, a figure which corresponds to the success of passerines in open nests. The average number of young raised per nest was 1.82; the average percentage of nestings that succeeded was 48. The bulletin includes information on the growth of the young, on food, parasites, and migration, as well as suggestions for management—planting of trees, provision of water, control of *Passer domesticus*.

The bulletin has proved difficult to read, partly because of its condensed form and the author's failure to explain various techniques and tables, and partly because nowhere is there a tabulation of the number of all the nestings, eggs laid, hatchings, and young fledged each year for town and country, with percentages of success and failure. Tables 35 and 36 are impossible to understand without recourse to the author's paper in *The Auk* (59, 1942:64-75), in which actual figures for nestings are given for 1938 and 1939, but this essential article is not, strangely enough, cited in the bibliography of the bulletin.

It is unfortunate that the author did not thoroughly acquaint himself with the published material on the life history of his subject before starting on his project. It is certainly hard to believe that some eggs hatched in 11 days and others in 20 (p. 382); the known co-ordination between hatching of squabs and the appearance of pigeon milk in the parental crops would certainly preclude such a spread. He makes the surprising statement that "usually 24 hours elapsed between eggs, but sometimes they were laid 12 hours apart" (p. 381, italics mine). In my article on the nesting of this species in Oklahoma, published in 1922 and 1923 (*Auk*, 39:457-474; 40:37-58), I cite Charles O. Whitman (Behavior of Pigeons, III. *Carnegie Inst. Wash. Publ.* No. 257, 1919), who stated that with the Mourning Dove the first egg is laid in the late afternoon of one day and the second on the morning of the second day after. This was the case with my captive bird that laid 15 eggs (*Condor*, 33, 1931:148-150). McClure's statements as to the intervals of egg laying could not have been based on wild birds since he did not visit nests twice a day. If his captive Doves laid at such amazingly short intervals, he should have marshalled his evidence and published this contradictory experience as such, not as normal behavior.

As to instances of three eggs in a nest, McClure gives the wrong interpretation (p. 391); the extra egg comes from another bird, or the nest owner lays an egg from her next clutch—six days after the second egg of the first set.

A calculation (p. 409) of the speed of migration is based on the assumption

that a bird started when 19 days old. Although the author's captive birds weaned their young at 16 days, it does not follow that wild young are cast adrift so early. I have seen well grown young, apparently about a month old, still fed by their parents, and McClure himself reports (p. 389) that the "growth of flight and tail feathers continued until the young were over a month old." It does not seem probable that young start migration before the age of 4 weeks.

When the author deals with the success of nests, he is on sure ground. But as soon as he talks about the *number of pairs* involved, at once an unknown enters. It is very difficult to estimate the number of pairs in a crowded population of this species; yet the accuracy of such estimates is of fundamental importance in the matter of the number of broods attempted and calculations of "production," both in the study area and in the county. In the bulletin, the technique used for estimating is not described. In the 1942 paper we read (p. 65): "The greatest number of nests existing in one day during the summer was taken as indicating approximately the number of nesting pairs for the area." On page 74 we are told: "Censusing by this method . . . at best can only be a somewhat closer estimate than a guess." And the reader must take care not to accept the "estimates" or "guesses," presented in the tables and summaries in the bulletin, as proved facts.

McClure considers that the Mourning Dove population in Iowa triples each year (p. 361). His technique for estimating populations (by counting active nests and using ratios derived in the 1942 paper mentioned above) is illustrated on pages 410-412 of the bulletin. He gets astonishingly high figures: if 20 active nests are found on 20 acres in June "after 5 days of mild weather," $6.6 \times 20 = 132$, the total nesting attempts (6.6, from Table 35, being the observed ratio of daily active nests in June to the season's yield); $50\% \times 132 = 66$, the successful nestings expected; $66 \times 1.82 = 120.12$, the total young production (1.82 being the average number of young raised per nest); $1.1 \times 20 = 22$ breeding pairs (1.1, from Table 36, being the supposed ratio of active pairs seen nesting in June to the total breeding stock); allowing a 10% variation, and correcting for loss (3 to 10 per cent), "the total number of birds expected by the end of the season is 133-175 from 20 acres." In other words, the original 44 birds have *trebled* at the least, *quadrupled* at the most.

In Table 22 of the bulletin, however, estimates of the population on the 220 acres gave seasonal averages of 5.4, 5.1, and 4.6 nesting attempts; these calculations credit them with 6 (132 attempts for 22 pairs). Further analysis of Table 22 shows the average number of breeding pairs to be not 290 (as given in the 1942 paper), but 340, which divided by 260 (the average number of active nests per day in the observation area), gives 1.3 instead of the 1.1 used in his illustration. This revised factor gives 26 pairs to 20 nests, so that the "total number of birds expected by the end of the season" would be only 2.7 to 3.5 times the original population, while the nesting attempts would average 5. That the area (220 acres) on which Table 22 was based is the same as the area covered in the 1942 paper, was confirmed for me by the author. As shown in Table 22, he revised his opinions as to the number of pairs involved, but republished the tables of ratios (Tables 7 and 8, 1942, become Tables 35 and 36, 1943) without revision, and moreover he uses the unrevised ratios to illustrate his method. But even with the above corrections, I still believe the author's figures for the number of nesting attempts and for population increase are too high; I believe he underestimated the number of pairs in town, as well as underestimating the percentage loss of juveniles and adults.

The overestimate of population increase not only weakens the paper and shakes the reader's confidence in the rest of the results—it plays directly into the hands of the hunters, and this in the case of a bird gravely endangered over a large part of its range. The author has done a great deal of hard and faithful labor in connection with this study, and he has obtained worthwhile data. They would have been far more valuable if he had studied the pertinent literature and acquainted

himself with the biology of the species chosen, and also if he had used more care in his calculations.—Margaret M. Nice.

THE BIOTIC PROVINCES OF NORTH AMERICA. By Lee R. Dice, University of Michigan Press, Ann Arbor, Michigan, 1943: 6¾ × 10 in., viii + 78 pp., 1 map. \$1.75.

Science is a process of discovering and sorting facts and drawing generalizations from them. New ways of classifying data are always welcome since they may bring to light new scientific principles. Students have proposed various systems for sorting information on the distribution of plant and animal organisms in North America, but only two receive major attention at the present time: the life-zone and the biome systems. In this new book, Dice outlines another scheme of classification, his major units being "biotic provinces," which are subdivided into "biotic districts," "life-belts," and "ecologic associations." A folding map shows the boundaries of the biotic provinces of North America. The book discusses each biotic province in respect to its name, synonyms, boundaries, topography, climate, soil, vegetation, general characteristics of its mammals and birds, and its subdivisions, (though the subdivisions are not worked out completely). Whether or not this system is worthwhile would seem to depend on its being more applicable to the facts than the life-zone and the biome concepts or on its being based on a philosophy so different that new principles are brought to light.

Life-zones are based on the distribution of taxonomic units, chiefly genera and species of animals; biomes on climax plant and animal communities; a biotic province is a "considerable and continuous geographic area . . . characterized by the occurrence of one or more important ecologic associations that differ, at least in proportional area covered, from the associations of adjacent provinces. In general . . . characterized also by peculiarities of vegetation type, ecological climax, flora, fauna, climate, physiography, and soil" (p. 3). Actually, however, Dice here bases his classification of biotic provinces "to a very large extent on the vegetation" and there are no long lists given of indicator species of animals, since "available descriptions of the associations of North America are wholly inadequate." In fact, "the limits of geographic range of species and races of plants and animals are not fully satisfactory criteria for determining the boundaries of biotic provinces and districts" (pp. 5-6).

In order that the provinces may fulfill Dice's primary requirement of being "continuous geographic areas" without the interspersions or overlapping of communities usually found in distribution maps of large biota, they are made to include groupings of plants and animals of great diversity. For example, instead of the Carolinian province extending westward into the prairie as tongues of deciduous forest along the rivers, the Illinoian province is made to include both types of vegetation, prairie and oak-hickory forest. Then again, in the mountains a single province may include a whole series of life-belts, for example, the Navahonian province, which includes alpine meadow, subalpine forest, montane forest, chaparral, pinyon-juniper woodland, and arid grassland. On the other hand, some associations usually considered as single units by other ecologists, for example, the mixed prairie, are here divided into as many as four biotic provinces. Although both are professedly based largely on the character of the vegetation, the boundaries of the biotic provinces and those of the biomes or their subdivisions, rarely coincide.

Biotic provinces as a classification are an improvement over life-zones in that the trans-continental belts of the latter are broken up south of the coniferous forests of Canada. Although the Canadian, Carolinian, and Austroriparian provinces show some correlation with the Alleghanian, Carolinian, and Austroriparian faunal areas in the eastern part of the country, there is no such correlation between provinces and the major faunal areas in the west. In mountainous areas, division by life-zones shows the effect of altitude on distribution better than divi-

sion by provinces does, since "life-belts" (more or less comparable with life-zones) are relegated to minor subdivisions of the provinces.

Names assigned to the biotic provinces are taken largely from the literature, mostly but not entirely upon a priority basis. These names go back for their origin to C. Pickering 1830, R. B. Hinds 1843, J. G. Cooper 1859, J. A. Allen 1871, E. D. Cope 1873, E. W. Nelson 1887, while a few are new. For the most part the names are geographical, which is a weakness.

The reviewer believes that while the concept of biotic provinces shows some improvement over life-zones (except when applied to mountainous areas) it is not so flexible nor so usable, nor is it based on such fundamental principles as the biome concept. Furthermore, the criteria used in determining the boundaries of the provinces are often vague, and the nomenclature is cumbersome. Probably no system will come into general and accepted use unless the delimitation of its units and its nomenclature are immediately obvious in the field because based on conspicuous features of the biota.—S. Charles Kendigh.

THE WILD TURKEY IN VIRGINIA: ITS STATUS, LIFE HISTORY AND MANAGEMENT. By Henry S. Mosby and Charles O. Handley. Virginia Commission of Game and Inland Fisheries, Richmond, Va., 1943: 6 × 9 in., xx + 281 pp., 2 col. pls., 67 figs. \$1.00.

This reviewer begins with a distinct bias in favor of the Wild Turkey, and would, had he been contemporary, almost certainly have been in full agreement with Benjamin Franklin's desire to make the Wild Turkey our national bird. It is a real pleasure, therefore, to welcome the first comprehensive monograph which has dealt with all phases of the bird's history, life history, and management. The book is a competent and workmanlike job, and will undoubtedly benefit the object of its study.

Although it deals primarily with the Wild Turkey in Virginia, the volume will have a very much wider application and usefulness. The Turkey ranges throughout Virginia, which is a remarkable epitome of all of eastern United States, since it includes conditions that approach the sub-tropical at the Virginia Capes, has a wide segment of the piedmont, an excellent sample of the ridge and valley province, and, on the Allegheny Plateau, remnants of spruce forest which are near-Canadian. We are given information about the distribution of the bird under this wide variety of conditions.

It is good news that Virginia, despite the age of its settlements, had in 1938, 2,020 flocks of Wild Turkeys, made up of 22,575 individuals. The larger number of the state's counties still have a Turkey population, the heaviest concentrations being on the east slopes of the Blue Ridge. The relationship between extensive forest areas and Turkey populations is clearly brought out; where there are not large forests the birds have not persisted.

The authors have had unusual success in artificial propagation of Wild Turkeys, and they have evolved a number of techniques which are being widely adopted by commercial game raisers. Their discussion of management is, therefore, particularly valuable. The statement, "It has been demonstrated that the Wild Turkey responds to management to a marked degree," is elaborated with suggestions for food plantings, predator and disease control, emergency feeding, refuges, and such matters. The authors are on sound ecological ground when they discuss the management of forests for the Wild Turkey. The book includes a suggested policy and program for Wild Turkey management in Virginia which will be of great value to game commissions of other states.

It is through such monographs as this that game management demonstrates its validity as a field of scientific endeavor. Sound ornithology is supplemented by economic evaluation of an animal in relation to man. Both pure and applied science benefit from this happy combination.—Maurice Brooks.

THE BIRDS OF BRITAIN. By James Fisher. William Collins Sons and Co., London, 1942: 6¼ × 8¾ in., 48 pp., 16 pls. (12 colored) and 22 figs. 4s. 6d.

James Fisher again shows his unusual ability as an ornithological writer by producing under this well-worn title an original and stimulating little book.

He makes no attempt to provide assistance in the identification of British birds, but wisely confines himself to presenting attractively and compactly an expert's summary of Britain's avifauna, past and present, its peculiar features, the observers (beginning with Matthew Paris in 1251), and finally, an indication of modern trends and probable future developments of bird study in Britain.

The book is illustrated with 38 rather good reproductions (nearly a third of them in color) of bird portraits by some 20 artists, ranging from Daniel King (c. 1652) to A. W. Seaby (1930). The pictures have been ingeniously chosen to both illustrate the text and give a very good insight into the development of bird illustration in Britain.

Any ecologist in this country will read the book with particular interest and will wonder whether our continent too is bound for such drastic and complete alteration of the original landscape as Britain has undergone.

This attractive book will provide Americans who are going to England in such numbers these days with the perspective so invaluable to any bird student when encountering a new avifauna.—J. Van Tyne.

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THE WILSON ORNITHOLOGICAL CLUB LIBRARY

The proposal that the Wilson Ornithological Club establish a library was first made by Frank C. Pellett of Hamilton, Illinois, and was brought before the annual meeting of the Club in Ann Arbor in 1928. A committee consisting of T. C. Stephens, Frank C. Pellett and Myron H. Swenk was appointed to consider the matter, and after two years of study and negotiations an agreement was signed by officers of the Wilson Club and the University of Michigan, establishing the Library in the University Museum of Zoology (*Wilson Bulletin*, 43, 1931:77-78). In a report of the Committee made in March, 1931, a request was made for gifts of reprints, periodicals, books, or entire libraries dealing with ornithology and related subjects; according to the agreement these were to be catalogued, filed, and kept as a unit among the book collections in the Museum. The library was to be open to the staff of the Museum of Zoology and to members of the Wilson Club in Ann Arbor; transportation costs one way were to be paid by the Museum on items borrowed by other members.

The growth of the library has been steady; from a mere yard of books on a shelf, the books and reprints have come to occupy twenty-eight feet of shelf space, and the periodicals about thirty-five feet. Books, reprints, and serials have been contributed; and fifty-five periodicals are currently received as gifts and in exchange for *The Wilson Bulletin*. A catalogue of about two thousand cards covers the main items, and a book plate, designed by George Miksch Sutton, marks each bound volume.

According to agreement, a catalogue (or list) of the items in the Library was to be prepared by the Museum and published by the Wilson Club for the information of the members. Since the manner of listing was a little uncertain, I volunteered to prepare a preliminary list for publication in the *Bulletin*. A complete list of all items, including reprints, would require about forty pages of fine print. Whether this will be prepared later by the Museum and published separately, or in the *Bulletin*, will depend on the wishes of the members, their response to this preliminary list, and the availability of the required funds. To make such a catalogue would require considerable work, and should not be undertaken until normal times, when ample help can be secured. I hope that the present list will be helpful to members in using the library. Members are invited to send inquiries about particular reprints desired, later accessions, or other details. All communications should be addressed to "The Wilson Club Library, Museum of Zoology, Ann Arbor, Michigan."

I hope that contributions to the Library will continue as they have in the past, and I shall be glad to have suggestions from members of the Club concerning the improvement of the Library and its facilities.

LIBRARY COMMITTEE,
Harry W. Hann, *Chairman*

The following gifts have been received recently:

R. M. Barnes: 725 periodicals
Frances Hamerstrom: 37 periodicals
Harry W. Hann: 1 book
Thomas D. Hinshaw: 1 book
Verna R. Johnston: 10 reprints
George A. Petrides: 2 pamphlets
Alma H. Prucha: 34 periodicals
A. W. Schorger: 1 reprint
O. A. Stevens: 3 reprints

WILSON ORNITHOLOGICAL CLUB



George A. Miller, Silliman

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WILDLIFE CONSERVATION

War and Waterfowl

Duck hunting is natural; it is part of our way of life. There is no explaining it, and few hunters could put in words their reasons for wishing to hunt this fall. No explanation is necessary; anyone who has felt a north wind clipping over his left shoulder in a certain hide on a certain marsh understands. But a few duck hunters have become a bit panicky over the prospects of hunting during this year of war. Here are some of the arguments they have given to justify an open season and the use of shells this coming autumn:

1. Duck meat can replace domestic meat in the present meat shortage.
2. Unless we "harvest the crop" there will be an over-population of waterfowl which will:
 - (a) exhaust the natural food supply and ruin the range, as over-populations of deer and cattle do;
 - (b) become a serious threat to cultivated crops;
 - (c) provide an opportunity for the illegal "market hunter" to reestablish himself.
3. Duck hunting would provide a necessary relief for war-torn nerves.

I have no right, of course, to speak of conditions beyond my own bailiwick; my horizon like that of most of us is limited. But my horizon happens to be limited by duck marsh. As far as I can see from my front porch stretches one of the finest waterfowl breeding marshes in the land. I, and the other members of this small marsh-side community, feel a bit closer to ducks, perhaps, than the average sportsman. Ducks are part of our lives, not just for a few days in autumn, but through much of the year. A failure to understand the fascination of ducks and duck hunting does not, therefore, lie at the root of what I have to say for myself and this community in answer to the arguments outlined above.

Wild duck as meat.—I agree that some forms of game should find a place in our war economy, but I do not agree that ducks should be placed on a plane with, for example, deer on an over-populated range. One sporting editor remarks that since duck hunters bag "one duck for every four shells fired, it becomes obvious that they are alleviating the meat shortage at the average cost of about eight cents a pound." Hunters who can bag duck meat for eight cents a pound are few and far between. Dressed for the table, a two pound duck (a good average for mixed bags) weighs one and one-quarter pounds, and provides about a pound of meat (including skin and fat). Shooting dollar-a-box shells, 40 to the bag of ten ducks, the cost of duck meat is sixteen cents a pound in shells alone. But few hunters can shoot ducks on the cost of shells; most must travel a distance to their duck marsh, and the cost in gas, and wear on car and tires is just as much a part of the price of duck meat as brass and powder. Even in this fine duck hunting region duck meat costs the hunter from twenty-five cents to a dollar a pound. Add a guide, club fees, or a rented canoe, as many gunners do, and the cost per pound mounts. Most hunters will admit that duck meat is luxury fare. Whatever the cost per pound may be in dollars and cents (which are plentiful these days) the real cost of wild duck meat is in gas, brass, powder and rubber—all vital war necessities.

The supposed threat of overpopulation.—First, it is true that there has been a general build-up in waterfowl numbers these last few years. To say, however, that failure now to reap the harvest of these gains means destruction of the natural food supply and range is to admit that our restoration program is sadly off balance. Here on the breeding grounds we are still restoring wasted marshlands; we are developing new management techniques; we are controlling the spring fires so disastrous to nesting waterfowl; we are shooting crows wherever

their spring nesting concentrations prove a heavy drain on waterfowl. Have we gone too far in this? Have we already produced more ducks than the country can maintain? The answer is, of course, no. One hears of three-fold and four-fold increases in waterfowl numbers. Increase over what? Isn't it increase over the lowest figure in North American waterfowl history? Populations are still far short of the numbers that poured down the flyways in a not so distant past, even short of the goal set at the beginning of the present restoration program. Among the members of this small marsh community, and they include many duck hunters and guides, there is the general feeling that "this will be a good year for ducks; with the scarcity of shells and fewer hunters, this will be the year ducks can make a real come-back." We say this because we know, despite the annual reports of vast gains, that the marshes reaching from our doorsteps to the horizon are still sadly underpopulated with nesting waterfowl. There are Mallards, yes, and Pintails. But ask anyone on the breeding grounds about the Canvasback, Redhead, Lesser Scaup or Ruddy Duck. They have increased; they have been saved from extinction for the present; but their numbers are still distressingly small and their future uncertain. This prairie marsh, many like it, and still others to be restored could maintain far more breeding ducks than now return each spring from the wintering grounds.

Mallards, Pintails, Black Ducks, and other species in some localities will feed upon cultivated crops this autumn and winter. Even during the years of the "duck depression," damage to grain fields in some localities was a problem. Such farm feeding is not evidence of depleted natural food supplies. In this region, Mallards and Pintails annually feed on stubble fields, despite the fact that their loafing waters provide a plentiful stand of wild duck food. Now, as in the past, this is purely a local problem; it will not be relieved by placing control in the hands of gunners. Crop damage is most serious in a delayed harvest. This year the harvest in some regions will be delayed because of shortage of man-power. If duck hunters truly have the welfare of ducks and crops in mind, they will give their spare time to help with the harvest in regions where there is a combination of man shortage and farm-feeding waterfowl.

I doubt that any force can again bring wild ducks to the market table. There has always been, even during the scarcity of ducks, an underground traffic in wild duck, but the stringent laws and the strong public opinion against the sale of wild ducks are such that talk of the return of the market hunter seems the mere shout of the propagandist, not a valid threat.

Recreational value of duck hunting.—Most of us agree that duck hunting is one of the finest "escapes from the toils of life." But it is doubtful whether the recreational value of duck hunting in war time is worth the cost in time and in essential war materials. Duck hunting as recreation this autumn is a matter for the individual and his conscience. However few or many shells he may be allowed, it is for him to decide how many shells he will use, and how much time he can spare from the task at hand.

* * * *

This last decade has seen a remarkable cycle of events. The danger of the extermination of many duck species was recognized nine or ten years ago. A tremendous effort was then begun in the United States and Canada to restore the dwindling populations, and ducks have since shown encouraging gains. As part of the restoration program, stringent restrictions were placed upon seasons, number taken, and methods of hunting. Some of these have recently been relaxed. There is now pressure for further relaxation—for longer seasons, bigger bags, for the return of live decoys and baiting, and for the opening of refuges to shooting. Such demands are a natural accompaniment to the up-swing in waterfowl numbers. But these demands are coming while we are at war, and I doubt whether there

are hunters and shells enough to constitute any serious present threat to waterfowl. The real threat is not in the number of ducks which might be shot this autumn but from war-time changes in policy which might seriously affect ducks in a post-war world.

As this issue of the *Wilson Bulletin* appears, the regulations for the new season are on paper. We have confidence in those who plan them. We are content to count officialdom among our members, as indeed it is; yet if we as ornithologists fail to put forward sound, democratic opposition to the sportsman pressure groups, we are no less responsible for imprudent changes in policy than the groups which forced them through. It is our responsibility, individually and collectively, to keep informed on the waterfowl situation just as we keep up to-date on developments in nomenclature or life history study. And it is our obligation through the remaining years of war and after the war to take an active part in the planning and maintaining of sound waterfowl policy.—Albert Hochbaum.

WILDLIFE CONSERVATION COMMITTEE

Frederick N. Hamerstrom, Jr., *Chairman*

REPORT OF THE AUDITING COMMITTEE

The Auditing Committee has checked the accounts of Gustav Swanson, Treasurer of the Wilson Club for 1942, and the financial report published in *The Wilson Bulletin* for March, 1943, and hereby expresses its approval of the state of these accounts.

Respectfully submitted,

CHARLES F. WALKER

THOMAS H. LANGLOIS

August 12, 1943

AFFILIATED SOCIETIES

We are glad to report that the Wisconsin Society for Ornithology has recently voted to affiliate with us, and we hope to have an account of their organization in a later issue.

An increasing demand for news of the affiliated societies has come from the Wilson Club membership. Suggestions and data should be sent to Dr. Gordon M. Meade of Rochester, New York, Chairman of the Committee on Affiliated Societies. We present below brief accounts of the history and aims of the Virginia Ornithological Society and the Inland Bird Banding Association.

THE VIRGINIA SOCIETY OF ORNITHOLOGY was founded in December, 1929. Because of transportation difficulties the annual meeting was not held in 1942, and it is doubtful, for the same reason, whether it can be held this year. Activities therefore, have centered around the publication of the mimeographed bulletin *The Raven*, and the Society has such an enthusiastic group of members that the cancellation of the annual meeting has had no serious effects. Local groups in such cities as Norfolk, Richmond, and Roanoke continue to get together for meetings and for field trips.

The officers of the Society are: President, A. O. English, Roanoke; Vice-president, William B. McIlwaine Jr., Petersburg; Secretary, Dr. Florence S. Hague, Sweet Briar; Treasurer, T. L. Engleby, Roanoke.

In spite of the fact that bird observation in Virginia goes back through three centuries, only certain small areas of the state have been thoroughly worked. There is a great deal still to be learned about distribution in Virginia—even of some of the more common birds—and the chief task which the Society of Ornithology has set itself is the gathering of data on which an accurate and comprehensive publication on the birds of Virginia can be based.—Florence S. Hague, Secretary.

THE INLAND BIRD BANDING ASSOCIATION held a meeting in conjunction with the Wm. I. Lyon Bird-banding Council at the Chicago Academy of Sciences on March 20, 1943. A full day and evening program on bird banding and other bird studies was given. The following officers were elected: president, C. C. Ludwig, Lansing, Michigan; vice-president and treasurer, M. J. Magee, Sault Ste Marie, Michigan; vice-president, Philip A. DuMont, Evanston, Illinois; vice-president, Paul A. Downing, Highland Park, Illinois; secretary, O. A. Stevens, Fargo, North Dakota.

A history of the Inland Association was published in the *Wilson Bulletin* for September, 1940. A news letter, *Inland Bird Banding News*, issued quarterly since 1929, was last year changed to a bi-monthly. Arrangements have been made with the Eastern Bird-banding Association whereby members of each association receive the news letters of both organizations. One feature of the *Inland News* during the past two years has been a series of summaries of the progress of banding in the various states of the Inland region.—O. A. Stevens, Secretary.

NEW LIFE MEMBERS



MYRON T. STURGEON became interested in birds while an undergraduate at Mount Union College, Alliance, Ohio. He majored in geology and paleontology, receiving the Ph.D. from Ohio State University in 1936. He is at present assistant professor of geology at Michigan State Normal College, Ypsilanti, where he gives courses in ornithology as well as in geology and general zoology. During the summers he assists with the class in Game Ornithology given by the Michigan Department of Conservation Training School at Higgins Lake, and serves as assistant geologist for the Geological Survey of Ohio.



GEORGE MIKSCH SUTTON graduated from Bethany College and received the Ph.D. from Cornell University. He was Assistant Curator of Birds at Carnegie Museum 1919-1924, and State Ornithologist of Pennsylvania 1925-1929. He has been a very active field man and has published many papers on the life histories, plumage, and taxonomy of birds, based on the data gathered during his expeditions to widely separated localities from northern Hudson Bay to southern Mexico. He is, of course, not only an ornithologist, but an outstanding painter of bird pictures. He has been Curator of Birds at Cornell since 1932 and is now on leave of absence serving as Captain in the U. S. Army Air Corps.

TO OUR CONTRIBUTORS

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

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

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

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No. 4

The Wilson Bulletin



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THE WILSON ORNITHOLOGICAL CLUB

Founded December 3, 1888. Named after Alexander Wilson, the first American ornithologist.

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President—S. Charles Kendeigh, University of Illinois, Champaign, Illinois.

First Vice-President—Olin Sewall Pettingill, Jr., Carleton College, Northfield, Minnesota.

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Associate Editors—Margaret M. Nice and F. N. Hamerstrom, Jr.

Assistant Editor—G. Reeves Butchart.

Membership dues per calendar year are: sustaining membership, \$5.00; active membership, \$3.00; associate membership, \$2.00.



Prince Albert, Sask., April 1, 1940

Photographed by Fred G. Bard

CANADA JAY

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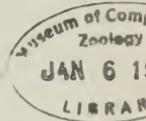
DECEMBER, 1943

No. 4

RELATIONSHIPS OF THE CANADA JAYS IN THE NORTHWEST

BY JOHN W. ALDRICH

13,814



THE separation of the North American jays of the genus *Perisoreus*¹ into two distinct species seems to be accepted by most ornithologists. The A. O. U. Committee on Nomenclature has retained the listing of two species through the latest edition of the Check-list (1931:220-221), although other authors, including Howe (1902:105), had apparently with good reason, accepted a conspecific status for these birds. Hellmayr (1934:66-70) also treats the forms as conspecific; Miller (1943:117) argues in favor of two separate species.

There seems to be no evidence that in habits, call notes, or habitat, there is any significant difference distinguishing one population from any other. Furthermore, in size (see Table 1) and in coloration the populations seem to intergrade geographically in a manner typical of racial variation. Apparently the two characters that have been assumed to be specific, separating the *obscurus* from the *canadensis* group, are the immaculate underparts and the white shaft streaks of the dorsal plumage in *obscurus* (Ridgway, 1904:365). I have found, however, that specimens from central northern Washington in the Biological Surveys Collections² demonstrate a continuous intergradation of these characters, and a total of 42 specimens from central northern Washington and central southern British Columbia not only completely bridge the gap between the *obscurus* and *canadensis* complexes, but also represent an undescribed race, easily separable from all others, which I propose to call:

Perisoreus canadensis connexus, new subspecies

COLUMBIAN JAY

TYPE.—Adult ♀, No. 271630, U. S. National Museum (Biological Surveys Collection); Bald Mountain, northwestern Okanogan County, Washington, altitude 6,800 feet; September 6, 1920; George G. Cantwell; original number 1062.

¹ For use of the generic name *Perisoreus* in place of *Cractes* (Billberg, 1828:14),

SUBSPECIFIC CHARACTERS.—In adult plumage, similar to *Perisoreus canadensis fumifrons*, but larger of wing, and slightly darker above, with white areas of head more extensive and less clouded with smoky brownish, entire underparts more whitish; like the neighboring *Perisoreus canadensis bicolor*, but darker above and more whitish below, with white areas of head more restricted, and dorsal white shaft streaking more pronounced; approaching *Perisoreus canadensis griseus*, but slightly larger, with more grayish dorsal coloration, and white shaft streaks reduced, white areas of head more extensive, and underparts more suffused with brownish gray; different from *Perisoreus canadensis albescens* chiefly in the darker dorsal coloration; like *Perisoreus canadensis pacificus*, of central western British Columbia, but paler above and below, with white areas of head more extensive, and more pronounced dorsal white shaft streaking.

In juvenal plumage *connexus* differs from *fumifrons* in being lighter throughout; from *bicolor*, it is distinguishable chiefly by the color of the head, which in *bicolor* exhibits considerable whitish on the occiput, and in *connexus* is entirely gray; it is somewhat lighter above than *griseus*, particularly with respect to head color; it is darker, especially on the head, than *albescens*. I have seen no juvenile specimens of *pacificus*.

MEASUREMENTS.—Adult male (15 specimens from Okanogan County, Washington): wing, 142.0-151.5 (146.7) mm.; tail, 136.0-152.0 (143.4); total culmen, 23.0-25.5 (24.4); tarsus, 34.0-37.8 (35.9); middle toe without claw, 16.0-18.5 (17.8). Adult female (10 specimens from Okanogan County, Washington): wing, 140.0-149.0 (144.4); tail, 135.0-152.0 (140.8); total culmen, 23.0-25.5 (24.5); tarsus, 34.0-36.5 (35.3); middle toe without claw, 15.5-18.0 (17.2).

RANGE.—Resident in the Lodgepole Pine-Engelmann Spruce Association, Canadian Life Zone, in the mountains of central northern Washington, central southern, central, and central eastern British Columbia, and central western Alberta.

DISCUSSION.—Specimens from Glacier, Whatcom County, Washington, are somewhat intermediate, having slightly more dusky

used by Ridgway (1904:750) and by Hartert and Steinbacher (1932:22), I am guided by the opinion of the A. O. U. Committee on Nomenclature (1908:394).

² The 12 critical specimens in this collection were taken by Walter P. Taylor and George G. Cantwell, in their "Boundary Expedition" across northern Washington in the summer and early autumn of 1920.

For the loan of additional specimens I am indebted to: Josselyn Van Tyne, of the Museum of Zoology, University of Michigan, for an excellent series of birds collected by Leonard Wing in the summer of 1940 at Conconully, in Okanogan County, Washington; Stanley G. Jewett, who kindly sent me specimens which he took in northern Washington; Major Allan Brooks, who lent important specimens from British Columbia; and Alden H. Miller, of the Museum of Vertebrate Zoology, University of California, for topotypes of *P. c. pacificus*.

TABLE 1
MEASUREMENTS (IN MM.) OF PERISOREUS

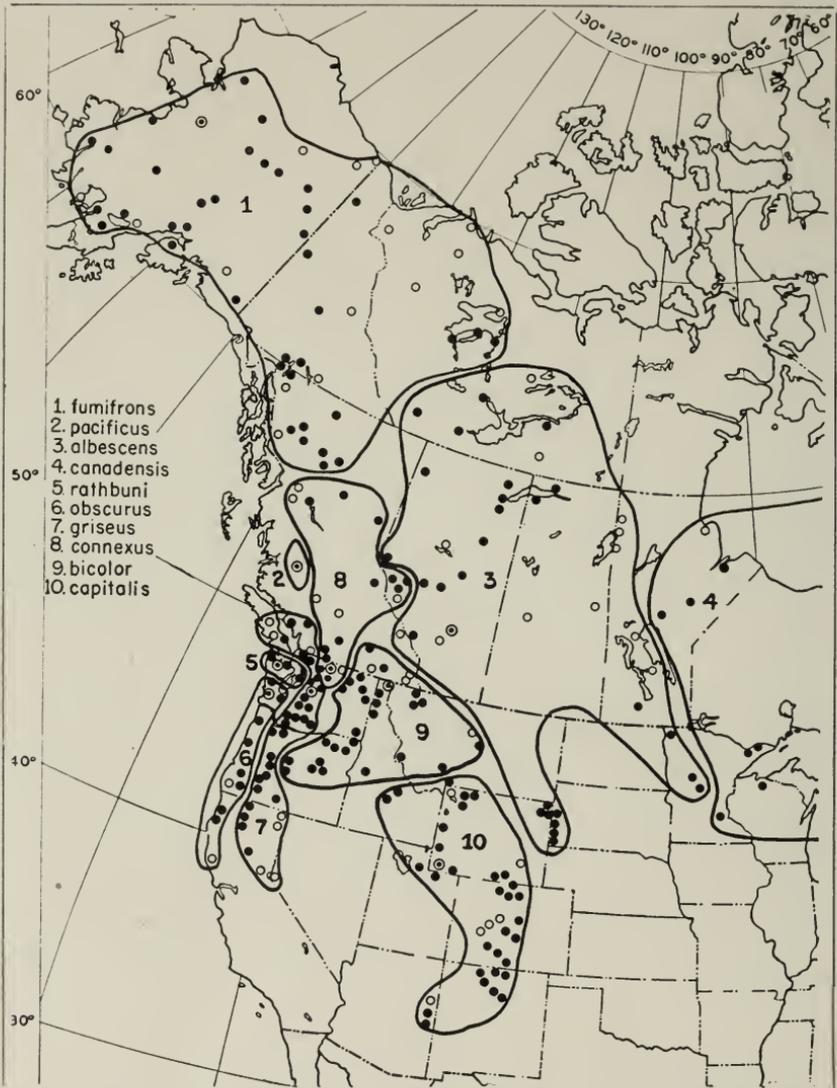
Subspecies	Wing	Tail	Total Culmen	Tarsus	Middle toe without claw
♂					
<i>obscurus</i> (5)	142.5-147.0 (144.9)	138.5-143.0 (141.4)	23.5-25.5 (24.4)	34.5-36.0 (35.3)	17.0-17.8 (17.4)
<i>griseus</i> (31)	137.5-149.5 (143.0)	130.0-142.5 (136.7)	22.0-25.5 (23.7)	33.0-37.5 (35.3)	16.0-18.0 (16.9)
<i>connexus</i> (15)	142.0-151.5 (146.7)	136.0-152.0 (143.4)	23.0-25.5 (24.4)	34.0-37.8 (35.9)	16.0-18.5 (17.8)
<i>rathbuni</i> (6)	136.0-143.0 (139.9)	129.0-134.0 (131.3)	22.8-25.0 (23.7)	33.5-37.0 (35.4)	16.5-17.5 (17.0)
<i>albescens</i> (14)	143.0-148.5 (145.6)	141.5-148.0 (144.0)	22.0-27.0 (24.8)	35.5-38.0 (36.7)	16.0-18.0 (17.0)
<i>bicolor</i> (22)	138.5-157.0 (146.5)	137.0-152.0 (143.6)	23.0-27.5 (25.1)	35.0-38.5 (37.0)	16.0-18.5 (17.1)
<i>fumifrons</i> (40)	138.5-148.0 (142.4)	138.0-149.5 (144.5)	23.5-27.5 (25.6)	34.0-40.0 (37.1)	15.5-18.5 (16.9)
<i>capitalis</i> (18)	146.5-159.5 (152.1)	137.0-153.0 (144.0)	25.5-27.5 (26.2)	36.0-37.5 (36.8)	16.0-18.5 (17.6)
♀					
<i>obscurus</i> (12)	132.5-139.5 (136.6)	126.5-136.5 (130.8)	22.0-25.0 (23.2)	33.0-36.0 (34.5)	15.5-17.5 (16.7)
<i>griseus</i> (24)	135.0-143.5 (140.0)	130.0-140.5 (135.0)	22.0-25.0 (23.5)	33.0-36.0 (34.4)	15.0-18.0 (16.0)
<i>connexus</i> (10)	140.0-149.0 (144.4)	135.0-152.0 (140.8)	23.0-25.5 (24.5)	34.0-36.5 (35.3)	15.5-18.0 (17.2)
<i>rathbuni</i> (6)	133.0-140.0 (136.4)	128.5-131.0 (129.8)	22.5-24.5 (23.5)	34.5-35.0 (34.8)	15.5-17.5 (16.5)
<i>albescens</i> (15)	137.0-143.0 (140.5)	133.0-145.0 (138.3)	23.0-27.0 (24.6)	34.5-37.0 (35.7)	14.5-17.5 (16.1)
<i>bicolor</i> (25)	140.0-149.0 (143.9)	136.0-150.0 (142.1)	22.8-25.5 (24.3)	34.5-38.5 (36.2)	15.5-18.0 (16.4)
<i>fumifrons</i> (39)	132.0-142.0 (136.9)	132.5-145.5 (138.9)	23.0-27.0 (24.5)	33.5-37.5 (35.7)	15.0-18.0 (16.3)
<i>capitalis</i> (12)	143.0-157.0 (149.5)	137.0-148.0 (142.0)	25.0-27.5 (26.6)	35.0-38.0 (36.9)	16.0-19.0 (17.0)

Figures in parentheses under the subspecies name indicate the number of specimens measured.

wash below, and white shaft streaks less pronounced than typical *griseus*. However, in these characters, as well as in the reduction in amount of white on the head, they are closer to *griseus* than to *connexus*.

(The distribution of the various races in Western North America is shown on Map 1. The distribution of the eastern races seems to have been adequately worked out by Austin, 1932:157.)

P. c. bicolor (Miller, 1933:289) extends into northeastern Washington and southeastern British Columbia, from northern Idaho; and specimens referable to that race have been taken as far west as eastern Okanogan County (Tunk Mountain), Washington, and Okanogan Lake,



Map 1. Distribution of western races of *Perisoreus canadensis*. Solid dots indicate localities of one or more specimens examined in the present study; circles represent other records of occurrence; and dots enclosed by circles are type localities.

British Columbia, where this race evidently intergrades rather abruptly with *connexus*. Southwestward in the Cascades the transition from *connexus* to *griseus* apparently also is rather abrupt. The type specimen of *griseus* came from Keechelus Lake in Kittitas County, Washington, and birds from Mount Stewart seem to be perfectly typical of that

race. A single specimen from the head of Big Creek near Lake Chelan is as dusky below as *connexus*, but with respect to dorsal and head coloration is perfectly typical of *griseus*, and probably on the whole is closer to that race, as is also a juvenile specimen from Lucerne on Lake Chelan. The surprising thing is, as Miller (1943:117) has pointed out, that there is not complete intergradation between *griseus* and *bicolor* in Oregon, though their ranges approach one another there rather closely. It is worthy of note, however, that specimens from the Maury Mountains and Howard in central Oregon, although definitely referable to *bicolor*, are lighter on the underparts than typical birds of that race and suggest a partial intergradation with *griseus* at that point. The amazing plasticity of this species in the northwestern United States is indicated by the occurrence of no less than five races in the state of Washington. The type localities of four of these are within the state.

Specimens from the Canadian Rockies in British Columbia and western Alberta are perplexing in that they are geographically situated within a circle formed by the five races—*fumifrons*, *albescens*, *bicolor*, *connexus*, and *pacificus*, and, therefore exhibit combined characters which have induced some investigators, including Miller (1943:118), to refer them to *canadensis*. Such a course, however, postulates a discontinuous range for *canadensis*, since present investigations show that *albescens* intervenes. Not that this in itself militates against considering them the same as *canadensis*, but the birds are not like typical *canadensis* of southeastern Canada and northeastern United States, being distinctly more grayish above and below than that race. They are much too dark to be called *albescens*, averaging even slightly darker than *fumifrons*, from which race they differ also in having a more whitish forehead. They are distinctly paler than typical *pacificus* (Miller, 1943:117) from the Rainbow Mountains of British Columbia. Although not typical of *connexus*, averaging somewhat darker below, they seem to be closer to that race than to any other, and have been so placed.

Specimens from northwestern British Columbia, as far south as Thutade Lake, seem to be referable to *fumifrons*, although Swarth (1922:229) thought specimens from Telegraph Creek differed from *fumifrons*, and referred them to *canadensis*. The area of intergradation between *fumifrons* and *connexus* is apparently broad in that region, and pronounced interdigitation of characters undoubtedly occurs. This is also the case in western Mackenzie, between *fumifrons* and *albescens*.

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FISH AND WILDLIFE SERVICE, U. S. DEPARTMENT OF THE INTERIOR,
WASHINGTON, D. C.

September 27, 1943

To the Editor of The Wilson Bulletin:

I have received so many inquiries as to when the next volume of my series of Bulletins on the Life Histories of North American Birds will appear, that I am reporting, for the benefit of the readers of The Wilson Bulletin, that no more volumes need be expected to appear until after the war. There are, however, two completed volumes in Washington, awaiting publication; and another, the 17th, is nearing completion here. These three include all the birds on the 1931 Check-list from the jays to the vireos, inclusive.

I am now starting to gather information for the 18th volume, which is to contain the wood warblers, and am appealing to my friends, who have so kindly sent me photographs and notes for the previous volumes, to send me similar material now for the warblers. I am very grateful for what help I have had in the past in this cooperative work, and would greatly appreciate further contributions.

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A. C. BENT

A STUDY OF WILD AND HAND REARED KILLDEERS

BY EMMA DAVIS

IT has long been accepted that, in common with many other shore birds, the male of the Killdeer (*Oxyechus vociferus*) takes part in incubating the eggs and perhaps in caring for the young. Audubon (1835:193) in writing of this species uses the expression, "the parents who sit alternately on the eggs," but he cites no specific observation. The statement was apparently accepted without substantiation until Pickwell (1930:501-502) reported two incubating males which he had collected in 1929. In the Finger Lakes District of New York, I have carried on an investigation of this and related problems by intensive observation of marked birds at six nests and of unmarked birds at nine other nests during three successive breeding seasons. One of these nests was that of birds reared in captivity. I am deeply indebted to A. A. Allen of Cornell University for help and guidance in my work.

WILD BIRDS

During the first season I confined myself largely to a close study of three nests. From an observation blind set up within three feet of each nest, I made daily observations as long as the nests were occupied.

Egg laying and incubation. I found the first nest April 19, when it contained only one egg. The second egg was laid April 20, the third April 22, and the fourth April 23. On May 15, while incubation was in progress, I marked one of the attending birds by spraying its breast with red color as it sat on the nest. It soon became clear that as the period neared its close the marked bird was assuming the greater proportion of the task. At 9:45 A.M. on May 20 all four eggs had hatched, giving an incubation period of about 27 days.

Exchanging places. None of the Killdeers I observed made any elaborate ceremony of changing over. When returning to resume incubation after an "off" period, the mate would usually announce its coming by a signal call in the air, a long *dee-ee-ee* with rising inflection. The sitting bird would answer with a loud *killdee killdee* and flutter its wings but remain on the nest; or it would call *pup pup pup* softly and toss dried weed stems about. The mate would always alight about 30 or 40 feet away and come on foot to the nest. Sometimes when it reached the nest the sitting bird would rise and walk away. At other times it would remain on the nest until it appeared that the mate with lowered head and breast was shoving it off. Both birds engaged in soft cluckings as they exchanged places. Often the sitting bird would run to meet the mate when it alighted, and the pair would copulate. Then the mate would go to the nest and begin incubation. At other times the sitting bird would leave the nest before the mate returned and, after running 30 or 40 feet, would fly away. The length of the attentive

periods varied from 15 to 90 minutes. The bird relieved of duty sometimes remained near, feeding within a radius of a hundred yards, or standing quietly within a few feet of the nest. Sometimes it flew off an eighth of a mile to a common feeding ground where several Killdeers were usually to be found.

Behavior on the nest. During the long periods of sitting, the Killdeers played with the nesting materials. The sitting bird would pick up dried stems of weeds and toss them about or, taking one of the small stones that rimmed the nest in its beak, it would lean over and repeatedly tap the ground with the stone. Sometimes it relaxed and slept. On hot days the incubating bird often stood over the eggs instead of sitting. The birds altered the position of the eggs at times by vigorous movements of the wings and feet. From the blind I could hear the eggs tapping against each other. Rarely the bird half rose and moved them with its beak. When the chicks began peeping in the shell the parent would cluck quietly as if in answer.

Hatching. At the nests I studied, the Killdeer chicks could be heard peeping in the shell from 18 to 48 hours before they emerged. My records show that pipping of shells occurred from 18 to 36 hours before the birds actually hatched. The period from the hatching of the first chick to the hatching of the last varied from 6 to 16 hours. The parents picked up the shell and flew away with it almost immediately after the hatching.

Care of young. On the day the eggs hatched I enclosed a space around the nest about six feet in diameter with a 12-inch fence of roofing-tin so that the young could not escape. They were confined within this area for 18 days. Fly larvae for food and water for drinking and bathing were provided.

Since Killdeers almost invariably approach the nest on foot, the fence presented a real obstacle to this pair, but they soon solved the problem by hopping to the top from the outside and down again on the inside. Here they attended their offspring, readily accepting the unnatural conditions. Near nightfall, however, on the first six days, they made frantic endeavors to lead the young away from the nest site. One parent would come into the enclosure, give the brood call, a harsh *pup pup pup*, then hop to the top of the fence and down on the outside, obviously expecting the brood to follow. It would continue this performance for an hour or more, pausing only for brief periods of brooding. There was a flat stone about two inches high within the enclosure, which the parents used for a "take off." After watching several times, the downy young began running to the same stone, flapping their diminutive wings and trying to jump over the fence at the spot where the parent had disappeared. I did not observe whether these performances continued longer than the six days. At night the parent could be found

brooding the young within the enclosure. Apparently no effort was ever made by the adults at this or other nests similarly enclosed to lift the young over the obstruction, as some species of rails do (Pettingill, 1938:414; Allen, 1934:202). In my observations of Killdeers I saw nothing to indicate that the young were ever carried by their parents as suggested by Pickwell (1925:492, 496).

Brooding, guarding against enemies, and warning of danger appear to be the extent of the parents' responsibilities. These duties are performed with a high degree of success. Of five broods I confined within uncovered enclosures, with no protection against hawks or other predators, only one brood came to grief. The indications were that these young had been eaten by a cat.



Figure 1. Young Killdeers within the enclosing fence the day after hatching.

For the first few days after the eggs hatched, both parents were on hand; as the chicks grew older they were left more and more to the care of one parent, but the mate very soon appeared whenever the bird on duty gave the danger call, a sudden sharp and rapid *dee-dee-dee*.

Attentiveness at other nests. At the second and third nests in 1931 my results were the same as at the first. By marking for identification I found one bird of each pair to be the more attentive during the latter part of the incubation period and afterwards to the young. At two nests

in 1932, observed through the incubation period, I again noted one of each pair to be the more attentive. Circumstances prevented me from collecting these "attentive" individuals to ascertain their sex. The sexes in this species are practically identical in plumage and size. Hiatt and Flickenger (1929:321), after observing unmarked pairs in the mating act, concluded that female Killdeers are larger than the males. But the measurements of adult males and females given by Ridgway (1919:100) indicate a variation in size too slight to be relied upon for field identification of sexes.

HAND REARED KILLDEERS 1932

From each of the two nests in 1932, I took three eggs as soon as I saw signs of hatching and put them into an incubator. All but one of the eggs hatched normally.

I kept the young Killdeers in large cardboard cartons for several days. Small, portable brooders furnished warmth. When I lowered the brooder into a box the young would run to meet it, uttering the soft *dee dee* note I had heard used by wild Killdeer chicks at the beginning of a brooding period. They would rest under the brooder a few minutes, run out to eat or drink, and then run back to the brooder.

At first I gave them only fly larvae for food. When they were 10 days old I offered them lean beef ground fine and hard boiled egg run through a sieve. This proved acceptable and became their staple diet. Occasionally I added sour milk and ground liver. The food was placed in shallow pans, and an abundant supply was kept before the birds at all times. Water and gravel were always available.

Five newly hatched Killdeers picked up in the field were put in with the incubator birds and reared with them. Each of the captive birds was banded. At the end of a week I put the young in a turkey pen. This was placed above the ground on uprights, thus minimizing the danger of predators. The walls on two sides and part of the roof were replaced by half-inch wire netting to ensure light and air. The floor space (3 x 18 feet) was spread with a thick layer of garden soil, sand, and gravel. Wide, shallow pans of water made tolerable wading pools. An observation blind set up beside the pen made it possible to watch what went on inside at any time.

One of the birds, a weakling at birth, died when seven days old; another died when six weeks old from an infection which entered by way of an injured toe. The others thrived and grew into normal healthy Killdeers.

When cold weather came, Professor Allen kindly offered to winter the birds in a brooder house that gave adequate protection and opportunity for exercise. The place was not heated, but the drinking water was kept from freezing by the use of small burners under the pans. The winter food consisted of a commercial pheasant meal with generous additions of hard-boiled egg.

HAND REARED KILLDEERS 1933

All but one of the birds survived the winter, and with no significant loss of weight. In early March I again assumed their care, housing them in the same quarters they had occupied the summer before.

Courtship behavior. By the middle of April all of the birds were exhibiting what appeared to be courtship behavior. At times they would crouch on the ground and raising the tail and hind part of the body would sway slightly from side to side while uttering a loud rapid *killiee killiee*, a call with a different rhythm from the usual *killdee kill-dee*. At other times they picked up from the floor of the coop the small stones commonly used for nesting material by Killdeers in this locality and dropped them at random. There was also considerable fighting among the members of the flock. So far I could discern no appreciable differences in behavior pattern. Experimentally I segregated any two that showed interest in each other, not knowing whether they were male or female.

Making the nest. On May 7, after three weeks of these seemingly aimless performances, one of the birds began definite nest making. For three days bird No. 107 had defended a certain small mound of earth where it would sit in the incubating position and give the loud mating call of *killiee killiee*. In making the nest the bird crouched low on this spot rotating slowly as it scratched the dirt loose with its feet and threw it out of the scraped area with vigorous backward kicks, all the while loudly calling *killiee killiee*. At intervals it sat quietly in the nest giving the soft *pup pup* call which is used during incubating and brooding. I cannot say how long was required for the actual scraping since it was impossible for me to observe continuously on that day, but on frequent visits from 8 A.M., when the nest making began, until 8 P.M., I found the bird occupied with the nest. At 8 P.M. the nest cavity was the size and shape usual in Killdeer nests, but it had no lining. The next day, May 8, I removed the other birds and placed them in a different cage, then segregated each in turn with No. 107. During this time No. 107 continued to run to the nest at frequent intervals, assume the courtship posture, and give the courtship call. It also continued the scraping and kicking motions. On May 12 when I put No. 105 in the coop with No. 107 these demonstrations ceased.

Mating behavior. On May 14 I saw the two segregated birds copulating; No. 107, the bird that had made the nest, was unmistakably the male. With none of the Killdeers I observed was the act of coition either preceded or followed by a special ceremony; and it was seldom accompanied by sound, never by fluttering of wings. Sometimes the male ran to the female, who would stand motionless with lowered head while he hopped lightly upon her back. Again the female would run

to the male, face away from him, and stand waiting. Conjunction was very brief. Throughout the entire period of nest building and incubation, Killdeers copulate frequently; I have seen several pairs repeat the act three or four times a day, sometimes twice within an hour. My captive birds were last seen copulating on the day the eggs hatched. This pair, No. 105 and No. 107, were the only ones of the captive birds to pair or make a nest although two of the other birds continued a gradually diminishing courtship behavior for several weeks.

Egg-laying, incubation, and brooding. On May 17 the female contributed a few small stones for the nest. I never saw the birds placing these stones, but eventually the nest came to have a definite lining. Sometimes, after incubation began, the female would get up from the eggs and standing a foot or two away would toss the small stones over her shoulder in the direction of the nest. On May 19 the nest contained the first egg. The next morning I found it in a far corner of the coop with the shell broken, probably by a deer mouse. A second egg was laid on May 22, a third on May 24, and a fourth on May 26. While marking the eggs for identification I accidentally punctured the shell of one, leaving only two in the nest. But on May 28 the female laid her fifth egg. All five eggs had been perfect in shape and appeared to be normal in size.

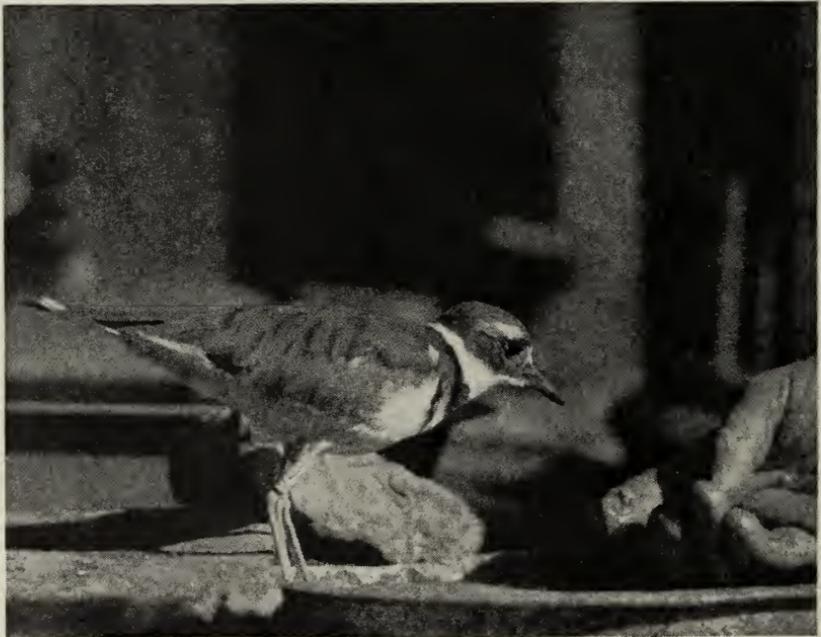


Figure 2. One of the captive-bred Killdeers feeding from the author's hand.

During the laying stage the female had little concern for the nest. She was seldom disturbed by my presence and would stand quietly watching me. Often she ate from my fingers. The male would sneak to the nest and cover the eggs when I drew near, but would tolerate my hand at the nest and even permit me to lift one side of his body to show the eggs to a visitor. On two occasions he lunged at me, but did not strike me. As incubation progressed the female became more solicitous for the welfare of the nest, but she was never so uneasy as the male. At this time both birds used the broken wing tactics when I appeared, but would soon desist, and one would return quietly to the nest even while I remained near. Observations were not continuous, but visits were frequent enough to satisfy me that the male assumed an equal share if not the greater part of the incubation duties.

At 6 A.M. on June 21 I found two of the eggs hatched. Late in the afternoon the two chicks had left the nest and had hopped over a three-inch partition inadvertently left in the coop and were making no effort to get back. For a time the female took care of the unhatched egg while the male brooded the young. Presently she apparently lost interest and merely looked on while the male hurried back and forth, alternately brooding the young for a few seconds, and sitting on the neglected egg. By 8:15 it seemed that he also had abandoned the egg; I put it into the incubator, where it hatched at 8 A.M. June 22.



Figure 3. The male Killdeer brooding his four-day old offspring in the coop.

For the first two or three days the female assisted in brooding the young. After that she left them almost completely in the care of the male. She seldom brooded them, and she kept at a distance from them. This behavior recalls the frequent absence of one parent from the nests observed in the fields during the preceding two years. Yet she was always ready to defend the young, giving the warning call and flying at me if I made a motion to pick them up. The captive birds expressed solicitude in the manner of wild birds but not to the same degree.

On June 29 three downy Killdeers which had hatched in the incubator from eggs found in the field, were put into the coop. The adult birds adopted them at once and gave all six birds the same care. They continued to brood until the young were 23 days old.

The young. In appearance and behavior all three offspring of the captive birds were entirely normal. They were not weighed until they were nine weeks old, at which time their average weight (67.7 grams) was 2.4 grams more than that of the three adopted birds. At seventeen weeks their average weight (83 grams) was 0.5 grams less than that of their parents taken at the same weighing. In the Cornell University collection, five adult specimens averaged 93.3 grams; 14 adult specimens in the University of Michigan Museum of Zoology collection averaged 87.6 grams.¹ Other measurements (culmen, tarsus, middle toe, wing, and tail) of the captive bred birds at 17 weeks were very close to the average given by Ridgway (1919:100) for 34 adult Killdeers.

ACTIVITIES OF THE YOUNG

Exercising, preening, and relaxing. When only a few hours old the chicks run with surprising strength and swiftness. On the first day they begin to stretch and flap their wings. At this age they also preen their down. When sunning themselves in their hours of relaxation, the young Killdeers from the day of hatching often assume the resting position of loons, grebes and other primitive birds. At such times they sit back on their heels, holding the body up at right angles to the long outstretched tarsi. I have never seen adult Killdeers take this posture. My notes do not record it after the nineteenth day.

Roosting. At night I always found my Killdeers standing or sitting flat on the floor of the coop or in the water pan, though there was ample opportunity for them to use perches from 6 inches to two feet high. In winter they often sat flat in the straw that covered the floor. During sleep the head was often turned and the beak slipped under the scapular feathers. At nightfall Killdeers call to each other, especially when disturbed. One will give the *dee-ee-ee* note with rising inflection; another

¹ I am indebted to George M. Sutton of Cornell University and to Josselyn Van Tyne of the University of Michigan for this information on the weights of wild Killdeers. The weights are the averages of adult birds of both sexes collected during the summer.



Figure 4. A characteristic resting posture of young Killdeers.

will call *killdee* softly as if in answer. After a few seconds the calls are repeated. At intervals the parents give the *pup pup* call used as the brood call.

Brooding. Until they are two or three days old Killdeers are brooded for short periods at frequent intervals. Thereafter, daytime brooding is limited to the cool hours of morning and evening and to spells of cloudiness or showers. The brood call of the young is a thin *peep peep*, with a creaking sound difficult to describe but unmistakable. The parent answers with a *peep pup pup*, *peep pup pup*. Frequently the parent gives the call first as an invitation to brood. Then the young answer and run to the parent. The note of the young as they snuggle under the parent is a soft *dee-ee* with a purring quality.

Bathing. I observed a Killdeer taking a full bath when it was 17 days old. The birds I watched usually began the bath by bobbing the whole body in a series of up and down jerks that dipped the hind parts into the water. At the same time the feathers were spread away from the vent. Less frequently they sat down in the water and leaned from one side to the other, then dipped in the beak and threw the water over the back with a jerk of the head. The wings were not fluttered in the bath.

Adults bathed several times a day in warm weather. Sometimes they bathed when there were crystals of ice in the water. I never saw Killdeers take a dust bath.

Feeding. Within a few hours after they leave the shell Killdeers begin to peck at small objects around the nest, but they do not really eat until the second day. The parents that I observed never fed the young or called attention to morsels of food. Several times I observed a curious performance, first described in my notes when the incubator birds were four weeks old and I had brought them a large pan of mud scooped from the edge of a pond: "The bird stands in the pan and presses the mud with one foot after the other. The foot that is patting is extended in advance of the other. Meanwhile the bird watches the mud closely. Now and then it probes with its beak. Often it brings out a small worm or a larva. Sometimes the weight of the body is added to the force exerted by the foot." Later, on three occasions I saw this soil patting by birds of different broods in the wet ground around the water pan. Once I saw one of my captive Killdeers tapping as it sat on its tarsi. Audubon (1835:194) mentions the Killdeer "patting the moist ground to force out the inhabitants," and Nice (1942:95) also describes a Killdeer that "lightly pawed the soft mud with one foot, then the other." Kirkman (1937:84), Colthrop (1923:170), and other writers have described this behavior as a method used by a number of gulls and shore birds to obtain worms.

(It was my expectation to continue experimenting with Killdeers in the hope of rearing succeeding generations in captivity, but late in December, 1933, the birds I had were destroyed in a fire.)

SUMMARY

The breeding habits of wild Killdeers were studied in 1931 and 1932 at 15 nests in the Finger Lakes District of New York.

The two sexes shared in incubation and care of the young. Sexes were indistinguishable in the field, but the birds at six nests were marked, and one of each pair was observed to be more attentive during the latter part of the incubation period and in the care of the young.

The adult birds continued normal care of the young even though the nests were fenced in to prevent escape of the young.

Parental care consisted of brooding, guarding against enemies, and warning of danger. The young were never fed by the parents.

In 1932 five eggs taken from nests in the field were hatched in an incubator and the young Killdeers hand reared along with five young Killdeers hatched in the field.

In 1933 two of the captive birds mated and produced three young.

The male made the nest. During egg-laying the male was more solicitous for the eggs than the female. He shared at least equally in

the incubation. When the young were several days old the male assumed almost entire care of the brood.

The young were brooded for 23 days.

The three young hatched in captivity seemed entirely normal.

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RING-BILLED GULLS OF THE GREAT LAKES

BY FREDERICK E. LUDWIG

THE Ring-billed Gull (*Larus delawarensis*) is one of the most interesting of the gulls that breed in the Middle West. The earliest breeding record of this gull for the Great Lakes area is that of Langille (1884:428), who reported it nesting on one of the Western Islands (Georgian Bay) "in immense numbers." Van Winkle (1893:114), Boies (1897:18), and Butler (1898:573) also reported it as breeding extensively on certain islands of the Great Lakes. But it was described by other authors (Gibbs, 1879:495; White, 1893:222; McIlwraith, 1894:47) as merely a migrant in the area during the last quarter of the nineteenth century; and, except for Saunders' report (1907:74) of breeding in large numbers in 1905 on an island in Georgian Bay and on one in northern Lake Huron, in 1906, there were no further published nesting records for the Great Lakes area until 1926, when William I. Lyon (1926:247; 1927:182) banded at least 67 Ring-bills on St. Martins Shoals in a colony which he found to be some four times larger on his next visit in 1927. During the intervening years, the Ring-bill was reported merely as a common migrant through the area (Kumlien and Hollister, 1903:10; Fleming, 1906:442; J. Claire Wood, 1908:325), and as having "formerly" nested on the islands of Lakes Huron and Michigan (Barrows, 1912:54; Bent, 1921:139). The absence of breeding records during this period of some 20 years, and the fact that Van Tyne worked at Hessel in Les Cheneaux Islands, only eight miles from the Shoals, during the summers of 1917 through 1920, without even a sight record of a Ring-billed Gull make it very probable that the Ring-bill did not nest in this area between the end of last century and about 1926, when Lyon discovered the colony established at St. Martins Shoals.

This paper is based mainly on the data I collected with C. C. Ludwig and C. A. Ludwig over a period of nine years (1933 to 1941), during which we banded 18,259 Ring-billed Gulls. The return records from these gulls were reported to us by the United States Fish and Wildlife Service, and data were supplied to us by other banders who have worked with Ring-billed Gulls, namely: G. W. Luther, William I. Lyon, H. E. MacArthur, Irvin Sturgis, Duke Trempe, and Josselyn Van Tyne.¹ Al-

¹ Josselyn Van Tyne of the University of Michigan Museum of Zoology has aided in the research work and the work necessary to compile a bibliography. The United States Lake Survey and the Department of Mines and Resources, Ottawa, Canada, supplied many maps and charts necessary for the work.

[As the *Bulletin* goes to press, we learn from Harrison F. Lewis that Ring-billed Gulls have been banded by Howard H. Krug, Adam Brown, and Lawrence Tyler on Lake Huron and Georgian Bay, and on Lake Ontario by others. Their data has apparently not been included in this paper, but the author is with the U. S. Navy in the southwest Pacific, and we are unable to consult him on apparent omissions and discrepancies. We feel, however, that the material will prove of interest and value to bird students in its present form, and we hope to publish a supplementary paper later.—Ed.]

together some twenty-nine thousand Ring-bills have been banded in the Great Lakes area.

NESTING DISTRIBUTION IN THE GREAT LAKES REGION

Ring-billed Gulls have been banded on at least 26 islands in the Great Lakes area. The colonies fall roughly into three main groups: (1) Michigan colonies on Lake Huron; (2) Michigan colonies on upper Lake Michigan; (3) Ontario colonies on Lake Huron (chiefly North Channel and Georgian Bay). Table 1 shows the number (when known) of Ring-bills banded on each island visited since 1926. Only islands with nesting colonies of Ring-bills at the time of visit and islands that had at some previous time supported a nesting colony are listed in the table. Since detailed data were not available from all banders, totals given must be taken as approximations only.

The Michigan colonies in Lake Huron (Group 1) have been by far the largest of all the nesting groups. Beginning in 1926, Lyon visited the St. Martins Shoal colony annually, banding Ring-bills there each year (except 1929) until 1934, when the colony failed. With C. C. and C. A. Ludwig, I began visiting St Martins in 1937, and it was not until 1939² that we found the Ring-billed Gulls nesting there again.

On Goose Island, about 25 miles east of St. Martins Shoal, large numbers of Ring-bills were nesting in 1937 and only a few in 1938. In 1939, when the nesting was resumed at St. Martins, no Ring-bills nested on Goose Island, and none during the succeeding years.

In 1931, G. W. Luther found these gulls nesting in numbers on an unnamed island near Canoe Point, Drummond Island, Chippewa County. He banded gulls there yearly until 1934, when this colony also failed, and no colonies were noted in the immediate vicinity until 1941, when Luther found a large colony on Huron Bay Shoals.

In 1933, there was a rather small colony on Scarecrow Island, Alpena County, Michigan. In 1934, the year the St. Martins and Drummond Island colonies failed, the Scarecrow Island colony was about three times as large as in 1933, and in 1935, about 18 times as large. Since that time the population has remained fairly constant. It is the largest single colony of Ring-bills in the Middle West.

The upper Lake Michigan colonies (Group 2) have been studied in detail since 1934. Lyon had made regular banding trips in the area since 1926, but Ring-bills were first found nesting on Delta County islands in 1933, and on various of the Beaver Islands in 1935 and 1936. The growth of this comparatively new nesting area is shown in Table 1.

It is interesting to compare this history of Ring-bills in the Great Lakes region (shown in greater detail in Table 1) with the summary

²Lewis (1941:27) reports that in 1939 "an exceptionally late spring" caused the Ring-billed Gulls which arrived at the St. Augustin sanctuary (north shore of the Gulf of St. Lawrence) to leave "about a week after their arrival," and that "they did not return at any time during the summer of that year, nor were they discovered nesting elsewhere."

TABLE 1
RING-BILLED GULLS BANDED IN THE GREAT LAKES REGION 1926-1941

ISLANDS VISITED	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
MICHIGAN, LAKE HURON																
St. Martins Shoal, Mackinac Co.	67	346	713	0	169	450	301	9	0			0	0	122	709	873
Goose Id., Mackinac Co.						0		0		B		1744	117	0	0	0
Squaw Id., Chippewa Co.						121	554	1037	632	0	0	0	0	0	0	0
Unnamed island near Canoe Pt., Drummond Id., Chippewa Co.										0	0	0	0	0	0	0
Huron Bay Shoal, Drummond Id., Chippewa Co.								102	272	1852	1890	2405	2067	1915	1887	1759
Scarecrow Id., Alpena Co.																
MICHIGAN, LAKE MICHIGAN																
Small Id., Delta Co.						0	0	19	6	5	B					
Gravelly Id., Delta Co.						0	0	23	7	192	20	10		0	0	120
Snake Id., Delta Co.						0					50	50	9	7	771	525
Squaw Id., Beaver Islands																
Pismire Id., Beaver Islands										94	57	134	157	0	0	0
Shoe Id., Beaver Islands										0	0	43	24	12	0	3
Hat Id., Beaver Islands					B					0	0	0	0	0	0	0
Naubinway Id., Mackinac County										0	18	0				
ONTARIO, LAKE HURON																
Limestone Id., Shawanaga Bay, G. B.				18						447						
Halfmoon Id., N. of Saugenee Pen., G. B.										159						
Gull Id., S. W. of Philip Edward Id., G. B.							315			549						
Young Squaw Id., E. of Smith Bay, G. B.							0			189						
Howland Rocks, S. W. of Darch Id., N. C.							365			412						
Minstrel Rock, W. of John Id., N. C.																125
Cousins Ids., S. of John Id., N. C.																0
West Id., S. W. of Blind R., N. C.																2
Fanny Id., Bayfield Sound, N. C.										12						
Henry Id., Bayfield Sound, N. C.							33	201								
Buller Reef, N. E. of Duck Ids., L. H.								B								
Magnetic Reefs, Cockburn Id., L. H.																
Yearly totals (approximate; see text)	67	346	713	18	169	571	900	2071	917	4163	1985	4427	2429	2081	3477	3663
Returns (incomplete data)	5	20	8	1	7	16	11	34	5	75	68	149	62	40	50	....

B—Birds banded; number not known.

O—Island visited; no Ring-billed Gulls on island.

Abbreviations: G. B.—Georgian Bay
N. C.—North Channel
L. H.—Lake Huron

TABLE 2
RETURNS ON RING-BILLED GULLS Banded IN THE GREAT LAKES REGION

STATE OR PROVINCE	1-6 mo.	1st yr.	2nd yr.	3rd yr.	4th-10th	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Alabama		1	2		1							2	1		1		
Arkansas			1										1				
Connecticut	37	86	25	1	2	3	2	2	1	6	30	31	1	20	10	2	6
Florida	10	6	3	1	1		2		1	2	7	2	1	2	2	2	1
Georgia	3	4				1			1	2	1			2	2	1	
Illinois		1								1							1
Indiana		1								1							
Kentucky		2								1		10		2	2	1	
Louisiana	8	10	3	1					1	1	6			2	2	1	
Massachusetts		4	2	1	1	16	1	18	34	7	3	3	1	1	2	3	6
Maryland	3	21	9	3	6		48	1	1	1	1	1	3	3	4	3	
Michigan	109									2	1	3	1	1	1		
Missouri	1	1															
Mississippi	3	5						1									
New Brunswick	1																
New Jersey	1	1	1														
New York	4	5	2			1	1		6	3	1	1	4		3	2	1
North Carolina	3	7	3	4											1	1	2
Ohio	18	8	1			3	5	2	5	7	1	1			3	3	3
Ontario	38	2	1		1	2	15	13	15	4	2				1	1	3
Pennsylvania	2	4	1						2	1							1
Quebec	1	3						3	2								
Saskatchewan	1	1						1	1	3	2			2	2	1	1
South Carolina	16	5	2						2								
Tennessee	3	3	1			1											
Texas	1	3	2					1		1	1	4	1	1	1	3	3
Virginia	4	6			1												2
West Virginia		2	1				1	3		1	2		1				
Wisconsin	9	2	2						5	2		1	2				
Totals	275	192	62	11	13	27	75	44	77	45	58	59	45	30	33	28	21

The first five columns give the number of returns during the first six months after banding (June through December), and the first, second, third, and fourth to tenth calendar year after banding. The remaining columns show the distribution (when known) of the same returns according to month. Because of the incompleteness of present available data these figures must be taken as indicative only of general trends.

by Harrison F. Lewis (1941:22) of the Ring-bill colonies on the north shore of the Gulf of St. Lawrence; Audubon found a colony of 22 nests there in 1833; in 1884, M. Abbott Frazar reported a few colonies in the vicinity of Cape Whittle; but apparently, as in the Great Lakes area, there were no further records until 1915, when Charles W. Townsend found a colony near Pointe du Maurier. Lewis notes, as Frazar had, "examples of the scattering of a large colony into several smaller groups, nesting on as many different islands." He adds: "Sometimes these changes are due to evident causes. . . and sometimes the reasons for them are obscure." During the five-year lapse at St. Martins the mean water level was lower than usual; otherwise the lapse remains unexplained. The data seem to indicate that colonies of Ring-billed Gulls have scattered from the St. Martins Shoal group of colonies throughout upper Lake Michigan, upper Lake Huron, and Georgian Bay.

RETURNS

Table 2 gives the number of Ring-bills banded per year and the returns received from them, but these data are incomplete since not all returns to other banders have yet reached us. On the 18,259 Ring-billed Gulls I have banded with C. C. and C. A. Ludwig, there have been 496 returns, or 2.7 per cent. On the rather similar Herring Gull, of which we have banded 19,564, there have been 739 returns or 3.8 per cent. The returns furnish important data on distribution by age and season, on winter and summer range, on migration routes, and on mortality.

DISTRIBUTION OF THE GULLS AFTER BANDING

Table 2 and Maps 1 to 3 illustrate the distribution of the Ring-billed Gulls after banding, as shown by the return records. All of these birds were banded as nestlings in the Great Lakes area. Recoveries were made in 4 provinces of Canada and in 25 states.

Map 1 shows the distribution during the first six months after banding. The greater proportion of the returns from banded young (174 out of 275) were from areas bordering on the Great Lakes, namely, Michigan, Wisconsin, Ohio, and Ontario. Most of these returns occurred in the first four months of life. Late in the fall, a rather large number of the young were returned from the south Atlantic and the Gulf states.

Map 2 shows the distribution during the first calendar year after banding (after December 31 of the year of banding). Out of 192 returns, 86 were from Florida, 19 from the other Gulf states, 30 from the south Atlantic states. Some of the first year birds spend all of the year after banding in the south; hence the large proportion of the returns from that area. Some, however, return north and are taken in the Great Lakes area.

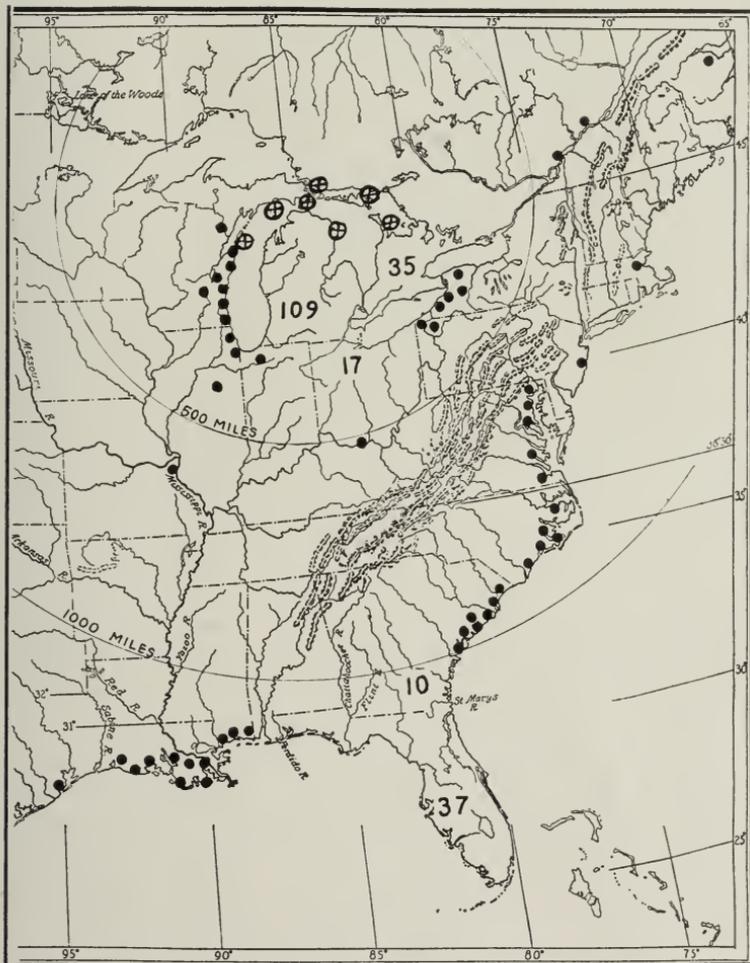
Map 3 (distribution during the second calendar year after banding) also shows a large proportion of the returns (25 out of 62) to be from Florida, a number from other southern states. But of these 62 returns,

48 were made during the period of January through June; hence the large number from the south.

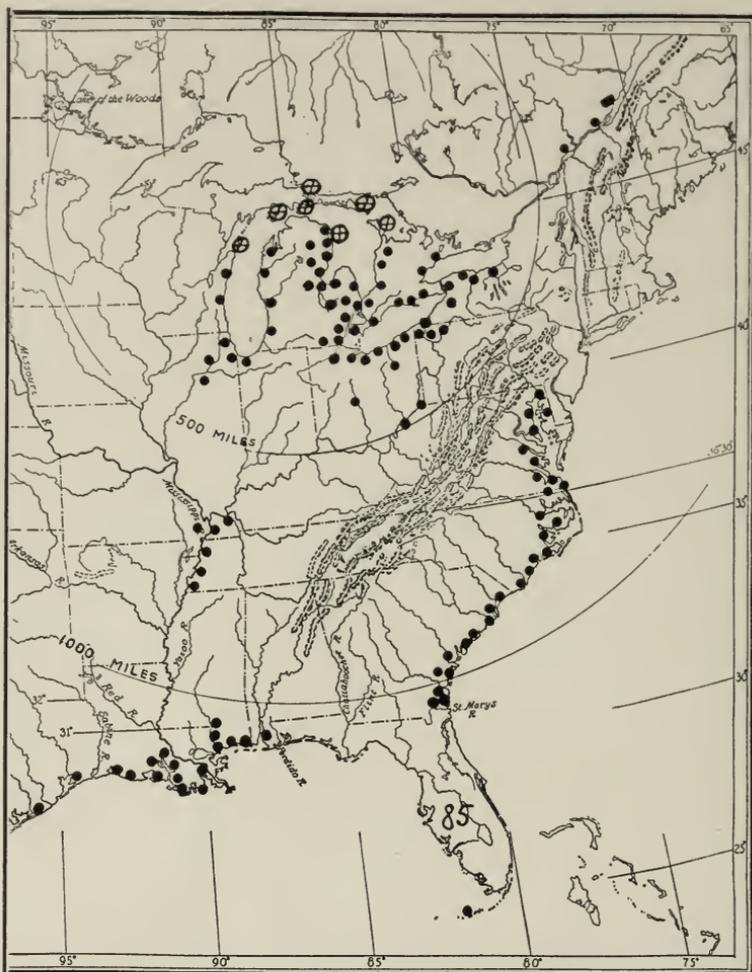
The returns made during the third through the tenth calendar year after banding (Table 2) are too small to give reliable indications of distribution. It should be noted, however, that the oldest returns (5, 6, 7, and 10 year returns) came from the nesting areas in the Great Lakes.

WINTER AND SUMMER RANGE

It is interesting to study the returns according to month (Table 2) in relation to the territory from which they were returned. There are

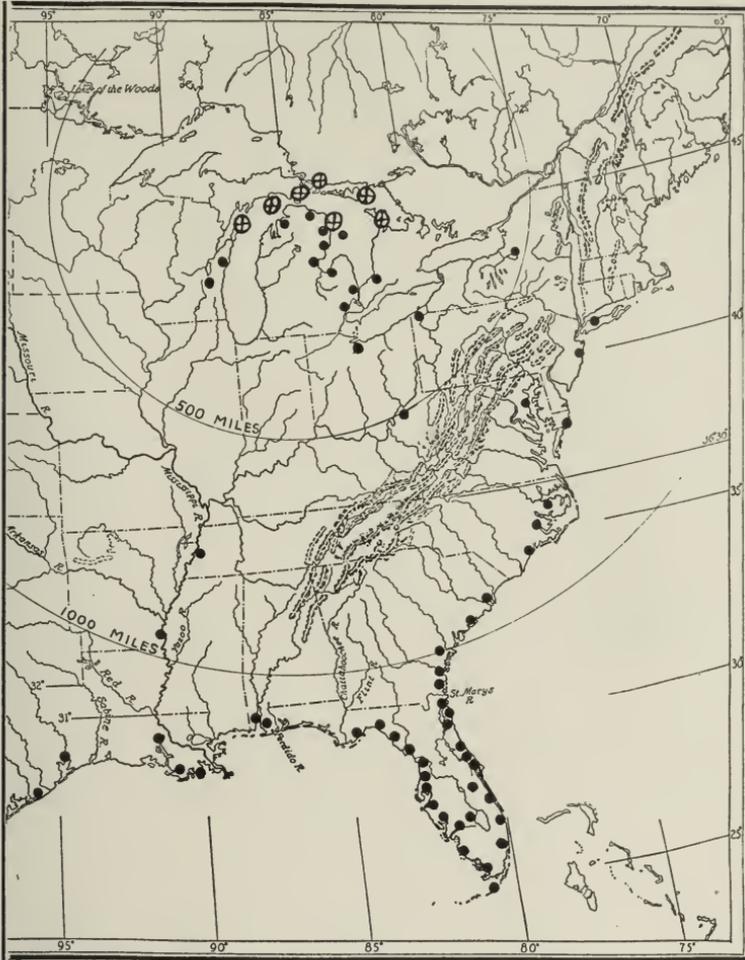


Map 1. Distribution of Ring-billed Gull returns during the first six months after banding. Numerals replace black dots in areas where there are too many returns to be plotted without overlapping. The principal breeding grounds where these young were banded are shown by crosses. (Maps by courtesy of The Historical Publishing Company, Topeka, Kansas.)



Map 2. Distribution of the Ring-billed Gull returns during the first calendar year after banding. Numerals replace black dots in areas where there are too many returns to be plotted without overlapping. The principal breeding grounds where these young were banded are shown by crosses.

two states from which there are returns every month in the year: Florida and Michigan. Most of the Florida returns come during the wintering period (November to April inclusive), when there is a large concentration of both immatures and adults in Florida and a considerable number throughout the south, particularly in the Gulf states. The winter concentration of Ring-billed Gulls is much higher in Florida than in any other state. The ocean beaches are literally lined with these gulls, and many are captured or found dead by the winter tourists. There are scattered recoveries in the south, however, during the other



Map 3. Distribution of Ring-billed Gull returns during the second calendar year after banding. The principal breeding grounds where these gulls were banded are shown by crosses.

seasons, even during the nesting season. These are immatures which may be considered "wandering migrants" during the first year after banding. The returns from Michigan as well as the returns from the other Great Lakes areas, grouped as a unit, are numerous from June through November, particularly numerous in August, September, and October. Many of these are, of course, returns from gulls in the first six months of life, when the mortality is high. Three returns for each winter month from Michigan and scattered returns from the other Great Lakes areas during the winter period (December to May inclusive) indicate that some Ring-bills winter in the region.

There are nine winter records for Michigan: Alpena, December 1, 1931; Charlevoix, December 27, 1936; St. Joseph, December 27, 1939; Straits of Mackinac, January 27, 1930; Saginaw, January 13, 1939; Lake St. Clair, January 18, 1939; Frankfort, February 27, 1931; Grand Haven, February 15, 1932; Sturgeon Bay, Emmet County, February 3, 1935. The records from the Straits, Sturgeon Bay, Charlevoix, Alpena, and Frankfort are north of the published winter range of the species in Michigan.

There is a very small scattering of returns in winter from other northern states (Connecticut, Illinois, Indiana, Massachusetts, New Jersey, New York, and Pennsylvania). The records were, unfortunately, not checked by correspondence with those who sent in the returns. It is possible, therefore, that some of the northern winter returns were from birds that died in the fall and were found in the winter.

Returns from the south Atlantic states (Maryland, North Carolina, South Carolina, and Virginia), grouped as a unit, also cover all months of the year (except July). They are meager in fall, fairly numerous in winter and spring—with 12 returns for May and June. Particularly interesting are the four returns from North Carolina made during the breeding season of the third year after banding—pointing to the possibility of a nesting colony of Ring-billed Gulls on the North Carolina coast.

MIGRATION ROUTES

Fall and spring returns from the upper Ohio River and along the Mississippi (Illinois, Missouri, and Arkansas) would seem to indicate that one main migration route of the Ring-billed Gull parallels these rivers. Spring and fall returns from Ontario, Quebec, New York, and Pennsylvania suggest another main migration route along the St. Lawrence waterway and Hudson River to the south Atlantic states. Records from New Brunswick may perhaps indicate an alternative route from the waterway to the Atlantic coast. (See Table 2 and Maps 1 to 3.)

MORTALITY

Since by far the largest number of the returns are from birds found dead, the figures in Table 2 are a rough index to mortality. We find that, as in other species of birds, mortality is highest in the first six months of life, followed closely by mortality in the first calendar year after banding. The figures for the Great Lakes areas (Michigan, Ontario, Ohio, and Wisconsin) show large numbers of returns in August; a smaller number in September; and a second large wave in October. The August returns are presumably the weaker birds, which die soon after the nesting. By September this lethal selection process is more or less complete, and food and weather conditions are favorable, so that fewer birds die. But in October the weather stiffens, food becomes

scarcer, and larger numbers of the gulls are found dead. Through the rest of the year the number of recoveries in these areas is comparatively small.

The data on the circumstances of recovery, available for 483 of the returns, are of some interest here. Most of these (263) were from birds found dead, 57 from birds found sick or injured, 48 from birds shot by hunters or trappers. Sixty-three were from birds, apparently normal, which were captured alive; many of these are returns from Florida, where, during their winter stay, these gulls become quite tame, some of them being recovered three or four times in the same locality by different people. Twelve returns were from birds killed by automobiles or other vehicles; seven from birds caught on fishermen's lines; seven from birds taken as scientific specimens. A scattering of the returns (eight) are from birds killed by cats or dogs; by flying into a high tension wire or flagpole; or by choking on fish.

The oldest Ring-billed Gull we have recorded was ten years old, but consecutive banding has not yet been carried on long enough to enable us to estimate the average length of life of the Ring-bill.

SUMMARY

After an interval of some 20 years, the Ring-billed Gull was again reported nesting in the Great Lakes region about 1926.

Between 1926 and 1941, at least twenty-nine thousand Ring-billed Gulls were banded in the region.

The data indicate that from the earliest of these recent colonies, St. Martins Shoals, the Ring-billed Gulls scattered throughout upper Lake Michigan, upper Lake Huron, and Georgian Bay; they have been found nesting on at least 26 islands in the region.

The colonies do not always remain stationary, but sometimes shift from island to island.

A colony on Scarecrow Island, Alpena County, Michigan, has become the largest single colony in the Middle West.

Winter returns from banded Ring-billed Gulls extend the known winter range northward; summer returns indicate that some of these gulls spend all their first year in the south.

Four returns from North Carolina, made during the breeding season of the third year after banding, point to the possibility of a nesting colony of Ring-billed Gulls on the North Carolina coast.

Fall and spring returns indicate migration routes along the upper Ohio River and the Mississippi, and along the St. Lawrence waterway and Hudson River.

Returns indicate that mortality is highest in the first six months of life, followed closely by mortality in the first calendar year after banding.

The oldest Ring-billed Gull we have yet recorded was ten years old.

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320 SPERRY BUILDING, PORT HURON, MICHIGAN

GENERAL NOTES

Whooping Cranes at Shoal Lake, Manitoba.—On April 26, 1943, I saw nine white birds flying north over East Shoal Lake, Manitoba. They were about a mile away, flying low over the water. Their profiles were obscured by the far shoreline so that positive identification was impossible, but I was certain they were neither Whistling Swans nor White Pelicans, both of which are rather common here during spring migration.

Later in the morning I walked north up the lake shore to the rich hay meadow at the "narrows" where, as I mounted the rise from the shoreline, I saw nine Whooping Cranes (*Grus americana*) some 200 yards distant. Although only my head and shoulders were visible to the birds, they took alarm. In circular flight slower than that of the Sandhill Crane, they gained an altitude of about 300 feet, then struck due north. Without glasses I could not be certain of the number of adults and young birds in the band, but at least three were adults.

Shoal Lake has been my home since 1889. Up until the late nineties Whooping Cranes were not uncommon migrants through the Interlake region of Manitoba. Flocks of 20 and 30 were common, and as children we were told the white birds were Sandhills in full maturity. Tall and wary, they were difficult to approach, and I know of only one or two being shot in those early days. I saw these birds in small numbers each year up until 1924, except 1915, 1916, and 1917, when none passed through. Since 1924 I have seen them but twice, three in 1934 and the nine birds this year.—F. C. WARD, 1933 *William Avenue, Winnipeg, Manitoba, Canada.*

Least Tern in southeastern Michigan.—High water in Lake Erie this year turned a field in Erie Township, Monroe County, Michigan (10 miles north of Toledo), into an area of shallow pools and mud flats separated from the lake by a hundred yards of slightly higher ground. The shore of the region is largely marshy, with frequent narrow strips of sandy beach. At this field in July the common birds were Ring-billed Gulls, Bonaparte's Gulls, Forster's Terns, Common Terns, and Black Terns, along with occasional Herring Gulls and Caspian Terns.

On June 19, 1943, I saw what I believed to be a Least Tern in this field, but circumstances prevented my being certain of the identity. On July 10, Louis W. Campbell and I took a Least Tern there—an adult male of the Mississippi Valley race, *Sterna albifrons athalassos* (described by T. D. Burleigh and G. H. Lowery, Jr., in *La. State Univ. Mus. Zool. Occ. Paper No. 10*, 1942). There have been several published reports of the Least Tern in Michigan, but no evidence had been found to confirm the reports, and there was strong reason to suspect that the supposed Least Terns were actually immature Black Terns (see B. H. Swales, *Wils. Bull.*, 25, 1913:32-33). This appears to be the first specimen of Least Tern taken in Michigan, though Campbell collected two immature females nearby, on the Lake Erie shore in Lucas County, Ohio, on September 16, 1934.

I am indebted to George H. Lowery, Jr., for the identification of this specimen, which is now in the University of Michigan Museum of Zoology.—HAROLD MAYFIELD, 3311 Parkwood Avenue, Toledo, Ohio.

The carpels of red spruce blossoms as food for birds.—During the past several years I have been paying particular attention to the belt of red spruce forest (*Picea rubens*) which clothes some of the higher mountain peaks in West Virginia, particularly with reference to the presence of crossbills and other northern finches in this forest. I have visited certain areas at all seasons of the year and have found the blooming season of the spruces to be, by far, the best time to find these birds of northern association.

This season ordinarily covers the first three weeks in June; June 10 is, generally speaking, near the height of the blossoming period. At this time the young spruces bear, during most years, a light to heavy crop of ovulate strobili containing numerous bract-like carpels which are coated with a waxy or resinous substance that is distinctly sweet to the taste. On many of the carpels this substance forms beads. The coated carpels are eaten avidly by both Red and White-winged Crossbills (*Loxia curvirostra* and *L. leucoptera*), and by Pine Siskins (*Spinus pinus*). These strobili, many of which never ripen into cones, are much more in evidence on young spruces (15 to 25 years old) than on older trees, and they are much more likely to occur annually than are mature cones. It is therefore much easier to estimate crossbill populations during June than at any other time at which I have tried it. I have found Red Crossbills in certain spruce patches during every June for the past five years.

On some of our visits during June, 1940, and again in 1941, Cedar Waxwings (*Bombycilla cedrorum*) were observed feeding habitually on these coated carpels. The crop of one individual collected in the act of feeding was stuffed with the carpels, and the body had the same accumulation of very firm fat which had been observed in the Red Crossbills collected there at that season. Cedar Waxwings have on a number of occasions been observed to feed on the petals of apple blossoms, but this is, so far as I am aware, the first recorded occurrence of their eating red spruce carpels.—MAURICE BROOKS, *Division of Forestry, West Virginia University, Morgantown, West Virginia.*

Ilex collina fruits as bird food.—On some of the higher mountains of Virginia and West Virginia there grows a very attractive deciduous holly which has recently been described as *Ilex collina* Alexander. Since this description was published subsequent to the appearance of Van Dersal's "Native Woody Plants of the United States, Their Erosion Control and Wildlife Values" (*U. S. Dept. Agric. Misc. Publ. No. 303, 1938*), there are no food records in that volume referable to this species. Even the largeleaf holly (*I. longipes*), with which the present species was long confused, is without data, so far as its use by wildlife is concerned.

Ilex collina, which I have called 'mountain long-stem holly' for want of a better name, is abundant in parts of the Allegheny Plateau, particularly at elevations of 3,000 feet or above. In the Cheat Mountains of West Virginia it occurs to 4,000 feet. During September and October it ripens immense crops of large, pulpy, long-pediceled drupes. Many of these persist on the shrubs until after the first of January; others fall to the ground and are eaten by birds and other animals.

In the winter of 1942-43 a number of trips were made for the purpose of observing the winter use made by animals of these fruits, and autumn observations have been made during several years. Thus far I have observed Ruffed Grouse (*Bonasa umbellus*), Catbirds (*Dumetella carolinensis*), Robins (*Turdus migratorius*), Wood Thrushes (*Hylocichla mustelina*), Olive-backed Thrushes (*H. ustulata*), and Cedar Waxwings (*Bombycilla cedrorum*) feeding on the fruits, and I have excellent evidence that wild Turkeys (*Meleagris gallopavo*) also use them. During a period when snow was on the ground in December, 1942, I visited a number of spots where this holly grew, and found that grouse had been scratching at every one of them, and at one clump a flock of Turkeys had completely trampled the area.

So far as I am aware, this holly is not now commercially available, although it is being propagated from cuttings which I have furnished the Soil Conservation Service. It seems to offer considerable promise as a winter food in Appalachian mountain areas where weather conditions are severe, and where glaze is a constant menace to birds and other wildlife.—MAURICE BROOKS, *Division of Forestry, West Virginia University, Morgantown, West Virginia.*

Starling nesting in Colorado.—The Starling (*Sturnus vulgaris*) was first definitely recorded for Colorado on December 17, 1938, by R. B. Rockwell (*Wils. Bull.*, 51, 1939:46). The following year Niedrach and Rockwell ("Birds of Denver and Mountain Parks," 1939:133) recorded the Starling as a winter resident in Colorado and cited a number of records.

On May 6, 1942, I saw a small flock of Starlings near Greeley. A. M. Bailey saw an individual on June 15, 1943, near Derby, Adams County, and one on August 3, 1943, at Lakeside Park, Denver.

On May 16, 1943, just beyond the south boundary of Lowry Field, Denver, I saw a Starling carrying food. The bird made several trips, and I traced her to a delapidated silo. In one of the cracked tile of the silo, about two-thirds of the way up from the inside base, the Starling was rearing its young. I was unable to see them, but they called quite vociferously immediately before and during feeding. The old bird was wary and made only three trips with food in the period (about one hour) I was able to spend at the spot. A week later, May 23, 1943, I returned to the same neighborhood and saw two young Starlings perched in some willows about a hundred yards north of the silo.—GEORGE H. BREIDING, 487 National Road, Fulton, Wheeling, West Virginia.

The Kentucky Warbler in the Toronto region.—On May 8, 1943, the writers with other members of the Toronto Ornithological Club, observed a Kentucky Warbler (*Oporornis formosus*) along the northern border of the Holland River Marsh, four miles southwest of Bradford, Simcoe County, Ontario. The bird, a male in full spring plumage, was feeding on the ground under hemlocks at the edge of a swampy woods. It was collected by O. E. Devitt. The specimen, now in the Royal Ontario Museum of Zoology, is the third for Ontario, the first for the Toronto region.

Published records of the occurrence of this species in Canada are comparatively few. An early Quebec record of a pair reported by John Neilson during early July, 1879, is mentioned by Montague Chamberlain ("Catalogue of Canadian Birds," 1887:106), but this record has been questioned since by several authorities (see Fleming, *Can. Field-Nat.*, 51, 1937:13). A specimen taken near Bryanston, Middlesex County, Ontario, by Robert Elliott on May 16, 1898, is now in the W. E. Saunders collection (John Macoun, "Catalogue of Canadian Birds," Pt. 3, 1904:633). A second specimen was collected by A. A. Wood near Strathroy, Ontario, on May 25, 1931 (*Can. Field-Nat.*, 46, 1932:209).

The following sight records made by reliable observers have also come to our attention: an individual observed by George Kennedy in Queen's Park, Toronto, on May 12, 1933; another reported by Ralph Hicks at Ashbridges' Bay, Toronto, on May 27, 1938; one seen by George North at Hamilton on May 3, 1942; and one by R. V. Lindsay at High Park, Toronto, on May 10, 11, and 12, 1943.—W. W. SMITH and O. E. DEVITT, 218 Eglinton Avenue, East, Toronto, Ontario.

WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been recently received:

Marie V. Beals—4 reprints	Amelia R. Laskey—1 reprint
William H. Behle—5 reprints	W. L. McAtee—12 pamphlets
Mary A. Bennett—1 reprint	Ernst Mayr—1 reprint
Arthur C. Bent—5 books	Margaret M. Nice—4 books, one reprint
Earle A. Brooks—1 book	Russell T. Norris—60 periodicals and reprints
William Henry Burt—1 reprint	Katie M. Roads—2 books, 8 journals
Herbert Friedmann—2 books, 14 reprints	Robert M. Stabler—6 journals
Leon Kelso—3 pamphlets, 5 reprints, 1 journal	T. C. Stephens—48 journals
	Dayton Stoner—7 reprints

EDITORIAL

The Treasurer will send out the 1944 dues notices shortly after the publication of the December *Bulletin*. It will save the Treasurer's time and the Club's funds if members will pay their dues promptly or notify the Treasurer of their intention to continue their membership.

War conditions inevitably result in a certain number of defective copies of *Bulletins* being mailed to members. Please report these to the Editor who will see that they are promptly replaced with good copies.

We are again indebted to Ruth D. Turner for preparing the annual *Bulletin* index. For other editorial assistance during the year we wish to thank Dean Amadon, J. J. Hickey, Margaret B. Hickey, Harrison F. Lewis, Ernst Mayr, Olin S. Pettingill, Jr., George M. Sutton, Milton B. Trautman, and Frank N. Wilson.

Most back numbers of the *Bulletin* are available at the editorial office. Members are allowed a ten per cent discount when ordering more than one copy.

ORNITHOLOGICAL NEWS

Contrary to the first announcement, the American Ornithologists' Union held the regular annual business meeting in New York on October 20. All officers were re-elected. New Council members chosen were: Ludlow Griscom, Alden H. Miller, and Harry C. Oberholser. S. Charles Kendeigh and Austin L. Rand were made Fellows, and the following five Members were elected: Dean Amadon, Robert J. Niedrach, Frank A. Pitelka, Julian K. Potter, and Terence M. Shortt.

The Brewster Medal was awarded to Alden H. Miller for his book, "Speciation in the Avian Genus *Junco*."

William Vogt has been appointed Chief of the Conservation Section of the Pan American Union and will be traveling extensively in Central and South America in the interest of wildlife conservation.

Ernst Mayr is preparing a manual on the birds of the southwest Pacific.

Herbert Brandt has taken over the Cleveland Bird Club's "Bird Calendar," changed its name to "Bird-Life," and is publishing it as a printed and handsomely illustrated octavo magazine. The "bird calendar" material appears as a section of the new magazine. The current volume is numbered 39, continuing the "Bird Calendar" series.

The name of Field Museum of Natural History is being changed to Chicago Museum of Natural History.

Arthur J. Sessing, of Minneapolis, and Cliff Hudson, of Racine, Wisconsin, just returned from a U. S. Government mission to Hudson Bay, bringing back with them some of the first wildlife photographs taken on Coats Island.

Brian Roberts, of the Scott Polar Research Institute, Cambridge, England, and author of notable papers on penguins, was in America this past fall on a mission for British Naval Intelligence. He visited Washington, Minneapolis, Ottawa, Boston, and New York, meeting many members of the Wilson Club during the course of his conferences in these cities.

ORNITHOLOGICAL LITERATURE

A GUIDE TO BIRD WATCHING. By Joseph J. Hickey, Illustrated by Francis Lee Jaques. Oxford University Press, New York, 1943: $5\frac{1}{2} \times 8\frac{3}{8}$ in., xiv + 262 pp. \$3.50.

The keynote of this exciting book is given in the first two sentences of the preface: "Bird watching embraces individual enterprise on the one hand, collective effort on the other. Above all else, it is marked by a ready exchange of experience, by a high regard for truth, and by a conviction that wild birds express the most spectacular development of nature."

For the first time we have a real guide to the study of the live bird in its environment, a guide written with freshness and humor, and teeming with problems. The first paragraphs of Chapter One, "How to Begin Bird Study," are masterpieces in depicting the sheer delight of bird study—its drama, the reward of discovery. "Each species offers a new glimpse of creation, each carries its own reward." And no one should miss the fun in the section on bird names, or the excellent trick for avoiding confusion by "privately calling" one water-thrush the "white Louisiana," the other the "yellow northern."

The five chief chapters are entitled: The Lure of Migration Watching; Adventures in Bird Counting; Explorations in Bird Distribution; The Romance of Bird Banding; and The Art of Bird Watching. Each subject is treated adequately from the standpoint of the field student; a sound theoretical basis is laid, and opportunities are pointed out for both individual and cooperative study. In Chapter Two the author's examination of the recoveries of 61 fledgling Robins in subsequent breeding season shows a definite tendency towards return to the vicinity of the birth place. In Chapter Three the disposition to under-estimate the number of small birds in a flock and to over-estimate the number of large birds is mentioned. Thrilling tales are given of counts of bird roosts of many species and of migrating hawks. Changes in local bird life are discussed here while changes over the continent, due to the white man, are given in a striking table (p. 177).

One of the author's special fields of interest is that of "ecological distribution." Here there are a number of original tables: 19, "Some foraging areas of birds in the nesting season," based on over 100 pairs of 14 species; 20, showing the lowest singing perches accepted by 17 species, suggesting the intriguing problem of specific height of such perches; and 18, a comparison of Nutcracker invasions in Europe and Crossbill in Massachusetts, showing a year for year correspondence, although due on the one hand to failure of cedar nuts in Siberia, and on the other to pinecone seeds in North America. Various factors in habitat selection are discussed, and an excellent treatment of the subject of succession given.

The "inauguration of systematic bird banding about 1920" was an even greater revolution in bird study than "the substitution of field glasses for the collector's gun, around 1900." Bird banding can be divided into three stages: the ringing of fledglings, the trapping of adults, and color banding. A survey of the results of the different methods is given, and excellent suggestions offered for making the most of the unique opportunity of banding, both by individuals and by cooperative effort. The author's organization of color banding of young Herring Gulls according to year and birth place is a fine example of collective action.

In the last chapter the author tells us: "The great mysteries of bird life still crowd our very doorsteps. We are still living in an age of wonder." The table on page 168—"Handbook Information Still Wanted on North American Birds"—is a vivid illustration of how little we yet know. The sections on "The student and his bird club," "Co-operative bird watching; research partnerships; organized inquiries" all emphasize the friendly contacts that are so characteristic of most students of birds. Excellent advice is given on publishing observations; "wordiness and insufficient data" are two of the commonest weaknesses, and a timely note

is added: "Above all, do not pad the bibliography." Finally in "Bird Watching and America" there is a straightforward statement of the responsibility of the bird watcher for the preservation of birds.

The 30 tables are well chosen and invitingly labeled "Some Examples and Results of Bird Watching." Five important appendices are included. The first is a unique contribution illustrated by sketches of models made by Charles A. Urner of shore bird tracks, as well as a detailed key to such tracks. A table summarizing the results of breeding bird censuses in North America arranged according to habitats is given in Appendix B. An exceedingly suggestive and detailed "Outline for a Life-History Study" constitutes one of the notable contributions of the book. Thirty-two pages are devoted to an annotated list of bird books in fourteen categories, and ten pages to a regional list of bird clubs in the United States and Canada; both of these sections will be of great value to the beginner in bird watching. A good index completes the volume. And in our enthusiasm over the text we must not forget Mr. Jaques' charming and spirited sketches.

Mr. Hickey has reached the goal he set himself: "It is the chief purpose of this book to show how bird watching can be made to last a lifetime, and to yield to the very end the same full measure of enjoyment."—Margaret M. Nice.

STUDIES IN THE LIFE HISTORY OF THE SONG SPARROW, II: THE BEHAVIOR OF THE SONG SPARROW AND OTHER PASSERINES. By Margaret Morse Nice. Trans. Linn. Soc. of New York, 6, Sept. 1943: viii + 329 pp., 1 pl. and 6 text figs. \$2.00 on direct order from The Linn. Soc. of New York, % Amer. Mus. Nat. Hist., Central Park West at 79th St., New York, 24, N. Y.

The second part of Mrs. Nice's "Studies in the Life History of the Song Sparrow" is a work of much wider interest and value than the first part, admirable as that one is. It is, as the author says in her foreword, "primarily a treatise on the behavior of passerine birds with the Song Sparrow as the chief example," and its initial chapter is a general discussion of bird behavior in which the approach to the particular species, *Melospiza melodia*, is outlined, and the main points of view adhered to in the analysis of the subsequent material are established. Mrs. Nice is convinced of the general accuracy and trustworthiness of Konrad Lorenz's theories and interpretations of avian activity, and arranges her data and presents her conclusions largely within the limits imposed by this conviction. If any general criticism may be made of her work it must be of the soundness of her judgment in so completely accepting Lorenz as a guide. Yet, who has so far appeared on the ornithological horizon to offer more suggestive and stimulating general concepts of bird behavior, or ones that help to clarify so many individual parts of the total picture? To the data Mrs. Nice presents on the Song Sparrow no one can take exception. No one else knows as much about the bird as she does. A large part of the material is new to ornithological literature and therefore cannot be critically compared with previous information, but there is no reason to doubt its validity. Seven years of intensive, meticulous and intelligent field and aviary studies have yielded a rich harvest of detailed, individualized, observational data both quantitatively and qualitatively incomparably in advance of what we have for any other bird species. Added to this we have in the present book a great number of interpretations and suggestive comments that are in themselves a digest of a vast and not always readily assimilable literature. In other words, Mrs. Nice's book presents more information than we have ever had about any single species, more thoroughly analyzed, and more completely integrated with current knowledge and modern concepts of animal behavior. To the serious student it will long be a basic work.

It is impossible in a short review to do more than list the main topics discussed. The book is so full of "meat" that the most that can be done here is to point out the wealth of material presented and to hope the interested readers of this notice will avail themselves of this new source of data and digest of ideas. The book is divided into 22 chapters and 5 appendices. The first chapter is a

general discussion of bird behavior, as already remarked, and treats of the pertinent observations by other students of the subject, the status of birds in comparison with other animals, the distinction between innate and learned behavior, and the Lorenzian concepts of releasers, signals, and the role of the companion. Chapter II describes the development of the young Song Sparrow in detail; chapter III takes up the discussion of the activities of the young bird, while the fourth chapter attempts to distinguish between those elements in its activities which are innate and those that are learned. The next chapter is a digression from the particular species to a comparative survey of the course of development in passerine birds generally. In the sixth chapter we return to the Song Sparrow and are given an account of the young bird after it leaves its parents, involving such topics as the postjuvinal molt, fall migration, the premature appearance of breeding behavior. The title of this chapter "The Young After Independence" might well have been altered to read either "The Young Bird After Dependence" or "The Young Bird After Achieving Independence," but this is a small matter that will not mislead the reader of the book. Subsequent chapter headings are, Song Sparrow Society in Fall and Winter (involving social integration, dominance); Awakening and Roosting; The Song of the Adult Male; Song in Female Birds; Development, Inheritance, and Function of Song; The Male and His Territory; The Function of Territory; The Male and His Mate; Relations of the Pair to Each Other and Their Neighbors; the Problem of Pair Formation; The Nest; The Eggs; Care of the Young; Defense of the Young; Enemy Recognition; and Innate and Learned Behavior in the Adult. Each chapter is divided into numerous sections, and each has a convenient summary. As an example of the detailed nature of the presentation we may transcribe from the table of contents, the arrangement of material in one of the chapters:

Chapter XI. Development, Inheritance and Function of Song.

- A. The Five Stages of Development of Song Sparrow Song
 - 1. Observations on Wild Birds
 - a. The progress of seven residents banded in the nest
 - b. Song development in some other Song Sparrows
 - c. Territory situations and song in juvenile birds
 - 2. Development of Song in the Hand-raised Song Sparrows
- B. Inheritance of Song in the Song Sparrow
 - 1. Do Song Sparrows Sing Like Their Fathers and Grandfathers?
 - 2. How Much Do Song Sparrows Imitate Each Other?
 - 3. The Case of the Hand-raised Birds
- C. Juvenile Songs of Other Species
 - 1. The Age at Which Young Birds Start to Sing
 - 2. The Character of the Song of Young Birds
- D. Inheritance and Imitation in Other Species
- E. The Evolutionary Trend
- F. A Definition of Song
- G. Function of Song in the Song Sparrow
- H. Some Theories as to the Function of Song in Birds
 - 1. Early Theories
 - 2. Advertising Song
 - 3. Song as a Signal
 - 4. Song as an Emotional Outlet
- I. The Function of Song in Birds
- J. Summary

Where in the literature of ornithology have we ever had such material so carefully assembled and so critically appraised and integrated? And, be it remembered, this is but one out of some twenty-two chapters! Each chapter would make a notable paper in itself and each could stand elaboration. As a matter of fact the one main trouble with the book is that it is too condensed. One tires of telegraphic terseness and wishes for a bit of conversational discourse.

The five appendices are concerned with the following topics: Chief Vocalizations of the Song Sparrow; Dominance, Singing, and the Challenge (Puff-Sing-Wave Posture) in Hand-Raised Birds; Behavior Upon the First Arrival of Females; Some Samples of Coition in 1929; and List of Orders and Passerine Families in which Distraction Display (Injury Feigning) has been Reported.

A bibliography and two indices, one to subjects, and one to species, complete this modestly issued but most significant book. Its author and the Linnaean Society are to be congratulated on the publication of the most searching study yet made of any wild bird.—Herbert Friedmann.

THE LIFE OF THE ROBIN. By David Lack. H. F. and G. Witherby Ltd., London, 1943: $4\frac{1}{4} \times 6\frac{3}{4}$ in., 200 pp., 6 pls., 2 text figs. 7s 6d.

No one should make the mistake of thinking that the author of this very attractive and readable little book has been forced to sacrifice clarity or scientific precision for the sake of attracting and holding popular interest. Laymen with any taste for natural history will find the book delightful and absorbing reading; on the other hand, ornithologists will immediately recognize it as a wholly dependable scientific treatise. Lack's first reports on his work on the English Robin (in the Proceedings of the Zoological Society of London, *The Ibis*, and *British Birds*) brought high praise from scientific reviewers, but those serials are not readily available to many American students. Fortunately this book provides the student with an inexpensive and amazingly complete summary of the Robin study.

Especially valuable are the chapters on song, fighting, territory, and age. The discussion of song and its function effectually disposes not only of the popular notion that the Robin sings because it is "happy" but also of the more scientifically respectable belief that the male Robin sings to please the female. Warning to rivals is, Lack decides, the principal use of the Robin's song. The male sings only on his territory, where his song advertises his presence and warns away intruders, usually obviating the necessity of an actual fight. When it does come to a fight the male on his own territory is normally victorious. As Lack puts it, victory "goes not to the strong but to the righteous, the righteous, of course, being the owner of property."

The hold of the Robin on the English people is vividly shown by a wealth of well-chosen quotations taken from an extraordinarily wide range of sources. Some of the quotations illustrate quaint misconceptions, but others give evidence of rather shrewd observation of biological phenomena several centuries ago.

In refreshing contrast to many recent popular bird books, this one is well documented. By placing most of the references, grouped according to the chapters to which they refer, in an appendix, the author avoids distracting the reader with a multitude of footnotes and yet provides the serious student with clues to the author's scientific sources.

Lack's experience should provide inspiration to any ambitious student of birds and their habits. When Lack began his investigation the English Robin was considered the best known bird of that bird-minded country, but four years of study by simple techniques, such as color banding, resulted in the discovery of a number of new and important facts and generalizations. A similarly thorough study of our even more common American Robin still remains to be done.—J. Van Tyne.

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Erratum

A printer's error in the September *Bulletin* made the first Sutton title on page 206 of the Bibliography section quite unintelligible. The correct reference is given in the same section (p. 255) of the present issue.

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Representative on the American Ornithologists' Union Council. Maurice Brooks

* As announced in the September *Bulletin*, the pressure of his duties in the U. S. Army Air Corps caused George Miksch Sutton to resign from his position as President of the Club, and his place was taken by Vice-President S. Charles Kendeigh.

MEMBERSHIP ROLL

****—Honorary Member. ***—Life Member. **—Sustaining Member.

*—Active Member. Others—Associate Members.

- *Abbott, Dr. Cyril Edward, Biology Department, Doane College, Crete, Nebraska1937
- Adams, I. C., Jr., 214 N. Eighth St., Columbia, Missouri1933
- Addy, C[harles] E[dward], 167A. State St., Newburyport, Massachusetts 1941
- Adelson, Richard H[enry], 34 Wensley Drive, Great Neck, Long Island, New York1938
- *Aldrich, Dr. John Warren, Fish and Wildlife Service, Washington, D.C. 1931
- Alexander, Donald Child, 127 Durant St., Lowell, Massachusetts1937
- Allan, Philip F[arley], 6537 Broad St., Brookmont, Maryland, Washington 16, D.C.1939
- *Allen, Prof. Arthur Augustus, Fernow Hall, Ithaca, New York1914
- Allen, Durward Leon, Rose Lake Wildlife Experiment Station, East Lansing, Michigan1933
- Allen, Francis H[enry], 215 La Grange St., West Roxbury, Massachusetts 1941
- Allen, Sgt. Robert W., 4th Malarial Survey Unit, APO 3665 % Postmaster, San Francisco, California1936
- Allen, Theodore, 2520 Mulberry Ave., Muscatine, Iowa1942
- Allin, Dr. Albert E[llis], Provincial Laboratory, Fort William, Ontario, Canada1943
- *Alperin, Irwin, 1100 E. 19th St., Brooklyn, New York1939
- Alpert, Bernard, 170 Broadway, New York City1939
- Amadon, Dean, American Museum of Natural History, Central Park West at 79th St., New York City1935
- Amidon, Mrs. Hilda Farnum, 282 Sigourney, Hartford, Connecticut ...1942
- *Ammann, Lt. George Andrew % Dr. O. H. Ammann, 272 Rockaway Ave., Boonton, New Jersey1935
- Anderson, Anders Harold, Route 5, Box 488, Tucson, Arizona1937
- Anderson, Miss Helen, Wausau Public Library, Wausau, Wisconsin ...1941
- Anderson, Sgt. John M., East Orwell, Ohio1938
- Anderson, Dr. Rudolph Martin, National Museum of Canada, Ottawa, Ontario, Canada1937
- Anthes, Clarence Alvin, 713 Hamilton Ave., Waukesha, Wisconsin1939
- Anthony, Mervil, U.S.V.H., Marion, Indiana1943
- Appleton, John Sparhawk, Simi, California1936
- *Armstrong, Miss Virginia, Musketaquid Road, Concord, Massachusetts ..1939
- Arnold, Elting, Box 27, RFD 3, Wilson Lane, Bethesda, Maryland ...1941
- *Ashton, Randolph, 800 Crown St., Morrisville, Pennsylvania1941
- *Austin, Dr. Oliver Luther, P.O. Box 236, Tuckahoe, New York1930
- Ayer, Mrs. Nathan Edward, 1300 Hillcrest Dr., Pomona, California ...1936
- Baechle, Rev. John W., C.P.P.S., St. Joseph's College, Collegeville, Indiana1943
- Baer, Miss Myrtle W., 1237 N. Jefferson St., Milwaukee, Wisconsin ...1941
- *Bailey, Alfred Marshall, Colorado Museum of Natural History, City Park, Denver, Colorado1928
- Bailey, Miss Arta I[ndiana], 624 Franklin Ave., Columbus, Ohio1941

¹ This list is compiled as of November 1, 1943. The Secretary would appreciate immediate notification of any omission of names, changes in address, or errors in the spelling of names, the use of titles, the class of membership, and the exact year of first election to membership.

- **Bailey, Harold H[arris], 820 Alhambra Circle, Coral Gables, Florida ..1908
- Bailey, Mrs. H. M., 1919 Douglas St., Sioux City, Iowa1918
- Baillie, James Little, Jr., Royal Ontario Museum of Zoology,
Queens Park at Bloor St., Toronto, Ontario, Canada1938
- Baird, James, St. Mark St., Jamaica Plain, Boston 30, Massachusetts ..1943
- **Baker, Bernard William, Marne, Michigan1938
- *Baker, John Hopkinson, 1006 Fifth Ave., New York City1930
- Baker, Miss Mary W[adell], 53 S. Harris Ave., Columbus, Ohio1943
- Baker, Rollin Harold, Box 171, Eagle Lake, Texas1938
- *Baker, William Calvin, 559 Euclid Ave., Salem, Ohio1931
- Baldwin, Mrs. Amy G., 6335 Kimbark Ave., Chicago, Illinois1943
- Barbee, Miss Louise S., 4322 Lindell Blvd., St. Louis, Missouri1942
- Barbour, Mrs. Charlotte Alice, Lisbon, New Hampshire1942
- Barkalow, Frederick Schenck, Jr., 207 Washington Ave.,
Marietta, Georgia1936
- **Barnes, Hon. Richard Magoon, Lacon, Illinois1908
- Barnes, William Bryan, Room 10, State House Annex,
Indianapolis, Indiana1941
- Barry, Harry L[ouis], % Mrs. F. L. Livengood, 1649 Glenn Ave.,
Columbus, Ohio1941
- *Bartel, Karl [Emil] Edgar, 2528 W. Collins St., Blue Island, Illinois ...1934
- *Bartlett, Guy, Rosendale Rd., RFD 1, Schenectady, New York1938
- *Bartsch, Dr. Paul, United States National Museum, Washington, D.C. ..1894
- *Batchelder, Charles Foster, 7 Kirkland St., Cambridge, Massachusetts ...1917
- Batchelder, Edgar Marden, 690 Lynnfield St., Lynn, Massachusetts ...1941
- Bates, Mrs. Frances Ward, 331 Washington St.,
East Walpole, Massachusetts1942
- Battell, Mrs. Harriet Chapman, 2812 Arbor St., Ames, Iowa1942
- Baumgartner, Dr. Frederick Milton, A. & M. College, Stillwater, Oklahoma 1935
- Bay, J[ens] C[hristian], % John Crerar Library, 86 East Randolph
St., Chicago, Illinois1939
- **Bean, Oakley R., Rural Mail Carrier 3, Rockville, Indiana1943
- Beard, Mrs. Allen Shelby, Stony Hollow Farm, Algonac, Michigan ...1942
- Beardslee, Clark Smith, 132 McKinley Ave., Kenmore, New York1942
- Beardsley, Miss Margaret Hortense, 736 Lafayette Ave., Ravenna, Ohio ..1941
- Beatty, Harry Andrew, Box 472, Christiansted, St. Croix, Virgin
Islands, U.S.A.1936
- Beck, Rollo Howard, Planada, California1943
- Becker, Edna E[lizabeth], Address unknown1939
- Becker, George Charles, Port Edwards, Wisconsin1941
- Bedell, Miss Marie L., 1430 West 20th St., Lorain, Ohio1940
- *Beebe, Ralph, 4169 Tenth St., Ecorse, Michigan1924
- *Beeghly, James Leon, R.D. 1, Lee Run Road, Poland, Ohio1933
- Behle, Dr. William Harroun, Department of Biology, University of
Utah, Salt Lake City, Utah1935
- Belcher, Paul Eugene, 988 Jefferson Ave., Apt. 3, Akron, Ohio1938
- *Bellrose, Frank Jr., Illinois Natural History Survey, Havana, Illinois ...1935
- Bennett, George Noel, 9219 Newburg Rd., Plymouth, Michigan1943
- *Bennett, Logan Johnson, 206 Forestry Bldg., Pennsylvania State
College, State College, Pennsylvania1934
- *Bennett, Miss Mary Allison, 623 East Carroll St., Macomb, Illinois1933
- *Bennitt, Rudolf, Department of Zoology, University of Missouri,
Columbia, Missouri1932

- Benson, Mrs. Mary Heydweiller, Feura Bush Road, RFD 1,
Delmar, New York1937
- *Bent, Arthur Cleveland, 140 High St., Taunton, Massachusetts1893
- Bergstrom, E. Alexander, 95 Evergreen Ave., Hartford 5, Connecticut ...1943
- *Berthel, Russell M[essner], Cottage Park, White Bear Lake, Minnesota 1939
- **Billington, Cecil, 21060 Thirteenth Mile Road, Birmingham, Michigan1939
- Binnington, Miss Nora Louise, 6006 Cabanne Place, St. Louis, Missouri ..1941
- Birkeland, Henry, Roland, Iowa1934
- Bishop, Howard Elmer, 206 W. Packer Ave., Sayre, Pennsylvania1941
- **Bishop, Dr. Louis Bennett, 450 Bradford St., Pasadena, California1903
- Bissonnette, T[homas] H[ume], Trinity College, Hartford, Connecticut ..1939
- Black, Charles Theodore, Route 3, Grand Ledge, Michigan1935
- *Blain, Dr. Alexander Willis, 2201 Jefferson Ave., E., Detroit, Michigan ..1902
- Blair, Charles H., 209 Ellery Ave., Jackson, Michigan1943
- *Blake, Emmet R[eid], Field Museum of Natural History, Chicago, Illinois 1939
- Blincoe, Ben Joseph, Route 1, Dayton, Ohio1919
- *Boggs, Ira Brooks, Morgantown, West Virginia1938
- *Bole, Benjamin Patterson, Jr., 2717 Euclid Ave., Cleveland, Ohio1938
- Bolt, Benjamin Franklin, 1110 Armour Blvd., Kansas City, Missouri1914
- Bond, Richard Marshall, 3607 S.W. Mt. Adams Drive, Portland, Oregon..1936
- Borell, Adrey Edwin, Soil Conservation Service, Box 1314
Albuquerque, New Mexico1936
- *Borror, Donald Joyce, Department of Zoology and Entomology,
Ohio State University, Columbus, Ohio1927
- Boulton, Rudyerd, 3317 Dent Place, Washington, D.C.1942
- Bowdish, Beecher Scoville, Demarest, New Jersey1921
- Bowen, Leon W., 77 Evergreen Ave., Bloomfield, New Jersey1942
- Bowers, J. Basil, 381 51st St., Oakland, California1942
- *Bowman, Lawrence Lincoln, Route 2, Ambler Rd., Canton, Ohio1935
- Boyd, Alvin Lee, Sig. Detach. Sat. Camp, Box 216, Pescadero, California.1943
- Boyd, Miss Elizabeth M[argaret], Mount Holyoke College, South
Hadley, Massachusetts1941
- *Brackbill, Harvey [Groff], 3201 Carlisle Ave., Baltimore 16, Maryland ..1942
- Bradley, Homer L., Chautauqua Refuge, RFD 2, Havana, Illinois1939
- Brand, Charles Salmon, 10 Brewster Terrace, New Rochelle, New York ..1941
- Brandenburg, Miss Arminta Alice, State Hospital, Toledo, Ohio1941
- **Brandreth, Courtenay, Ossining, New York1939
- *Brecher, Leonard C[harles], 1900 Spring Dr., Louisville, Kentucky1939
- *Breckenridge, Dr. Walter John, Museum of Natural History,
University of Minnesota, Minneapolis, Minnesota1929
- Breeze, F. J., Delphi, Indiana1943
- Breiding, George H., 487 National Road, Fulton, Wheeling, West Virginia.1942
- Brereton, Dr. E[wart] L[ount], Box 99, Barrie, Ontario, Canada1943
- **Bretsch, Clarence, 690 Broadway, Gary, Indiana1925
- Brigham, Edward Morris Jr., Route 1, Box 348, Battle Creek, Michigan 1931
- *Brigham, H. Storrs Jr., 3817 Sedgwick Ave., New York City1942
- Brignac, Miss Rita, Sunflower Junior College and Agricultural High
School, Moorhead, Mississippi1939
- Brimley, Clement S., Division of Entomology, North Carolina
Department of Agriculture, Raleigh, North Carolina1942
- Bristow, Harry Sherman Jr., Pine Avenue, Cedars, Delaware1942
- *Brodkorb, [William] Pierce, Museum of Zoology, Ann Arbor, Michigan..1936
- Brooking, A[ibert] M[unsell], Hastings Museum, Hastings, Nebraska ...1941
- *Brooks, A[lonzo] B[eecher], French Creek, West Virginia1931

Brooks, Dr. Earl, Noblesville, Indiana1941
*Brooks, Earle Amos, 166 Plymouth Rd., Newton Highlands,
Massachusetts1933
*Brooks, Maurice Graham, Division of Forestry, West Virginia
University, Morgantown, West Virginia1926
Broun, Maurice, The Northfield, East Northfield, Massachusetts1935
*Brouwer, Dr. Pearl Thompson, 2287 N. Lake Drive, Milwaukee,
Wisconsin1942
Brown, Clarence D., 222 Valley Rd., Montclair, New Jersey1938
Brueggemann, Miss Anna L., 584 Sheridan Ave., Columbus, Ohio1943
*Bruns, James Henry, 724 Whitney Bldg., New Orleans, Louisiana1941
*Bryens, Oscar McKinley, RFD 1, McMillan, Luce County, Michigan ...1924
Buchanan, Forest Wendell, Amsterdam, Ohio1939
*Buckheister, Carl W., 1006 Fifth Avenue, New York City1943
Buckstaff, Ralph Noyes, Oshkosh Public Museum, Oshkosh, Wisconsin ..1941
Bujak, Boleslaus Joseph, 2547 N. St. Louis Ave., Logan Square
Station, Chicago 47, Illinois1936
Bundy, M[alcolm] F[olland], R.R. 2, Atlanta, Indiana1941
**Burelbach, Maj. Martin J., 510 West 4th St., Chattanooga, Tennessee ..1942
Burland, Lee J[ohnson], Ballston Lake, New York1939
*Burleigh, Thomas Dearborn, Fish and Wildlife Service, Baton
Rouge, Louisiana1922
***Burns, Franklin Lorenzo, Berwyn, PennsylvaniaFounder
Burroughs, Raymond Darwin, Game Division, Department of
Conservation, Lansing, Michigan1937
*Burt, Dr. William Henry, Museum of Zoology, University of
Michigan, Ann Arbor, Michigan1928
*Burtch, Verdi, Branchport, New York1924
Bussewitz, Albert William, 10 Straub St., Rochester 13, New York1943
*Butchart, G. Reeves, Museum of Zoology, University of Michigan,
Ann Arbor, Michigan1943
*Butler, Lawrence Michael, 436 Holly, St. Paul, Minnesota1940
Butzen, Thomas Frank, Forest Park, Madison 5, Wisconsin1943
Cadbury, Joseph M[oores], Johnson Court, No. 1, 16 E. Johnson
St., Germantown, Philadelphia, Pennsylvania1943
Cagle, Dr. Fred R., Museum, Southern Illinois Normal University,
Carbondale, Illinois1942
*Cahalane, Victor Harrison, National Park Service, Merchandise
Mart, Chicago 54, Illinois.1933
Calvert, Earl Wellington, Haliburton, Ontario, Canada1937
Calvert, William J[onathan] Jr., 615 N. Pelham Rd.,
Jacksonville, Alabama1942
*Campbell, Louis Walker, 4531 Walker Ave., Toledo, Ohio1926
*Campbell, Miss Mildred Florence, 29 N. Hawthorne Lane,
Indianapolis, Indiana1938
Capps, Cpl. Beryl F[ranklin], 37th General Hospital, Camp
Blanding, Florida1939
*Carpenter, Floyd S., 2402 Longest Ave., Louisville, Kentucky1934
**Carrothers, Miss Vera, 14704 Alder Ave., East Cleveland, Ohio1938
*Carter, John Darlington, Lansdowne, Pennsylvania1930
*Cartwright, Bertram William, 59 Elm Park Rd., Winnipeg,
Manitoba, Canada1930
Case, Leslie Delos Sr., 714 West Madison St., Ann Arbor, Michigan ...1938
Cassel, J[oseph] Frank[lin], 1529 Dauphin Ave., Wyomissing,
Pennsylvania1940

- *Chambers, Willie Lee, Robinson Road, Topanga, California1909
 Chance, Edgar Percival, Gurdons, Witley, Godalming, Surrey, England ..1941
 *Chapman, Dr. Floyd Barton, 1944 Denune Ave., Columbus, Ohio1932
 *Chapman, Dr. Frank Michler, American Museum of Natural History,
 Central Park West at 79th St., New York City1910
 Chapman, Lawrence Boylston, 1 Woodridge Rd., Wellesley,
 Massachusetts1940
 Charles, Mrs. G[eorge] E[d], Route 1, Box 160, West Columbia,
 South Carolina1942
 *Chase, Henry B. Jr., Southern Biological Supply Co., New Orleans,
 Louisiana1932
 Chutter, Miss Mildred C., Box 229, Athens, Ohio1936
 Clapp, G[eorge] Howard, Pabst Farms, Oconomowoc, Wisconsin1941
 *Clarkson, Mrs. Edwin, 248 Ridgewood Ave., Charlotte, North Carolina .1940
 Clement, Roland C[hables], 804 Walnut St., Fall River, Massachusetts ..1941
 *Clow, Miss Marion, Box 163, Lake Forest, Illinois1929
 Coats, Miss Ruth Emily, 702 E. 1st St., Tillamook, Oregon1942
 *Coffey, Lt. Ben Barry, O.C.S. Dept. of Tactics, Ft. Sill, Oklahoma1927
 Cole, Dr. Leon Jacob, Department of Genetics, University of
 Wisconsin College of Agriculture, Madison, Wisconsin1921
 *Coles, Victor, 2910 Grasselli Ave., Westwood, Cincinnati, Ohio1929
 *Compton, Lawrence Verlyn, 409 West Webster St., Pittsburg, Kansas ..1923
 *Comstock, Kenneth E., 82 Centennial Ave., Cranford, New Jersey1943
 Comstock, W. Ogilvie, New Ipswich, New Hampshire1942
 Conrad, Charles Louis, 423 Warwood Ave., Wheeling, West Virginia1937
 Conway, Albert E[ward], Box 135, West Chester, Pennsylvania1939
 *Cook, Miss Fannye Addine, State Fish and Game Commission,
 Box 451, Jackson, Mississippi1923
 Cooley, Miss Eleanor Graham, Bot.-Chem.-Pharm. Library,
 University of Iowa, Iowa City, Iowa1936
 Coombes, Robert Armitage Hamilton, Sea Bank, Bolton-le-Sands,
 Caraforth, Lancashire, England1939
 Cordes, William Joseph Jr., 1115 Lullwater Rd., Atlanta, Georgia1941
 *Cottam, Dr. Clarence, Fish and Wildlife Service, Merchandise Mart,
 Chicago 54, Illinois1929
 Cottrell, George William Jr., 4724 Alton Place, Washington, D.C.1941
 Craighead, Frank C., 5301 41st St., N.W., Washington, D.C.1941
 Crosby, John Alexander, 56 Broadway Ave., Toronto, Ontario, Canada ..1943
 Cross, Edmund R[ust], 1751 University Ave., San Diego, California1941
 *Cruickshank, Allen Dudley, National Audubon Society, 1006 Fifth
 Ave., New York City1939
 Cunningham, Miss Elizabeth Rose, Box 85, Canton, Maine1943
 Cunningham, James W., 4312 Walnut, Kansas City, Missouri1935
 *Currier, Edmonde Samuel, 8541 N. Chicago Ave., St John's Sta.,
 Portland, Oregon1930
 Curtis, Miss Elizabeth Long, 5648 Beach Dr., Seattle, Washington1935
 Dahlberg, Wendell [Oscar], 11312 S. Michigan Ave., Chicago, Illinois ..1939
 Dale, David, Route 2, Humbert Rd., Alton, Illinois1943
 Dalke, Dr. Paul David, U.S. Wildlife Unit, University of Missouri,
 Columbia, Missouri1936
 Dambach, Charles A., Ohio Wildlife Research Station, O.S.U.,
 Columbus, Ohio1934
 Damon, David, 724 Sixth St., Ames, Iowa1933
 *Dandridge, Miss Serena K., Shepherdstown, West Virginia1943

Danner, May S. [Mrs. John M.], 1646 Cleveland Ave., N.W., Canton, Ohio	1921
**Darden, Mrs. Colgate W., Executive Mansion, Richmond, Virginia	1943
Davey, Winthrop N[ewbury], 2485 Hendee Rd., Jackson, Michigan	1941
*Davidson, William Mark, National Research Center, Beltsville, Maryland	1933
Davis, Dr. David Edward, 721 Elmwood Ave., Wilmette, Illinois	1940
Davis, George, State Teachers College, Murfreesboro, Tennessee	1936
Davis, George W., 3 Fremont St., Montpelier, Vermont	1941
Davis, Mrs. Louie Irby, Box 988, Harlingen, Texas	1933
Davis, Dr. William B., Department of Wild Game, College Station, Texas ..	1938
Day, Miss Pearl Elizabeth, 8 Alton, Milo, Maine	1943
Dean, A. Lawrence, Virginia Polytechnic Institute, Blacksburg, Virginia ..	1943
Dear, Lt. Col. L[ionel] S[extus], Box 127, Port Arthur, Ontario, Canada ..	1939
Dechen, Mrs. Lillian Orvetta, 14 Summer St., Port Dickinson, Binghamton, New York	1939
*Decker, Charles O., 6450 Kenwood Ave., Chicago, Illinois	1938
Delavan, Wayne C., R.R. 2, Box 61, Bronson, Kansas	1943
*DeLury, Dr. Ralph Emerson, Dominion Observatory, Ottawa, Ontario, Canada	1920
Dempsey, Geoffrey Hamilton, Elmhurst Hall, The University, Reading, Berkshire, England	1940
Denney, Arthur Hugh, 112 Wildlife Bldg., Columbia, Missouri	1943
Derleth, August, Sauk City, Wisconsin	1943
DeSelm, Hal R., 97 Clinton Heights Ave., Columbus, Ohio	1943
**Desmond, Hon. Thomas C[hables], Box 670, Newburgh, New York	1942
Deusing, Murl, Milwaukee Public Museum, Milwaukee, Wisconsin	1937
Devitt, Otto Edmund, 218 Eglinton Ave., E., Toronto, Ontario, Canada ..	1935
Dice, Dr. Lee Raymond, Laboratory of Vertebrate Biology, University of Michigan, Ann Arbor, Michigan	1943
Dickinson, Mrs. William Winston, 2006 Reid Ave., Bluefield, West Virginia	1942
Dille, Frederick Monroe, 822 Grand Ave., Nogales, Arizona	1912
Dingle, Edward von Siebold, Huger, South Carolina	1921
*Dixon, James Benjamin, R.D. 1, Box 688, Escondido, California	1936
Dobbins, H[ugh] C[linton], 1456 W. Clifton Blvd., Lakewood, Ohio ..	1941
Dock, George Jr., 119 Brite Ave., Scarsdale, New York	1941
*Dodge, Victor Kenney, 137 Bell Court West, Lexington, Kentucky	1935
Dole, J. Wilbur, 51 E. Stone St., Fairfield, Iowa	1930
Domm, Dr. Lincoln Valentine, Whitman Laboratory for Experimental Zoology, University of Chicago, Chicago, Illinois	1936
Donaldson, Harry Byron, Rose Lake Wildlife Experiment Station, R. 1, East Lansing, Michigan	1943
Doughty, Jacob P[hinzy], R. 2, Prospect, Kentucky	1940
*Douglass, Dr. Donald W., Game Division, Department of Conservation, Lansing, Michigan	1929
Downing, Paul E., 835 Waukegan Ave., Highland Park, Illinois	1943
Dreyfoos, Wallace David, 1212 Virginia Ave., N.E., Atlanta, Georgia ...	1941
Drum, Miss Margaret, Owatonna, Minnesota	1937
Duer, Harry E., 9304 Edmunds Ave., Cleveland, Ohio	1941
*Duffield, Marjorie [Mrs. J. W.], Frost Lane and Oakwood Drive, Peekskill, New York	1940
*DuMont, Philip Atkinson, Fish and Wildlife Service, Merchandise Mart, Chicago 54, Illinois	1928
*Duncan, Donald Pendleton, 5841 Nickerson Ave., Chicago, Illinois	1936

- Dundas, Lester Harvey, Germfask, Michigan 1943
- Dusi, Julian Luigi, 886 Wilson Ave., Columbus, Ohio 1941
- *Eagleson, Joseph P., 85 East Gay St., Columbus, Ohio 1945
- Eagleson, Mrs. Mary Stoddard, 169 Miller Ave., Columbus, Ohio 1945
- *Eastman, Whitney H[askins], % General Mills, Inc., Chamber of Commerce Bldg., Minneapolis, Minnesota 1941
- *Eastwood, Sidney Kingman, 301 S. Winebiddle Ave., Pittsburgh, Pennsylvania 1928
- Eaton, Stephen Woodman, 808 S. Main St., Geneva, New York 1942
- *Edge, Mrs. Charles Noel, 1215 Fifth Ave., New York City, 29 1931
- *Eifert, Virginia S. [Mrs. H. D.], Illinois State Museum, Springfield, Illinois 1941
- *Eifrig, Charles William Gustave, Windermere, Orange Co., Florida 1907
- Eisenmann, Eugene, 110 West 86th St., New York City 1942
- *Ekblaw, Dr. George Elbert, 511 W. Main St., Urbana, Illinois 1914
- *Ekblaw, Walter Elmer, Clark University, Worcester, Massachusetts 1910
- Elder, William Hanna, Natural Resources Bldg., Urbana, Illinois 1938
- *Elliott, Dr. Richard M., 1564 Vincent St., St. Paul, Minnesota 1940
- Ellis, Prof. Hazel Rosetta, Kenka College, Kenka Park, New York 1942
- ***Ellis, Ralph, 2420 Ridge Rd., Berkeley, California 1926
- Emerson, David L[owell], 25 Everett Ave., Providence, Rhode Island .. 1939
- *Emerson, Guy, 16 Wall St., New York City 1938
- *Emilio, Shepard Gilbert, R. 4, Laconia, New Hampshire 1929
- Emlen, Miss Eleanor Cope, Awbury, Germantown, Philadelphia, Pennsylvania 1942
- Emlen, Dr. John Thompson, Jr., Psychobiological Laboratory, Johns Hopkins Hospital, Baltimore, Maryland 1936
- Empey, Miller, Freeland, Michigan 1939
- *English, Dr. Pennoyer Francis, Department of Zoology, Pennsylvania State College, State College, Pennsylvania 1934
- Ennis, James Harold, Cornell College, Mount Vernon, Iowa 1942
- Erickson, Arnold Burton, Division of Economic Zoology, University Farm, St. Paul, Minnesota 1938
- *Erickson, Miss Mary Marilla, Santa Barbara State College, Santa Barbara, California 1930
- Erickson, Ray C[harles], 1104 Washington Ave., St. Peter, Minnesota .. 1939
- *Errington, Dr. Paul L[ester], Iowa State College, Ames, Iowa 1932
- Etz, Mrs. Elizabeth [Cecilia], Thornhedge, Wheeling, West Virginia ... 1940
- *Eustice, Alfred LeRoy, Bright Land Farm, Barrington, Illinois 1941
- *Evans, Dr. Evan Morton, 550 Park Ave., New York City 1929
- Evans, John Harwood, 517 Jackson Drive, Oshkosh, Wisconsin 1943
- Faegre, David [Colin], Belfield, Stark County, North Dakota 1940
- Fahrenheit, Fred Henry, 2912 Elmo Place, Middletown, Ohio 1942
- Fales, John House, 1917 Elkhart St., Silver Spring, Maryland 1939
- **Fargo, William Gilbert, 506 Union St., Jackson, Michigan 1923
- Farner, Donald S[tanley], 4926 Cass, Omaha, Nebraska 1941
- *Feeney, W. S., Ladysmith, Wisconsin 1937
- Feighner, Miss Lena Veta, 298-1 South Tremont St., Kansas City, Kansas 1935
- Findlay, Miss Violet L., Board of Education, 11th and Washington Sts., Wilmington, Delaware 1943
- Fischer, Richard Bernard, 140-19 Beech Ave., Flushing, New York ... 1942
- Fleetwood, Raymond Judy, Piedmont Wildlife Refuge, Round Oak, Georgia 1931
- Fleugel, James Bush, 1104 American National Bank Bldg., Kalamazoo, Michigan 1942

Floyd, E[arl] Pershing, 202 North Hogan, Pryor, Oklahoma	1939
*Floyd, Judge Joseph Larke, 1009-11 George D. Harter Bank Bldg., Canton, Ohio	1903
Flynn, Michael Burke, 415 S. Crouse Ave., Syracuse, New York	1942
*Foote, Maurice Edwin, R. 1, Mantua, Ohio	1932
Ford, Edward Russell, Newaygo, Michigan	1914
Forsyth, Mrs. Louise [Ann], Lebanon Road, Hanover, New Hampshire.	1940
Fox, Adrian Caspar, % Mrs. Nels Fasen, Leeds, North Dakota	1937
France, Horace Owen, Biology Department, University of Colorado, Boulder, Colorado	1941
*Fredine, C[larance] Gordon, Long Prairie, Minnesota	1938
Freer, Marion F., [Mrs. R. Lloyd], 4 Lenox Place, St. Louis, Missouri ..	1942
**French, Mrs. Elizabeth Thomas, 1315 Las Lomas, Albuquerque, New Mexico	1943
Frost, Herbert Hamilton, "Pen Craig", Newport, Rhode Island	1941
Fryman, Miss Kathryn E., 409 Elm St., Wyandotte, Michigan	1943
Fuller, Raymond Tiff, Winterton, New York	1943
*Furniss, Owen Cecil, 2203 First Ave., W., Prince Albert, Saskatchewan, Canada	1934
Furth, John T[homas], 436 Felton Ave., Highland Park, New Jersey	1939
*Gabrielson, Dr. Ira Noel, Fish and Wildlife Service, Merchandise Mart, Chicago 54, Illinois	1913
Gallard, Stephen Lee, 9 Lee Place, Bronxville, New York	1942
*Gammell, Dr. Robert T., Kenmare, North Dakota	1943
**Ganier, Albert F[ranklin], 2112 Woodlawn Drive, Nashville, Tennessee.	1915
Gardiner, Dan S. Jr., 1707 South 21 East, Salt Lake City, Utah	1941
Garges, Wilbur Lawrence, 119 12th Ave., Huntington, West Virginia	1943
Garrett, Miss Lois, 1709 Chestnut St., Kenova, West Virginia	1942
Garrison, Sgt. David L[loyd], 5th General Hospital, A.P.O. 519, Postmaster, New York City	1940
Gatterdam, Paul C[hristoffers], 2539 Edgewood Pl., La Crosse, Wisconsin	1940
Gavin, Angus, Eskimo Point, via Churchill, Manitoba, Canada	1942
Geiser, Ernest, R.F.D. 4, Troy, New York	1943
Gensch, Robert H[enry], Lakes States Forest Experiment Station, University Farm, St. Paul, Minnesota	1939
George, John L[othar], U.S.S. Mervine, % Fleet Postmaster, New York City	1939
Gerstell, Richard, Pennsylvania Game Commission, Harrisburg, Pennsylvania	1939
Gibbs, Harold N[elson], A-71 Sowans Rd., Barrington, Rhode Island ..	1941
Gibbs, Walter C., Whitehall, Michigan	1941
Gier, Dr. Herschel Thomas, Ohio University, Athens, Ohio	1937
Gifford, Dr. Harold, 3636 Burt, Omaha, Nebraska	1936
Gilbert, Gareth, 2422 Indianola Ave., Columbus, Ohio	1943
Gilbert, Dr. Perry Webster, Department of Zoology, Cornell University, Ithaca, New York	1942
Gillette, Delbert A., R. 5, Yakima, Washington	1942
Gillette, Miss Fredericka B., 1319 Forest Ave., Ann Arbor, Michigan ..	1938
Giltz, Maurice L[eroy], 841 Lincoln Way, N. W., Massillon, Ohio	1939
Givens, Laurence Spessard, Box 67, St. Marks, Florida	1943
Glenn, Robert W., 509 Orchard Ave., Avalon, Pittsburgh, Pennsylvania.	1934
**Glover, Ray James, R.D. 1, Addison, Pennsylvania	1943
Gloyd, Dr. Howard Kay, Chicago Academy of Sciences, 2001 North Clark St., Chicago, Illinois	1925

- *Goetz, Christian John, 3503 Middleton Ave., Cincinnati, Ohio1930
- *Goldsmith, Glenn Warren, Box 1611, University Station, Austin, Texas ..1931
- Good, Ernest E[ugene], R.R. 5, Van Wert, Ohio1937
- Goodspeed, Mrs. Olive M., 76 Willow St., Augusta, Maine1943
- *Gordon, J[esse] Halford, 139 East Second Ave., Roselle, New Jersey ..1942
- *Goslin, Charles R[ussell], 407 Washington Ave., Lancaster, Ohio1940
- Goslin, Robert M[artin], 316 Wilson Ave., Columbus, Ohio1936
- Gram, Mrs. Margaret Edwards, 409 Notre Dame Ave., Grosse
Pointe, Michigan1941
- *Grange, Wallace, Babcock, Wisconsin1941
- *Grant, Cleveland Putnam, 620 Greenup St., Covington, Kentucky1928
- Graves, Miss Katherine, 1209 North Illinois St., Apt. 28,
Indianapolis, Indiana1942
- *Gray, William Arthur, Room 646, 224 S. Michigan Ave., Chicago, Illinois.1938
- Greeley, Frederick, 200 Chestnut St., Winnetka, Illinois1942
- Green, N. Bayard, Training School, Marshall College, Huntington,
West Virginia1943
- Green, Miss Rhoda J[anet], 8 Betsy Ross Lane, Sylacauga, Alabama ...1940
- **Greene, Albert E., 1841 Cambridge Rd., Ann Arbor, Michigan1939
- Greene, Earle Rosbury, 22 Virginia Court, New Orleans, Louisiana ...1930
- Greenhalgh, Clifton M., Kanab, Utah1939
- *Gregg, Miss Pearl, Middlebourne, West Virginia1942
- *Gregory, Stephen Strong Jr., Box N., Winnetka, Illinois1922
- Griffin, Donald R[edfield], Biology Laboratory, Harvard University,
Cambridge, Massachusetts1941
- Griggs, Julian G[adden], Camp Wellston, Wellston, Michigan1939
- Grimes, Samuel Andrew, 825 South Shores Rd., Jacksonville, Florida ..1924
- *Grimm, William C[arey], Box 424, Linesville, Pennsylvania1939
- Grinnell, Lawrence I[rving], 710 Triphammer Rd., Ithaca, New York ..1939
- *Griscom, Ludlow, Museum of Comparative Zoology, Cambridge,
Massachusetts1937
- Griswold, John A[ugustus] Jr., 115 South St., Auburn, New York1941
- Grose, E. R., Sago, West Virginia1939
- Groskin, Horace, 210 Glenn Rd., Ardmore, Pennsylvania1937
- *Gross, Dr. Alfred Otto, 11 Boody St., Brunswick, Maine1927
- Gunderson, Harvey Lorraine, % Mr. H. H. Gunderson, Gary, Minnesota 1941
- Haecker, Frederick Woods, 506 South 52nd St., Omaha, Nebraska1938
- *Hagar, Mrs. Jack, Box 339, Rockport, Texas1930
- *Hague, Dr. Florence S., Sweet Briar College, Sweet Briar, Virginia ...1931
- Hahn, Miss Helen H[amilton], 71 Mill St., Williamsville, New York ...1941
- Haines, T. P., 1428 White St., Ann Arbor, Michigan1941
- *Hainsworth, William Pickard, 216 Railroad Ave., North Andover,
Massachusetts1930
- Haller, Frank D[enver], 125 S. Second St., Coshocton, Ohio1940
- *Hallman, Roy Cline, Box 826, Panama City, Florida1928
- *Hamerstrom, Lt. Frederick N. Jr., 6th Alt. Trg. Unit, AAB
Mountain Home, Idaho1934
- Hamilton, Mrs. R. E., 208 College St., Dalton, Georgia1942
- *Hamilton, Dr. William J[ohn] Jr., Department of Zoology,
Cornell University, Ithaca, New York1933
- Hammond, Merrill C[lyde], Lower Souris Refuge, Upham,
North Dakota1939
- *Handley, Charles Overton, Virginia Polytechnic Institute, Blacksburg,
Virginia1925

*Handley, Charles Overton Jr., Blacksburg, Virginia	1941
*Hann, Dr. Harry Wilbur, Department of Zoology, University of Michigan, Ann Arbor, Michigan	1930
Hanna, Wilson Creal, 141 E. F Street, Colton, California	1936
Hanson, E[lmer] Charles, Jr., 1305 Wisconsin Ave., Racine, Wisconsin	1940
Happ, George Bippus, The Principia College, Elsau, Illinois	1935
Hardy [Cecil] Ross, Dixie Junior College, Saint George, Utah	1940
*Harkness, Reed B., 4908 Laclede Ave., St. Louis, Missouri	1942
*Harper, Dr. Francis, 224 S. Chester Rd., Swarthmore, Pennsylvania ...	1930
Harrell, Byron Eugene, 1594 Stanford Ave., St. Paul, Minnesota	1943
Harrell, Frank Ridlen, Museum Libraries, University of Michigan, Ann Arbor, Michigan	1936
**Harriot, Samuel Carman, 200 West 58th St., New York City	1934
Harris, H. D., P.O. Box 579, Chappaqua, New York	1943
Harris, Mrs. I. B., 39 Franklin Park, W., Columbus, Ohio	1943
Harrison, Hal H. [Harold Holmes], The Valley Daily News, Tarentum, Pennsylvania	1941
*Hart, Frank Elmer, 2499 Medary Ave., Columbus, Ohio	1943
*Hartman, Frank A[lexander], Hamilton Hall, Ohio State University, Columbus, Ohio	1941
*Hartwell, Arthur Mowry, 1506 Mt. Curae, Minneapolis, Minnesota ...	1940
Haskins, Edith D., Hanover Rd., Lebanon, New Hampshire	1941
Hausler, Mrs. M., 7348 Paxton Ave., Chicago, Illinois	1936
**Havemeyer, Henry Osborne, Mahwah, New Jersey	1930
Hawkins, B. L., Hamline University, St. Paul, Minnesota	1936
Hawksley, Mrs. Janet P., 123 Lafayette Circle, Cincinnati, Ohio	1942
**Hebard, Frederick V[anuxem], 1500 Walnut St. Bldg., Philadelphia, Pennsylvania	1940
Heckler, S. B., Folly Farm, Cherry Plain, New York	1942
Hedges, Harold Charles, R. 2, Lake Quivira, Kansas City, Kansas	1940
*Hefley, Harold M[artin], Department of Biology, Texas Technological College, Lubbock, Texas	1942
*Heidenkamp, Joseph Jr., 538 Glen Arden Drive, Pittsburgh, Pennsylvania	1942
Heiser, Pvt. Joseph M[atthew] Jr., Hg. & Hg. Co., Reception Center, Ft. Sam Houston, Texas	1939
Henderson, Alexander, 89 Woodland Rd., Chestnut Hill, Massachusetts ..	1941
Hendricks, G. Bartlett, The Berkshire Museum, Pittsfield, Massachusetts	1943
*Hendrickson, Dr. George Oscar, Department of Zoology and Entomology, Iowa State College, Ames, Iowa	1933
*Henry, Cordia John, Lower Souris Refuge, Upham, North Dakota ...	1933
Henwood, Mrs. Ethel May, 609 West Ohio, Urbana, Illinois	1941
Herula, Joseph, 2140 Evergreen Ave., Chicago, Illinois	1942
**Hewitt, Oliver Harold, Fernow Hall, Cornell University, Ithaca, New York	1943
*Hickey, J. J., 5214 S. Woodlawn, Chicago 15, Illinois	1940
***Hicks, Dr. Lawrence Emerson, Ohio Wildlife Research Station, Ohio State University, Columbus, Ohio	1925
Hiett, Lawrence Davison, 1945 Ottawa Drive, Toledo, Ohio	1929
Higgins, Harold Guymon, 352 N. 1st E., Price, Utah	1941
Hill, Herbert Oliver, 61 Irving Place, New York City	1938
Hill, Louise B. [Mrs. Julian Werner], 1106 Greenhill Ave., Wilmington, Delaware	1935
Hill, Norman Pierce, 15 Oxford St., Arlington, Massachusetts	1941

- Hill, Raymond W., 3316 Kenmore Rd., Shaker Heights, Cleveland, Ohio. 1941
- *Hillmer, Davis B., 8228 Woodward Ave., Detroit, Michigan 1926
- *Hilton, Dr. David Clark, 305 Continental Bldg., Lincoln, Nebraska 1918
- *Hinds, Frank J., Biology Department, Western Michigan College,
Kalamazoo, Michigan 1935
- *Hinshaw, Thomas Doane, 1827 San Juan Ave., Berkeley, California 1926
- Hobson, Dorothy Madden, [Mrs. L. G.], Bloomington, Indiana 1935
- Hochbaum, Hans Albert, Delta, Manitoba, Canada 1942
- Hoff, Clayton M., 810 Blackshire Rd., Wilmington, Delaware 1943
- Hoffman, Paul William, 8415 Kenyon Ave., Wauwatosa, Wisconsin ... 1940
- Hoffmeister, Linus C[hristian], 504 W. Ripa Ave., Lemay, Missouri ... 1939
- *Holabird Christopher, 2236 Lincoln Park West, Chicago, Illinois 1940
- *Holland, Harold May, Box 615, Galesburg, Illinois 1915
- Hoodema, Richard L., 116 W. 14th St., Holland, Michigan 1941
- Horner, Sgt. William A., Hdq. Co., 103 Inf. Div. (Band), A.P.O. 470,
Shreveport, Louisiana 1943
- Horton, Louise D. [Mrs. M. B.], 360 Prospect St., Fall River,
Massachusetts 1941
- Hostetter, D[avid] Ralph, Eastern Mennonite School,
Harrisonburg, Virginia 1937
- Hotchkiss, Neil, Patuxent Research Refuge, Bowie, Maryland 1940
- Hough, Mrs. Eleanor Sloan, 4820 Olentangy Blvd., Columbus, Ohio ... 1941
- Howard, William J[ohnston], 5518 Fairglen Rd., Chevy Chase 15,
Maryland 1940
- Howe, Henry Branch Jr., 414 W. Ponce de Leon Ave., Decatur, Georgia .. 1943
- Howell, Joseph Corwin, Department of Zoology, Oklahoma A. & M.
College, Stillwater, Oklahoma 1938
- Howes, W. H., Box 310, Kindersley, Saskatchewan, Canada 1943
- Hoyt, George B[rown], 2603 Habersham Rd., Atlanta, Georgia 1941
- *Hoyt, J[ohn] Southgate Y[eston], Stark General Hospital,
Charleston, South Carolina 1936
- Huggins, Russell A., Department of Physiology, School of Medicine,
University of South Dakota, Vermillion, South Dakota 1937
- *Hughes, George Thomas, R. 2, Plainfield, New Jersey 1929
- Hulbert, Lloyd Clair, 529 West Grand River Ave., East Lansing,
Michigan 1938
- *Hunt, Ormond Edson, 14-133 General Motors Bldg., Detroit, Michigan .. 1937
- Hunter, Lawrence E., 1103 Olympia Ave., Columbia, South Carolina ... 1934
- Hurley, John Beatty, 401 S. 17th Ave., Yakima, Washington 1937
- Hutchinson, Arthur E., 715 Mission Canyon Rd., Santa
Barbara, California 1940
- Hyde, Lt. A[rthur] Sidney, SOS, SAAB, Santa Ana, California 1939
- Ingersoll, Albert Mills, 908 F Street, San Diego, California 1921
- **Ingersoll, Marian Croy, % Terwilliger, 69-11 Forest Ave.,
Ridgewood, Long Island, New York 1942
- *Jackson, Cicero Floyd, University of New Hampshire, Durham,
New Hampshire 1936
- *Jackson, Frances Lee, 541 Hammond St., Chestnut Hill, Massachusetts .. 1941
- Jameson, Everett Williams Jr., 179 Highland Ave., Buffalo, New York.. 1941
- *Jamison, C[onrad] H[eston], 2811 Acklen Ave., Nashville, Tennessee .. 1940
- *Janvrin, Dr. Edmund R. P., 38 E. 85th St., New York City 1942
- Jaques, F[rancis] L[ee], 610 West 116th St., New York City 1939
- Jaquith, Barbara Elizabeth [Mrs. L. Everett], 72 Hudson Dr.,
Toronto, Ontario, Canada 1943

- Jenkins, James H[obart], 1204 W. Chestnut, Mt. Vernon, Ohio1939
Johanson, Miss Flora Ingeborg, 229 Sagamore Rd., Millburn,
New Jersey1942
*Johnson, Irene W. [Mrs. Oscar], 38 Portland Pl., St. Louis, Missouri ..1931
Johnson, Perry Frank, 2918 S. Anthony Blvd., Fort Wayne, Indiana1935
*Johnson, Robert Anthony, 150 East St., Oneonta, New York1930
Johnson, William M[cNutt], 108 E. Depot St., Knoxville, Tennessee ..1939
Johnston, David Ware, 1037 St. Charles Ave., N. E.,
Atlanta, Georgia1943
Johnston, Miss Verna R[uth], Thornton Township High, Harvey, Illinois.1941
*Jonah, Miss Christie May, 47 Linden St., Hackensack, New Jersey1942
*Jones, Harold Charles, Mount Berry, Georgia1929
*Jones, John Courts, 718 Garfield St., Eveleth, Minnesota1931
***Jones, Dr. Lynds, 352 W. College St., Oberlin, OhioFounder
Jones, S[olomon] Paul, 509 West Ave., N., Waukesha, Wisconsin1921
Jones, Victor Emmons, University of Idaho, Southern Branch,
Pocatello, Idaho1938
Jorae, Miss Irene Frances, Central Michigan College of Education,
Mount Pleasant, Michigan1942
Jorns, Byron C., 3725 Gregory St., Madison, Wisconsin1943
*Jung, Clarence [Schram], 6383 N. Port Washington Rd.,
Milwaukee, Wisconsin1921
Jurica, Dr. E., Lisle, Illinois1940
Kahmann, Mrs. Karl W., R. 2, Hayward, Wisconsin1941
Kahn, Diana Hope [Mrs. Reuben L.], 1122 Michigan Ave.,
Ann Arbor, Michigan1938
*Kalmbach, Edwin Richard, 546 Custom House, Denver, Colorado1926
*Kase, John Charles, Versailles, Indiana1937
*Keller, Richard T., 1601 S. Fourth St., Springfield, Illinois1943
*Kelso, Leon Hugh, 1370 Taylor St., N.W., Washington, D.C.1930
Kemp, David L., 42 Thayer St., New York City1943
*Kendeigh, Dr. S[amuel] Charles, Vivarium Bldg., University of
Illinois, Champaign, Illinois1923
Kerns, Chester M., 97 West Green St., Westminster, Maryland1941
Kerr, Miss Mary Helen, 1290 Delaware, Springfield, Missouri1943
Kiefer, Mrs. Elizabeth D., 243 Gratiot Blvd., Port Huron, Michigan1941
*Kieran, John, 4506 Riverdale Ave., Bronx, New York City1942
Kindler, Mrs. Grace Emma, R. 1, Sheridan Drive, Lancaster, Ohio1937
Kirk, Allan D[ixon], 14 Forest Hill Rd., Wilkinsburg, Pennsylvania1939
Kirkpatrick, Charles Milton, Department of Forestry, Purdue
University, Lafayette, Indiana1941
*Klinkerfuss, Dr. G. H., 340 Bermuda Ave., Normandy, Missouri1941
*Klinkerfuss, Mrs. G. H., 340 Bermuda Ave., Normandy, Missouri1941
Kluge, Miss Helen H[enrika], R. 1, Woodtick Rd., Waterbury,
Connecticut1942
*Knapp, Elmer Leslie, R.F.D. 2, Troy, Pennsylvania1930
Knox, Miss Margaret Richardson, 4030 Park Ave.,
Indianapolis, Indiana1937
Koch, Peter, Terrace Park, Ohio1939
Koehler, Mrs. Arthur, 109 Chestnut St., Madison, Wisconsin1941
Koestner, E. J., Box 263, Piper City, Illinois1938
Kolb, Charles Haven Jr., 5210 Catalpha Rd., Baltimore, Maryland1937
**Kortright, Francis H., 5 St. Edmunds Dr., Toronto, Ontario, Canada ..1943
Kosten, John Leonard, 967 Pine Ave., N.W., Grand Rapids, Michigan ..1939

- *Kozicky, Edward L., 206 Forestry Bldg., State College, Pennsylvania ..1943
 Kramer, Theodore Christian, Department of Anatomy, East Medical
 Bldg., University of Michigan, Ann Arbor, Michigan1939
 Kraus, Dr. Douglas L., Department of Chemistry, California Institute
 of Technology, Pasadena 4, California1942
 Kreag, Keith K., R.R.2, Box 196, Lansing, Michigan1942
 Kuitert, Lt. Louis Cornelius, 706 Florence St., Kalamazoo, Michigan1938
 *Kutz, Dr. Harry Leon, Game Research Center, Delmar, New York1939
 *Kyllingstad, Henry C[arrell], Mountain Village, Alaska1940
 Lacey, Miss Mifton H., % Canton Girl Scouts, 433 Tusc W.
 Headquarters, Canton, Ohio1939
 Laffoon, Jean [Luther], 1401 W. Third St., Sioux City, Iowa1940
 *Lagler, Dr. Karl F., Department of Zoology, University of Michigan,
 Ann Arbor, Michigan1941
 ***Lambert, Bert H., 16854 Wildemere Ave., Detroit, Michigan1936
 *Lamson, Arrol L., Siniscroft, Simsbury, Connecticut1943
 Lanning, Robert George, 56 Chatsworth Drive, Toronto, Ontario, Canada.1942
 Lanyon, Wesley Edwin, 23 E. Wheelock St., Hanover, New Hampshire ..1943
 *Larrabee, Austin Park, Yankton College, Yankton, South Dakota1921
 *Laskey, Amelia Rudolph [Mrs. F. C.], Graybar Lane, Nashville,
 Tennessee1928
 Lawrence, William Hobart, 1410 Decatur St., N.W., Washington 11, D.C. 1943
 Lay, Daniel Wayne, 1445 Avenue G, Beaumont, Texas1939
 Lea, Robert Bashford, 737 Center St., Elgin, Illinois1940
 Lee, Dr. Howard James, Major M.C. Station Hospital, Ft. Leonard
 Wood, Missouri1941
 Leedy, Dr. Daniel Lovey, Ohio Wildlife Research Station, Ohio
 State University, Columbus, Ohio1936
 Leenhouts, Miss Pearle Esther, Pease Rd., Williamson, New York1941
 Legg, William C[larence], Mount Lookout, West Virginia1939
 *Leopold, Prof. Aldo, 424 University Farm Place, Madison, Wisconsin..1928
 Leopold, A[ldo] Starker, Box 247, West Plains, Missouri1940
 Levy, Mrs. Alice Klund, 235 East 22nd St., Apt 11T, New York City ..1941
 *Lewis, Dr. Harrison Flint, Lands, Parks and Forest Branch, Department
 of Mines and Resources, Ottawa, Ontario, Canada1939
 Lewis, Brother Hubert, Cretin High School, St. Paul, Minnesota1940
 *Lewy, Dr. Alfred, 2051 East 72nd Place, Windsor Park Station,
 Chicago, Illinois1915
 Lindzey, James S., 901 West 22nd St., Wilmington, Delaware1942
 *Linsdale, Dr. Jean Myron, Jamesburg Route, Monterey, California1928
 Linton, M[orris] Albert, 315 Oak Ave., Moorestown, New Jersey1941
 Lloyd, Clark K., 2712 Hoover Ave., Dayton, Ohio1925
 *Lloyd, Hoyes, 582 Mariposa Ave., Rockcliffe Park, Ottawa,
 Ontario, Canada1922
 Lockley, R. M., Skokholm Bird Observatory, Dale, Haverfordwest,
 Pembrokeshire, Wales, Great Britain1940
 Lodge, William Ralph, Silver Lake Estates, R. 2, Cuyahoga Falls, Ohio ..1935
 Loefer, John B[enjamin], 28 Chestnut St., Berea, Kentucky1941
 Longley, William Howard, Box 55, Bayview, Idaho1943
 Lord, Dr. Frederick P[omeroy], 39 College St., Hanover,
 New Hampshire1939
 Lovell, Dr. Harvey B., 3011 Meade Ave., Louisville, Kentucky1936
 *Lovett, Emery Jr., 2900 Via La Selva, Palos Verdes Estates,
 California1942

Low, Dr. Jessop B., School of Forestry, Utah State Agricultural
College, Logan, Utah1941

*Low, Seth Haskell, Salt Plains Wildlife Refuge, Jet, Oklahoma1931

***Lowery, George Hines Jr., Museum of Zoology, Louisiana State
University, Louisiana1937

Loyster, Earl Leroy, Wisconsin Conservation Department,
State Office Bldg., Madison, Wisconsin1943

*Ludwig, Claud Charles, 506 Wilson Bldg., Lansing, Michigan1938

Ludwig, Dr. Frederick Edwin, 2864 Military St., Port Huron,
Michigan1941

Lum, Miss Elizabeth C[aroline], 4015 29th St., Mt. Ranier, Maryland ..1940

*Lunk, William Jr., 29 Bell Run Rd., Fairmont, West Virginia1937

*Luthy, Ferd Jr., 306 North Institute, Peoria, Illinois1937

MacArthur, John W[ood] Jr., 200 Glencairn Ave., Toronto,
Ontario, Canada1941

MacDonald, Donald L[aurie], 72 Alexandra Blvd., Toronto,
Ontario, Canada1941

MacDonald, Edwin Charles, 8 Sussex Ave., Toronto, Ontario, Canada ..1942

*MacDonald, Kenneth F., Fort Niobrara National Wildlife Refuge,
Valentine, Nebraska1941

MacLean, Miss Dorothy W[illiams], 21 Ashley St., Hartford,
Connecticut1939

MacLulich, Dr. D. A., 144 Mavety St., Toronto, Ontario, Canada1933

MacMullan, Lt. Ralph Austin, Address unknown1940

*McAtee, Waldo Lee, Fish and Wildlife Service, Merchandise Mart,
Chicago 54, Illinois1911

McBeath, Donald Young, L'Anse, Michigan1936

McCabe, Robert Albert, 424 University Farm Place, Madison, Wisconsin.1942

McClure, H. Elliott, 315 S. 17th St., Ord, Nebraska1942

*McCreary, Otto, Agricultural Hall, University of Wyoming,
Laramie, Wyoming1930

McCue, Dr. Earl Newlon, Box 104, Morgantown, West Virginia1941

*McCullagh, Dr. E[rnest] Perry, 2020 E. 93rd St., Cleveland, Ohio ...1937

McGraw, Harry Arthur, 1600 5th Ave., Altoona, Pennsylvania1936

***McIlhenny, Edward Avery, Avery Island, Louisiana1910

McKeever, Otto Donald, Box 143, Rensselaer, Indiana1943

*McKnight, Edwin Thor, 5038 Park Place, Friendship Station,
Washington, D.C.1936

*McMath, Robert R., Route 4, Pontiac, Michigan1934

McMurray, Arthur A., 1101 Poplar Ave., Memphis, Tennessee1939

*McNeil, Dr. Charles Andrew, 111 West Fourth St., Sedalia, Missouri ..1914

McNeill, John T. Jr., 800 W. Fisher Ave., Logan, Philadelphia,
Pennsylvania1943

McNish, Edgar Mann, Madison, Tennessee1940

Mace, Miss Verna Marie, Department of Physiology, Colorado State
College, Fort Collins, Colorado1943

Mack, Horace Gordon, % Gilson Mfg. Co., Guelph, Ontario, Canada ..1937

Magath, Dr. Thomas Byrd, Mayo Clinic, Rochester, Minnesota1935

*Magee, Michael Jarden, 603 South St., Sault Ste Marie, Michigan1919

Magney, Mrs. G. R., Scandia, Minnesota1940

Magoon, Donald J., University of Colorado Museum, Boulder, Colorado 1943

Manners, Edward Robert, 233 Maple Ave., Westville, New Jersey1942

Manville, Richard, Museum of Zoology, University of Michigan,
Ann Arbor, Michigan1941

Markle, Jess Mathew, 917 Sierra St., Madera, California1943

- Marshall, D. M[Arthur], Hornings Mills, Ontario, Canada1941
- Marshall, William H[ampton], Box 188, Idaho Falls, Idaho1942
- *Maslowski, Karl Herbert, 1034 Maycliff Place, Cincinnati, Ohio1934
- Mason, Miss Esther, 2523 Montgomery St., Louisville, Kentucky1941
- Mathiak, Harold A[lbert], Horicon, Wisconsin1941
- *Mayfield, Dr. George Radford, Vanderbilt University, Nashville,
Tennessee1917
- *Mayfield, Harold F[ord], 3311 Parkwood Ave., Toledo, Ohio1940
- ***Mayr, Dr. Ernst, American Museum of Natural History, 79th St.
and Central Park West, New York City1933
- Mead, Frank W[aldreth], 227 Brighton Rd., Columbus, Ohio1941
- Meade, Dr. Gordon Montgomery, Strong Memorial Hospital,
260 Crittenden Blvd., Rochester, New York1937
- Mellinger, Enos Oren, North Lima, Ohio1939
- Meltvedt, Burton W., Paullina, Iowa1930
- Mendall, Howard L[ewis], 28 Pendleton St., South Brewer, Maine1936
- Meng, Heinz Karl, 116 Miller St., Ithaca, New York1943
- *Metcalf, Dr. Zeno Payne, State College Station, Raleigh, North Carolina 1900
- *Meyer, Henry, Zoology Department, University of Tennessee,
Knoxville, Tennessee1939
- Michaud, Howard H[enry], 1205 Kensington Blvd., Fort Wayne, Indiana.1938
- Michener, Harold, 418 North Hudson Ave., Pasadena 4, California1926
- Mierow, Miss Dorothy, Carnegie Museum, Oakland Sta., Pittsburgh,
Pennsylvania1940
- *Miles, Merriam Lee, Box 148, Vicksburg, Mississippi1941
- Miles, Mrs. Philip E., 1900 Arlington Place, Madison 5, Wisconsin1943
- Miller, Alden Holmes, Museum of Vertebrate Zoology, Berkeley,
California1930
- *Miller, Douglas Scott, 122 Lawrence Ave., E., Toronto,
Ontario, Canada1939
- Miller, Loye [Holmes], University of California, Los Angeles,
California1939
- Miller, Richard Fields, 2627 N. Second St., Philadelphia, Pennsylvania..1942
- Mills, Robert H[enry], 2466 Medary Ave., Columbus, Ohio1941
- Milnes, Miss Hattie Kernahan, 331 Gowen Ave., Mt. Airy,
Philadelphia, Pennsylvania1935
- *Minich, Edward C., 1047 Fairview Ave., Youngstown, Ohio1923
- Mitchell, Earl T[homas], Box D, Horicon, Wisconsin1940
- Mitchell, Harold Dies, 378 Crescent Ave., Buffalo, New York1936
- Mitchell, Helen [Mrs. R. V.], Four Winds Farm, R.D. 1, Canton, Ohio ..1943
- *Mitchell, Mrs. Osborne, R.R. 1, Streetsville, Ontario, Canada1933
- **Mitchell, Dr. Walton Iungerich, 398 Vassar Ave., Berkeley, California ...1893
- Moeran, Edward Henry, 541 Bronx River Rd., Yonkers, New York1940
- Mohler, Levi L., 1635 Smith St., Lincoln, Nebraska1942
- *Monk, Harry Crawford, 406 Avoca St., Nashville, Tennessee1920
- *Monroe, Burt Leavelle, Ridge Rd., Anchorage, Kentucky1935
- *Monson, Gale, 1312 Broadway, Needles, California1933
- *Moore, Miss Dora, 60 E. Mulberry St., Athens, Ohio1934
- Moore, George A[zro], 289 Admiral Rd., Stillwater, Oklahoma1928
- Moore, George M[itche]ll, Fisheries Laboratory, College of William
and Mary, Williamsburg, Virginia1942
- Moore, Miss Jeanne, 718 Onondaga St., Ann Arbor, Michigan1943
- Moore, Miss Laura Brooks, French Creek, West Virginia1941
- Moore, Paul Joseph, Wildlife Research Station, Ohio State University,
Columbus, Ohio1942

Moore, Robert Thomas, R.F.D. 1, Box 28A, Pasadena, California	1939
Moran, James Vincent, No. 1 Alfred St., Jamaica Plain, Boston, Massachusetts	1943
Morgan, Allen Hungerford, Cochituate Rd., Wayland, Massachusetts...	1943
Morrell, Charles K., 119 E. Maxwell St., Lexington, Kentucky	1943
Morrell, Miss Elsie, 148 Peachtree St., Knoxville, Tennessee	1942
*Morse, Miss Margarette Elthea, 11432 Mayfield Rd., Cleveland, Ohio ..	1921
*Moseley, Edwin Lincoln, University Museum, Bowling Green, Ohio ...	1925
**Moser, Dr. R[euben]Allyn, 813 N. 50th St., Omaha, Nebraska	1940
Moul, Edwin Theodore, R.D. 5, York, Pennsylvania	1942
*Moulton, Mrs. Paulina Etta, Lower School St., Sanford, Maine	1942
Mousley, William Henry, 4073 Tupper St., Westmont, Montreal, Quebec, Canada	1922
**Mudge, Edmund W. Jr., 4105 Averill Way, Dallas, Texas	1939
Mueller, Walter Josef, 3043 N. Prospect Ave., Milwaukee, Wisconsin ...	1936
Muirhead, Miss Peggy, 3945 Lake Park Ave., Chicago, Illinois	1940
Mundy, Miss Barbara B., 1009 Park Ave., New York City	1942
Munro, James Alexander, Okanogan Landing, British Columbia, Canada	1935
*Munter, Capt. William Henry, 13th Floor Alaska Bldg., 2nd and Cherry Sts., Seattle, Washington	1933
Murdock, James Ingram, 311 Irving Ave., Glendale, California	1940
*Murie, Adolph, San Carlos, Arizona	1932
*Murie, Olaus Johan, Jackson, Wyoming	1934
Murphey, Dr. Eugene Edmund, 432 Telfair St., Augusta, Georgia	1935
Murray, Rev. Joseph James, Lexington Presbyterian Church, Lexington, Virginia	1931
Musselman, T[homas] E[dgar], 124 S. 24th St., Quincy, Illinois	1940
Nash, Nathaniel C[ushing] IV, 1 Reservoir St., Cambridge, Massachusetts	1941
*Neff, Johnson Andrew, 546 Custom House, Denver, Colorado	1920
*Nelson, Arnold Lars, Food Habits Research, Fish and Wildlife Service, Washington, D.C.	1932
Nelson, Charles Ellsworth Jr., 124 Oxford Rd., Waukesha, Wisconsin ..	1937
Nelson, Edwin L[ewis], 77 Adelaide Ave., New Brunswick, New Jersey..	1939
**Nelson, Dr. Theodora, 315 East 68th St., New York City	1928
Nelson, Urban C., Soil Conservation Service, Stillwater, Minnesota ...	1939
Netting, M. Graham, Carnegie Museum, Pittsburgh, Pennsylvania	1941
Nevius, Mrs. Richard, Route 1, Greenville, Tennessee	1940
Newcomer, Miss Ruth Chisholm, Jolly Hill, Novelty, Ohio	1942
Newman, Barnett, 343 East 19th St., New York City	1942
*Newth, Donald J[ennings], 480 W. Kirby, Detroit, Michigan	1939
Newton, Earl T[homas], 5500 College St., Kansas City, Missouri	1939
*Nice, Dr. Leonard B., 5708 Kenwood Ave., Chicago 37, Illinois	1932
*Nice, Mrs. Margaret Morse, 5708 Kenwood Ave., Chicago 37, Illinois ...	1921
*Nichols, Charles Ketcham, 212 Hamilton Rd., Ridgewood, New Jersey ..	1933
Nichols, John Treadwell, American Museum of Natural History, 79th and Central Park West, New York City	1941
Nichols, L[eon] Nelson, 331 East 71st St., New York City	1937
*Nickell, Walter Prine, Cranbrook Institute of Science, Bloomfield Hills, Michigan	1943
Nixdorf, Elbert Baker, 961 East King St., Lancaster, Pennsylvania	1943
*Nordquist, Theodore, 549th, C.A. Bn., Camp Edwards, Massachusetts ...	1941
Norris, Robert Allen, 1408 North College Ave., Tifton, Georgia	1941
Norris, Russell T[aplin], Box 847, Preston Laboratory, Butler, Pennsylvania	1939
*Norse, William J[ohn], 531 West 211th St., New York City	1939

- North, George Webster, 249 Charlton Ave., Hamilton, Ontario, Canada .1941
 Nyc, Frederick Francis Jr., Box 869, Brownsville, Texas1943
 *Oberholser, Dr. Harry Church, Cleveland Museum of Natural History,
 2717 Euclid Ave., Cleveland 15, Ohio1894
 O'Conner, Miss Esther Laura, 4344 Locust Ave., Kansas City, Missouri ..1940
 *Odom, Dr. Eugene Pleasants, Department of Zoology, University of
 Georgia, Athens, Georgia1930
 Oliver, Miss Mary Clara, Ganado Mission, Ganado, Arizona1934
 Olsen, Humphrey A., Pikeville College Library, Pikeville, Kentucky1941
 Olson, Mrs. Gladys E., 17906 Lake Road, Lakewood, Ohio1942
 **Osborn, Hon. Chase Salmon, Sault Ste Marie, Michigan1943
 *Osgood, Dr. Wilfred Hudson, Field Museum of Natural History,
 Chicago, Illinois1910
 Otis, Dr. Charles Herbert, Department of Biology, Bowling Green
 State University, Bowling Green, Ohio1937
 Ott, Frederick Louis, 2527 N. Wahl Ave., Milwaukee, Wisconsin1941
 *Overing, Robert, R.F.D. 4, Raleigh, North Carolina1930
 *Owre, Oscar Jr., 2625 Newton Ave., S., Minneapolis, Minnesota1935
 Painton, Dr. Harry R., 488 Lilac Dr., Montecito, Santa Barbara Co.,
 California1939
 *Palmer, Ralph Simon, Department of Zoology, Vassar College,
 Poughkeepsie, New York1934
 *Palmer, Dr. Theodore Sherman, 1939 Biltmore St., N.W.,
 Washington, D.C.1914
 Parker, Henry M[elville], 122 School St., Concord, New Hampshire ...1941
 Partch, Max L[orenzo], 613 W. Prairie St., Columbus, Wisconsin1940
 *Patterson, Lt. Robert, Cadiz, Ohio1943
 Paxton, Thomas R[ice], 1064 East Clifton Rd., N.E., Atlanta, Georgia ..1941
 *Pearce, John, 643 Park Sq. Bldg., Boston, Massachusetts1939
 *Peartree, Edward William, 425 S. State St., Oconomowoc, Wisconsin ...1941
 *Peasley, Mrs. Harold Raymond, 2001 Nash Drive, Des Moines, Iowa1934
 Peavey, Mrs. Leonore Gastineau, 4222 Carrollton, Indianapolis, Indiana .1937
 Peelle, Miles L., 329 Rice St., Adrian, Michigan1940
 *Peet, Dr. Max Minor, 2030 Hill St., Ann Arbor, Michigan1935
 Penner, Lawrence R., Department of Zoology, University of
 Connecticut, Storrs, Connecticut1940
 Perner, Miss Margaret E., 2463 Woodridge Rd., Cleveland Heights, Ohio 1943
 Peters, Miss Ellen, 442 5th St., Brooklyn, New York1942
 *Peters, Harold Seymour, 107 River Rd., Ashley Forest, Charleston,
 South Carolina1924
 *Peterson, Alfred, Box 201, Brandt, South Dakota1931
 Peterson, Mrs. Charles Emil, Madison, Minnesota1936
 Peterson, Lt. Liven A[dam], 904 South 4th Ave., Virginia, Minnesota ..1940
 *Peterson, Roger Tory, National Audubon Society, 1006 Fifth Ave.,
 New York City1942
 Peterson, Mrs. Theodore, 80 Oaklawn Ave., Battle Creek, Michigan1941
 Petrides, George Athan, 259 King Ave., Athens, Georgia1942
 *Pettingill, Dr. Olin Sewall Jr., Department of Zoology, Carleton
 College, Northfield, Minnesota1930
 **Phelps, William H[enry], Apartado 2009, Caracas, Venezuela1940
 **Philipp, Frederick Bernard, 99 John St., New York City1940
 *Phillips, Cpl. Alan Robert, Det. Med. Dept., Kennedy General
 Hospital, Memphis, Tennessee1934
 *Pickwell, Dr. Gayle Benjamin, State Teachers College, San Jose,
 California1923

*Pierce, Robert Allen, Nashua, Iowa	1941
*Pirnie, Dr. Miles David, W.K.Kellogg Bird Sanctuary, Augusta, Michigan	1928
Pitelka, Frank Alois, Museum of Vertebrate Zoology, University of California, Berkeley, California	1938
Plath, Karl, 2847 Giddings St., Chicago, Illinois	1942
**Poole, Cecil A., 830 Chapman St., San Jose 11, California	1942
*Poor, Hustace Hubbard, 112 Park Ave., Yonkers, New York	1935
*Porter, Thomas Wayne, 307 S. Lansing St., Mount Pleasant, Michigan ...	1938
*Potter, Julian Kent, 437 Park Ave., Collingswood, New Jersey	1915
Potter, Louis Henry, R.F.D. 2, West Rutland, Vermont	1941
*Pough, Richard Hooper, 33 Highbrook Ave., Pelham, New York	1938
Prather, Millard F[illmore], 912 McMillan Ave., W.E., Apt. H, Birmingham, Alabama	1940
*Preble, Edward Alexander, 3027 Newark St., Washington, D. C.	1929
*Preble, Norman A[lexander], Biology Department, Ashland College, Ashland, Ohio	1941
*Presnall, Mrs. Clifford Charles, Lake Zurich, Illinois	1930
*Prill, Dr. Albert G., Main St., Scio, Oregon	1921
**Procter, William, Bar Harbor, Maine	1937
Prucha, Miss Alma H., 3052 N. Maryland Ave., Milwaukee, Wisconsin ...	1942
*Puschel, Paul, 520 Drexel Ave., Glencoe, Illinois	1939
Putnam, Loren Smith, Box 202, College Station, Murray, Kentucky ...	1942
*Pyle, George Winner, South Valley Rd., Box 604, Paoli, Pennsylvania ..	1939
Quay, Thomas L[avelle], Department of Zoology, North Carolina State College, Raleigh, North Carolina	1939
Quimby, Don C., 4742 Garfield Ave., S., Minneapolis, Minnesota	1942
Ragusin, Anthony Vincent, Box 496, Biloxi, Mississippi	1937
Rahe, Carl W., 4666 Turney Rd., Cleveland, Ohio	1931
Ramisch, Miss Marjorie, 1835 Noble Rd., No. 28, East Cleveland, Ohio ...	1943
Ramsden, Dr. Charles Theodore, 8 and 19, Vista Alegre, Santiago, Cuba	1914
Rapp, William F[rederick], Jr., 130 Washington Ave., Chatham, New Jersey	1941
*Rebmann, G. Ruhland, Jr., 7007 Hampden Lane, Edgemoor, Bethesda, Maryland	1941
*Reeder, Miss Clara Maude, 1608 College Ave., Houghton, Michigan ...	1938
*Reese, Mrs. Hans H., Circle Close, Shorewood Hills, Madison, Wisconsin.	1941
Rett, Egmont Z[achary], Museum of Natural History, Santa Barbara, California	1940
Reuss, Alfred Henry Jr., 12910 S. Mozart St., Blue Island, Illinois	1936
Rice, Mrs. Harry Wilson, 3940 Richfield Rd., Minneapolis, Minnesota ..	1940
*Ricker, Dr. W. E., Department of Zoology, Indiana University, Bloomington, Indiana	1943
*Ricks, Jesse J., 30 East 42nd St., New York City	1931
Riggs, Carl D., 548 S. State St., Ann Arbor, Michigan	1943
Riner, Miss Alice, 503 S. Millwood, Wichita, Kansas	1939
Ritchie, R. C., 250 Riverside Drive, Toronto, Ontario, Canada	1942
*Roads, Miss Myra Katie, 463 Vine St., Hillsboro, Ohio	1914
Robbins, Chandler S[eymour], Patuxent Research Refuge, Bowie, Maryland	1941
Robbins, Samuel Dowse Jr., 910 W. Dayton St., Madison, Wisconsin ...	1941
Roberts, Homer Donald, 1011 Hazel St., Birmingham, Michigan	1943
**Roberts, Dr. Thomas Sadler, Museum of Natural History, University of Minnesota, Minneapolis, Minnesota	1914
***Rogers, Charles Henry, East Guyot Hall, Princeton, New Jersey	1903

- Rogers, Irl, 402 Alturas Ave., Modesto, California1937
- *Rogers, Mrs. Walter E., 911 E. North St., Appleton, Wisconsin1931
- *Rollo, Mrs. W. E., Otis Rd., Barrington, Illinois1942
- Root, Oscar M[itche]ll, Brooks School, North Andover, Massachusetts ..1940
- Rorimer, Irene Turk [Mrs. J. M.], 39 University Circle,
Charlottesville, Virginia1938
- Rosene, Walter Melvin Jr., 1212 Jupiter, Gadsden, Alabama1923
- *Rosewall, Dr. Oscar Waldemar, Department of Zoology, Louisiana
State University, University, Louisiana1931
- Ross, Charles Chandler, 7924 Lincoln Dr., Chestnut Hill,
Philadelphia, Pennsylvania1937
- *Rossbach, Dr. George Bowyer, Poynette, Wisconsin1943
- *Roth, Conrad, Box 1108, Portsmouth, Ohio1943
- Rowland, Miss Caroline, 276 Chestnut Ave., N.E., Warren, Ohio1942
- Rudd, Robert L., 225 W. Alisal, Salinas, California1939
- Ruecker, Miss Emilie, Seapowet Ave., Tiverton, Rhode Island1943
- *Rust, Henry Judson, Box 683, Coeur d'Alene, Idaho1921
- *Rysgaard, George Nielson, Museum of Natural History, University
of Minnesota, Minneapolis, Minnesota1937
- Sampson, Miss Mabel, 67 East 8th St., Winona, Minnesota1943
- Sandve, J. Reuben, 863 23rd Ave., Minneapolis, Minnesota1943
- *Satterthwait, Mrs. Elizabeth Allen, 806 W. Ohio St., Urbana, Illinois ...1925
- Saugstad, N[els] Stanley, R. 4, Minot, North Dakota1939
- *Saunders, Aretas Andrews, 361 Crestwood Rd., Fairfield, Connecticut ..1934
- *Saunders, Dr. George Bradford, Fish and Wildlife Service, 1623 N.W.
Washington St., Brownsville, Texas1926
- *Savage, James, Buffalo Athletic Club, Buffalo, New York1939
- Sawyer, Miss Dorothy, R.F.D. 1, Unadilla, New York1937
- Schaller, Ralph A., State University, Bowling Green, Ohio1943
- Schaub, Mary Hall [Mrs. J. B.], 1040 Isabella St., Wilmette, Illinois ..1939
- Schlenker, Miss Lydia, 410 Floyd St., Toledo, Ohio1937
- *Schneider, Miss Evelyn J., University of Louisville, Belknap
Campus, Louisville, Kentucky1935
- *Schorger, Dr. Arlie William, 168 North Prospect Ave., Madison,
Wisconsin1927
- Schroeder, Miss Clara, Address unknown1937
- *Schuette, Chal, 1446 Beaver Rd., Sewickley, Pennsylvania1942
- Schutz, Miss Clara I[rene], 277 Park Place, Meadville, Pennsylvania ...1941
- Schwall, Eugene Edward, New Concord, Ohio1943
- *Schwartz, Charles Walsh, R 6, Columbia, Missouri1943
- Scotland, Dr. Minnie Brink, 42 Continental Ave., Cohoes, New York ...1938
- Scott, Dr. Thomas George, Department of Zoology, Science Bldg.,
Ames, Iowa1936
- Scott, Walter Edwin, Mendota Beach Heights, Madison 5, Wisconsin ...1938
- Seibert, Henri C., 204 Vivarium Bldg., Wright and Healey Sts.,
Champaign, Illinois1941
- *Sener, Miss Ruth, 233 Charlotte St., Lancaster, Pennsylvania1943
- Serbousek, Miss Lillian, 1226 Second St., S.W., Cedar Rapids, Iowa1935
- *Shaffer, Chester Monroe, 125 Spence Place, Knoxville, Tennessee1934
- Sharp, Dr. Ward M., Valentine Lakes Waterfowl Refuge,
Valentine, Nebraska1936
- Shaver, Jesse M., George Peabody College for Teachers, Nashville,
Tennessee1922
- Shaw, Dr. Charles H[icks], Bremen, Ohio1941
- Shaw, Mrs. Elizabeth Martin, 2312 Stuart Ave., Richmond 20, Virginia ..1943

**Shearer, Dr. Amon Robert, Mont Belvieu, Chambers Co., Texas	1893
*Shelford, Dr. Victor Ernest, Vivarium Bldg., Wright and Healey Sts., Champaign, Illinois	1931
Shepherd, J. Max, 504 River Rd., Maumee, Ohio	1941
Sheppard, Roy Watson, 1805 Mouland Ave., Niagara Falls, Ontario, Canada	1933
Sherwood, John Willitts, 26 Smith St., Salinas, California	1936
Shirling, Albert Elwood, 3849 E. 62nd St., Kansas City, Missouri	1941
Short, [Hubert] Wayne, 1207 N. 7th St., St. Louis, Missouri	1941
Shortt, Angus H., 101 Morier Ave., St. Vital, Winnipeg, Manitoba, Canada	1942
Shortt, Terence Michael, Royal Ontario Museum of Zoology, Queens Park at Bloor St., Toronto, Ontario, Canada	1941
Shubeck, Paul [Peter], 440 Bond St., Elizabeth, New Jersey	1943
Sibley, Charles G., 1438 Hawthorne Terrace, Berkeley, California	1942
Simmons, Mrs. Amelia C., 2007 N. Holton St., Milwaukee, Wisconsin	1943
***Simmons, Edward McIlhenny, Avery Island, Louisiana	1942
Simpson, William B., 1101 Poplar Ave., Memphis, Tennessee	1943
Sims, Harold Lee, 714 St. Philip St., Thibodaux, Louisiana	1942
*Singleton, Mrs. Albert, 68 W. Cooke Rd., Columbus, Ohio	1943
Skaggs, Merit Bryan, Julian Rd., South Euclid, Ohio	1934
Slack, Miss Mabel, 1004 Everett Ave., Louisville, Kentucky	1934
Slagle, Elmer Charles, 115 Court House, Duluth, Minnesota	1941
*Smith, Dr. Arthur Francis, Manning, Iowa	1934
*Smith, Frank Rush, R.F.D. 2, Box 100, Laurel, Maryland	1910
Smith, Miss Gwendolyn B., 205 Noland St., Falls Church, Virginia	1942
*Smith, Harry Madison, Whitman Laboratory of Experimental Zoology, University of Chicago, Chicago, Illinois	1936
*Smith, Lewis MacCuen, 8040 St. Martins Lane, Chestnut Hill Sta., Philadelphia, Pennsylvania	1931
Smith, Luther Ely, 1554 Telephone Bldg., 1110 Pine St., St. Louis, Missouri	1941
Smith, Orion O., 1539 Crosby St., Rockford, Illinois	1936
*Smith, Roy Harmon, 183 N. Prospect St., Kent, Ohio	1936
Smith, Thomas [Price], Osage Ave., Anchorage, Kentucky	1941
Smith, Wendell Phillips, Wells River, Vermont	1921
Snapp, Mrs. Edith LaVantia, 310 W. Michigan Ave., Urbana, Illinois ..	1940
Snyder, Lester Lynne, Royal Ontario Museum of Zoology, Queens Park at Bloor, Toronto 5, Ontario, Canada	1929
Snyder, Richard Craine, 431 Clark St., South Orange, New Jersey ...	1940
Sooter, Clarence Andrew, Malheur National Wildlife Refuge, Burns, Oregon	1940
Soper, J[oseph] Dewey, 827 Riverwood Ave., Fort Garry, Winnipeg, Manitoba, Canada	1937
Spangler, Miss Iva M., 128 E. Foster Parkway, Fort Wayne, Indiana ...	1939
Spawn, Gerald B., South Dakota State College, Brookings, South Dakota	1941
Spear, Ivan MacDonald, 39 W. Elm St., Yarmouth, Maine	1942
*Speirs, Mrs. Doris Huestis, Ancaster, Ontario, Canada	1936
Speirs, John Murray, Ancaster, Ontario, Canada	1931
Spencer, Miss O[live] Ruth, 1030-25 Ave. Court, Moline, Illinois	1938
Sperry, Charles Carlisle, 1455 S. Franklin St., Denver, Colorado	1931
Spofford, Walter Richardson II, Vanderbilt University Medical School, Nashville, Tennessee	1942
Stabler, Robert M[iller], Glen Mills, Pennsylvania	1939
Stacey, J[ohn] W[illiam], 236 Flood Bldg., San Francisco, California ...	1940

- Stackpole, Richard, 292 Beacon St., Boston, Massachusetts1940
- Staebler, Arthur Eugene, Museum of Zoology, University of Michigan,
Ann Arbor, Michigan1937
- **Stahl, Miss Marjoretta Jean, Kimberly, West Virginia1942
- Stanford, Jack A[rchibald], 328 John St., Ann Arbor, Michigan1941
- Stark, Miss Wilma R[uth], 1701 16th St., N.W., Washington, D.C.1939
- Starrett, William Charles, % W. E. Starrett, 105 Glen Oak Court,
Peoria, Illinois1933
- *Stebbins, Miss Fannie Adell, 31 Ely Ave., West Springfield, Massachusetts.1935
- Steggerda, Dr. Morris, Department of Genetics, Carnegie Institution
of Washington, Cold Spring Harbor, Long Island, New York1941
- Stephens, Dr. Thomas Calderwood, Morningside College, Sioux City,
Iowa1911
- Stevens, Dwight W., 1722 Brenner St., Saginaw, Michigan1941
- *Stevens, O. A., State College Station, Fargo, North Dakota1926
- Stevenson, Henry M. Jr., Department of Biology, University of
Mississippi, University, Mississippi1943
- Stevenson, H[orace] Godwin Jr., 641 Woodward Way, Atlanta,
Georgia1939
- *Stevenson, James Osborne, 6633 Sheridan Rd., Chicago, Illinois1943
- *Stewart, Paul Alva, Leetonia, Ohio1925
- Stewart, Robert Earl, Patuxent Research Refuge, Bowie, Maryland1939
- *Stickney, Mrs. Albert Jr. % H. E. Herrick, Woodmere, Long Island,
New York1935
- *Stiles, Bruce F., 1546—30th St., Des Moines, Iowa1935
- *Stillwell, Jerry E., 7460 San Benito Way, R. 4, Dallas, Texas1935
- *Stine, Miss Perna M., State Teachers College, Minot, North Dakota1931
- **Stoddard, Herbert Lee, Sherwood Plantation, R.F.D. 5,
Thomasville, Georgia1916
- Stone, Harry H[erbert], Jr., Box 101, Sturbridge, Massachusetts1941
- *Stoner, Dr. Dayton, New York State Museum, Albany, New York1912
- Stophlet, John Jermain, 2612 Maplewood Ave., Toledo, Ohio1934
- Storer, John Humphreys, 579 Beaver St., Waltham, Massachusetts1939
- Storer, Robert Winthrop, Museum of Vertebrate Zoology,
Berkeley, California1938
- *Storer, Dr. Tracy Irwin, Division of Zoology, University of California,
Davis, California1928
- Stoudt, Jerome H., 209 N. Mill St., Waupun, Wisconsin1941
- *Street, J. Fletcher, 1120 Locust St., Philadelphia, Pennsylvania1943
- Street, Thomas M., Bottineau, North Dakota1940
- ***Strehlow, Elmer William, 721 W. Mason St., Green Bay, Wisconsin ...1941
- Stringham, Dr. Emerson, General Delivery, Austin, Texas1940
- ***Strong, Dr. Reuben Myron, 5840 Stony Island Ave., Hyde Park Sta.,
Chicago, Illinois Founder
- Struck, Dr. Kuno Herbert, 1003 First National Bank Bldg.,
Davenport, Iowa1942
- Stupka, Arthur, Great Smoky Mts. National Park, Gatlinburg,
Tennessee1935
- ***Sturgeon, Myron T., Michigan State Normal College, Ypsilanti, Michigan.1934
- Sturgis, S. Warren, 66 Marlboro St., Boston, Massachusetts1941
- *Sturm, Louis, Sheffield Rd., Glendale, Ohio1943
- *Sumner, Lowell, Box 188, Menlo Park, California1943
- *Suthard, James Gregory, 1881 Raymond Ave., Long Beach, California ..1936

***Sutton, Capt. George Miksch, A.C., Arctic Section, ADTIC, 25 Broad St., New York City	1920
*Swanson, Dr. Gustav, Division of Economic Zoology, University of Minnesota, University Farm, St. Paul, Minnesota	1927
*Swedenborg, Ernie David, 4905 Vincent Ave., S., Minneapolis, Minnesota	1929
Swoger, Arthur Glenn, 921 Wood St., Wilkinsburg, Pennsylvania	1943
*Taber, Wendell, 3 Mercer Circle, Cambridge, Massachusetts	1936
Tallman, William S[weet], 4 Linden Pl., Sewickley, Pennsylvania	1940
*Tanger, Mrs. C. Y., 318 N. President Ave., Lancaster, Pennsylvania ...	1943
Tanghe, Leo J., 120 Barnard St., Rochester, New York	1943
Tanner, James Taylor, 16½ N. Church St., Cortland, New York	1937
Tatum, Miss Bernice, 1105 Lowell, Kansas City 2, Kansas	1943
*Taverner, Percy Algernon, 45 Leonard Ave., Ottawa, Ontario, Canada ...	1905
*Taylor, Dr. Aravilla Meek, Lake Erie College, Painesville, Ohio	1936
***Taylor, Dr. Arthur Chandler, Irving Zuelke Bldg., Appleton, Wisconsin.	1929
Taylor, Miss Joanne, 1176 Shattuck, Berkeley, California	1941
***Taylor, Rose Schuster [Mrs. H. J.], 900 Santa Barbara Rd., Berkeley, California	1916
*Taylor, Walter Penn, 254 Faculty Exchange, College Station, Texas ...	1937
Taylor, William Ralph, Museum of Vertebrate Paleontology, University of Kansas, Lawrence, Kansas	1940
*Teachenor, Dix, 1020 West 61st St., Kansas City, Missouri	1923
*Templeman, Dr. Wilfred, Memorial University College, St. John's, Newfoundland	1943
Thacher, S. Charles, 2918 Brownsboro Rd., Louisville, Kentucky	1942
*Thomas, Edward Sinclair, 319 Acton Rd., Columbus, Ohio	1921
*Thomas, Mrs. Rowland, R.F.D. 3, North Little Rock, Arkansas	1937
Thomson, Nelson P., 61 W. Eleventh Ave., Columbus, Ohio	1943
*Thornton, William James, Box 1011, Birmingham, Alabama	1940
***Thorp, George Boulton, % Arens Controls, Inc., 2253 Halsted St., Chicago, Illinois	1935
*Tift, Richard, Madison Terrace Apts., Albany, Georgia	1937
*Tinker, Almerin David, R.F.D. 1, Chelsea, Michigan	1909
*Tipton, Dr. Samuel R[idley], University of Alabama Medical School, Tuscaloosa, Alabama	1941
Todd, Mrs. Elizabeth D., 918 West Main St., Kalamazoo, Michigan ...	1939
Todd, George Kendall, 770 Browning Ave., Salt Lake City, Utah	1943
Todd, Henry Oliver, Jr., Woodbury Road, Murfreesboro, Tennessee ...	1938
Todd, Mrs. Mabel [Augusta], 1622 Kensington St., Houston, Texas ...	1940
**Todd, W[alter] E[dmond] Clyde, Carnegie Museum, Pittsburgh, Pennsylvania	1911
*Tomkins, Ivan Rexford, 513 E. Duffy St., Savannah, Georgia	1931
Toner, George Clive, 63 Lowther Ave., Toronto, Ontario, Canada ...	1939
*Townsend, Miss Elsie White, Wayne University, Detroit, Michigan ...	1938
*Trautman, Milton Bernhard, Stone Laboratory, Put-in-Bay, Ohio ...	1932
Trimm, Wayne, 165 Strong Ave., Syracuse, New York	1943
Tryon, Clarence Archer Jr., Zoology Department, Montana State College, Bozeman, Montana	1942
*Tubbs, Farley F., Game Division, Department of Conservation, Lansing, Michigan	1935
***Tucker, Mrs. Carll, Penwood, Mount Kisco, New York	1928
Tucker, Edward Robert, 245 N. Auburndale, Memphis, Tennessee	1942

- *Turner, Miss Ruth D[ixon], Department of Zoology, Vassar College,
Poughkeepsie, New York1939
- Tvedt, Harold B[loom], MDR. P-MFSS, Carlisle Barracks,
Pennsylvania1941
- *Twomey, Dr. Arthur Cornelius, Carnegie Museum, Pittsburgh,
Pennsylvania1936
- *Tyler, Dr. Winsor Marrett, 1482 Commonwealth Ave., Brighton,
Massachusetts1914
- *Uhler, Francis Morey, Patuxent Research Refuge, Bowie, Maryland ...1931
- **Uhrig, Mrs. A. B., Box 28, Oconomowoc, Wisconsin1926
- Umbach, Miss Margaret, 2526 East Drive, Fort Wayne, Indiana1941
- *Vaiden, Meredith Gordon, Rosedale, Mississippi1937
- Van Camp, Laurel, Genoa, Ohio1943
- Vandervort, Charles Champion, Laceyville, Pennsylvania1937
- Van Epps, Claude A., 824 Eighth St., Brookings, South Dakota1943
- *van Rossem, Adriaan Joseph, 2205 West Adams St., Los Angeles,
California1939
- **Van Tyne, Mrs. C. H., 349 East Ridgewood Ave., Ridgewood,
New Jersey1939
- ***Van Tyne, Josselyn, Museum of Zoology, University of Michigan,
Ann Arbor, Michigan1922
- Varney, Eugene H., South Egremont Rd., Great Barrington,
Massachusetts1943
- *Vaughan, William Coleman, 591 Ashland Ave., Buffalo, New York1933
- Velich, Ralph W., 5212 S. 23rd St., Omaha, Nebraska1941
- Vesall, David Bernard, Stillwater, Minnesota1940
- Vesey, W. Glenn, 102 East High St., Painesville, Ohio1943
- *Visscher, Dr. Paul, Biology Laboratory, Western Reserve University,
Cleveland, Ohio1924
- *Vogt, William, % Mrs. F. V. Brown, 32 Cunningham Ave., Floral
Park, New York1935
- Voke, Miss Mabel, 243 Eighteenth Ave., Columbus, Ohio1943
- *Vollmar, Mrs. Joseph E., 6138 Simpson Ave., St. Louis, Missouri1941
- *Wade, Douglas E., Dartmouth College, Hanover, New Hampshire1936
- Walker, Dr. Charles Frederic, Stone Laboratory, Put-in-Bay, Ohio1939
- Walker, M. V., Glacier National Park, Box 406, Belton, Montana1943
- ***Walkinshaw, Dr. Lawrence Harvey, 1416½ W. Michigan Ave.,
Battle Creek, Michigan1928
- Wallace, George John, Zoology Department, Michigan State College,
East Lansing, Michigan1937
- Wallner, Alfred, 111 Roby Rd., Madison, Wisconsin1941
- Wangnild, Miss Lillian M., 2818 Gaylord St., Denver 5, Colorado1943
- Wanless, Dr. Harold R[ollin], 704 S. McCullough St., Urbana, Illinois ..1940
- Warner, Mrs. Carmen Hambleton, 177 W. Hubbard Ave.,
Columbus, Ohio1939
- *Watson, Dr. Clarence W., Box 833, Atlanta, Georgia1943
- Watson, Frank Graham, 2418 Chestnut Ave., Long Beach, California ...1937
- Watson, Robert J., Box 75, Blacksburg, Virginia1943
- *Weaver, Richard Lee, Audubon Nature Center, Port Chester, R.D. 1,
New York1936
- Weber, Edmund P., 95 Ingram Ave., Pgh, No. 5, Ingram,
Pennsylvania1942.
- *Weber, Louis M[arkus], 2713 Dodier St., St. Louis, Missouri1941
- *Weber, Orlando Franklin Jr., Mount Kisco, New York1936

Webster, Cpl. J[ackson] Dan, Co. E., M.D.E.T.S., O'Reilly General Hospital, Springfield, Missouri	1939
Webster, [Noah] Randall, 341 Western Ave., Brookville, Pennsylvania ..	1940
Weingart, Vernon Rolland, R.D. 1, Kent, Ohio	1940
*Welch, Mrs. Lola Harriet, 610 Bowen St., Savanna, Illinois	1943
Welles, Mrs. Mary Pyke, R.F.D. 2, Ossining, New York	1938
Wessel, John P., Wright City Junior College, 3400 Austin Blvd., Chicago, Illinois	1941
Wester, Russell William, 112 Prospect St., Nutley, New Jersey	1942
*Wetmore, Dr. Alexander, U.S. National Museum, Washington, D.C.	1903
*Weydemeyer, Winton, Fortine, Montana	1930
*Weyl, Edward Stern, 6506 Lincoln Drive, Mt. Airy, Philadelphia, Pennsylvania	1927
Wharram, S. V., Austinburg, Ohio	1943
*Wheatland, Miss Sarah Bigelow, 532 State St., Bangor, Maine	1942
Wheeler, Miss Ruth, 3340 W. 37th Ave., Denver 11, Colorado	1943
White, Courtland Y., 1118 Spruce St., Philadelphia, Pennsylvania	1942
*White, Francis Beach, Silk Farm Rd., R. 2, Concord, New Hampshire ..	1926
*White, Miss Katherine A[ugusta], R. 2, Collinsville, Illinois	1940
Whitney, Nathaniel Ruggles, Jr., Lowell M-33, Cambridge, Massachusetts	1942
*Whittier, Mrs. Lida, 2830 E. 13th St., Cleveland, Ohio	1943
Widdicombe, Harry T., 15 College Ave., N.E., Grand Rapids 3, Michigan	1943
Widmann, Berthold, 4621 Wesley Ave., Los Angeles, California	1936
*Wiggin, Henry Taylor, 151 Tappan St., Brookline, Massachusetts	1941
Wilcox, Harry Hammond, Jr., Madison Court, Ann Arbor, Michigan	1938
Wiles, Harold O[liver], 26 Boxwood Ave., Wilmington, Delaware	1936
Wilkowski, William, 119 Bronson Ct., Kalamazoo 12, Michigan	1943
*Williams, Laidlaw Onderdonk, Box 453, Carmel, California	1930
*Wilson, Archie F[ran cis], 1322 Braeburn Rd., Flossmoor, Illinois	1937
Wilson, Bruce V., Okemos, Michigan	1943
Wilson, Mrs. Carl, 11285 Lakepoint, Detroit 24, Michigan	1941
*Wilson, Dr. Gordon, 1434 Chestnut St., Bowling Green, Kentucky ...	1920
Wilson, Harold Charles, Ephraim, Wisconsin	1938
Wilson, Myrtha M. [Mrs. Henry E.], R. 3, Raleigh, North Carolina ...	1942
Wilson, Rowland Steele, Address unknown	1941
**Wineman, Andrew, 150 Michigan Ave., Detroit, Michigan	1934
Wing, Harold Francis, R. 3, Jackson, Michigan	1941
*Wing, Leonard William, State College, Pullman, Washington	1924
Winterbottom, J[ohn] M[iall], African Education Office, P.O. Box 150, Livingstone, Northern Rhodesia	1939
*Wood, Dr. Harold Bacon, 3016 N. Second St., Harrisburg, Pennsylvania	1932
Woodward, Arthur Jason, 504 Kahkwa Blvd., Erie, Pennsylvania	1937
*Woodward, Miss Barbara, East Main St., Le Roy, New York	1943
Worley, John G[raves], 237 Charleston St., Cadiz, Ohio	1936
Wright, Miss Audrey Adele, 1312 Hepburn, Louisville, Kentucky	1941
Wright, Lt. Col. Dana, State Game Farm, St. John, North Dakota	1943
Wright, Ernest Bicknell, 140 W. Chestnut Ave., Chestnut Hill, Philadelphia, Pennsylvania	1941
Wright, J[ohn] T[homas], R. 5, Box 665, Tucson, Arizona	1941
Wright, Philip L[incoln], Montana State University, Missoula, Montana	1940

Wright, Thomas Jr., Box 65, Wakefield, Rhode Island	1939
Wyman, Miss Mary May, 1040 Mary St., Louisville, Kentucky	1940
Yeager, Lee E[mmett], Illinois Natural History Survey, Urbana, Illinois	1939
*Yeatter, Dr. Ralph Emerson, Illinois Natural History Survey, Urbana, Illinois	1932
Young, J. Addison II, 93 Argyle Ave, New Rochelle, New York	1942
**Young, James B[oswell], 2516 Talbott Ave., Louisville, Kentucky	1937
Zempel, Arnold, 626 Crandall, Madison, Wisconsin	1941
*Zimmerman, Dale, 480 North Almont St., Inlay City, Michigan	1943
*Zimmerman, Fred Robert, 702 S. Thornton Ave., Madison 4, Wisconsin ..	1935
Zirrer, Francis, R. 3, Hayward, Wisconsin	1943

REPORT OF THE NOMINATING COMMITTEE

Once more war conditions have made it inadvisable to attempt any kind of annual meeting of the Wilson Ornithological Club. The annual election of officers must therefore be conducted by mail. Your Committee offers the following nominations for officers of the Wilson Ornithological Club for 1944:

President: S. Charles Kendeigh

First Vice-President: Olin Sewall Pettingill, Jr.

Second Vice President: Harrison F. Lewis

Secretary: Maurice G. Brooks

Treasurer: Milton B. Trautman

Councillors: Burt L. Monroe, Eugene P. Odum, Lawrence H. Walkinshaw

Principles of good government make it urgent that as many as possible of our members participate in this election. In addition to the slate offered above, all Active and Sustaining members of the Club are eligible for office. You are urgently requested to mail in your votes to the Secretary, whether you choose to support the slate given above, or whether you choose to write in the names of others for one or all of these offices.

A. E. GANIER

LYNDS JONES

MARGARET M. NICE, *Chairman*

To the Members of the Wilson Ornithological Club:

Last year, with his statement for dues, each Wilson Club member received a nominations blank, with the urgent request that names of prospective members be submitted to the Secretary. The response was good, some ten per cent of those receiving the blanks sending in the names of one or more persons. Persons nominated have been solicited, and a good number of new Club members has resulted.

This procedure will again be followed in 1944, and your officers request your fullest cooperation in putting us in touch with persons of ornithological interests. Despite the disruptions of the war, we will close our Club year with something over a thousand members, only a very slight reduction from last year's figure.

We hope that many persons may find the coming year an opportune time to participate more actively in Wilson Club affairs by raising the class of their membership. We need more Active and Sustaining members. The present size and excellence of *The Wilson Bulletin* can only be maintained if an adequate number of members carry more than the minimum subscription. May we ask that you seriously consider raising the class of your membership?

MAURICE BROOKS, *Secretary*

AFFILIATED SOCIETIES

THE GEORGIA ORNITHOLOGICAL SOCIETY was established in 1937 at the instigation of the Atlanta Bird Club. The *Oriole*, which had been founded in 1936 by Don Eyles and Norman H. Giles and sponsored by the Atlanta group, became the official organ. Semi-annual meetings have been held in various parts of the state but were cancelled this year because of transportation problems. A meeting next spring is planned, however. Meetings and field trips of local groups have been encouraged, and the data they gather are collected and summarized. This spring the members concentrated on the collection of data on number of eggs and percentage of hatch of common southern bird species.

The officers of the Society are: President, Eugene P. Odum; First Vice-President, Mrs. Lucille Rotchford; Second Vice-President, Miss Annie Reddy; Executive Secretary, Miss Blanche Tait; Treasurer, Mr. Ray C. Werner; Historian-Librarian, Dr. Beatrice Nevins; Editor, J. Fred Denton.

Committees have been active from time to time on education, sanctuaries, and history, and an exchange library is being built up. Occasional Paper No. 1, "The Birds of Athens, Clarke County, Georgia," by Thomas Burleigh, was published in 1938. A fully annotated check-list of Georgia birds is now being prepared by a group of members which includes Earle Greene, Herbert L. Stoddard, William Griffin, and Ivan Tomkins. It is hoped that this will be published during the coming year as Occasional Paper No. 2.—Eugene P. Odum, *President*

THE WISCONSIN SOCIETY FOR ORNITHOLOGY began in January, 1939, with the issue of Vol. 1, No. 1 of a monthly mimeographed bulletin, *The Passenger Pigeon*, under the auspices of The Madison Bird Club. An organization meeting was called at Madison on May 6 and 7, 1939, and officers elected as follows: N. R. Barger, President; Alvin Throne, Vice-president; Murl Deusing, Secretary; Karl W. Kahmann, Treasurer; W. E. Scott, Editor; A. W. Schorger and Clarence Jung, Members-at-Large of the Executive Committee. A total of 123 charter members were accepted into the Society at that time. The present active membership is approximately 400. Annual meetings, which are a highlight of the year for members, have attracted an attendance as large as 300. On April 12, 1942, the organization became incorporated under the Wisconsin laws, at the annual meeting at Green Bay. The name of the group was then changed to "The Wisconsin Society for Ornithology." On May 1, 1943, the Society voted unanimously for affiliation with The Wilson Ornithological Club at the Fifth Annual Convention at Milwaukee.

In 1942 a special committee consisting of N. R. Barger, Elton E. Bussewitz, Earl L. Loyster, Sam Robbins, and W. E. Scott prepared a preliminary check-list, with migration charts, of Wisconsin birds. Beginning with the July 1940 issue, *The Passenger Pigeon* has been issued quarterly and is now a larger and more complete bulletin.—W. E. Scott, *Editor of The Passenger Pigeon*

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In addition to names of species and of authors, this index includes references to the following topics: age determination, anatomy, bibliography, conservation, courtship, distribution, food, localities by states and countries, migration, molt, nesting, new forms noticed, parasitism, physiology, population, predation, roosting, taxonomy, territory, weight.

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