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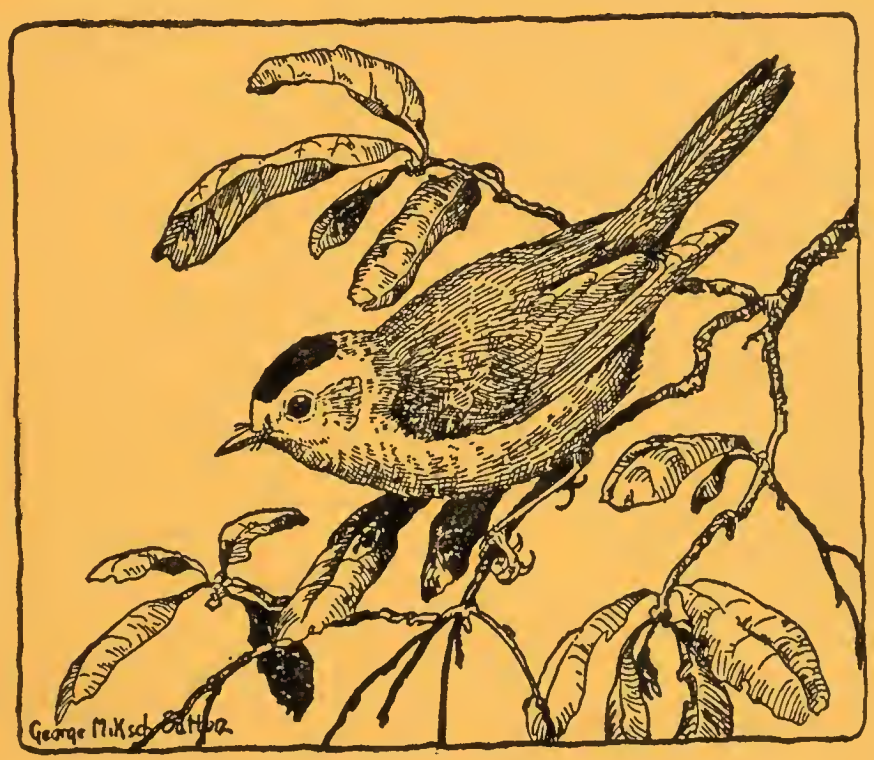

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Named after ALEXANDER WILSON, the first American ornithologist.

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THE WILSON BULLETIN

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THE PRESIDENT'S PAGE

The idea in the minds of the founders of the Wilson Ornithological Club was undoubtedly the exchanging of records and experiences about birds. Soon the group's increase gave rise to the publication *The Curlew*, the purpose of which was to keep members in touch with each other's studies and findings. This still is the major purpose of *The Wilson Bulletin*.

There is another commendable objective of a club such as ours, however, which I feel has not been realized to the extent it should be. There are many persons in the W.O.C. with financial means to spare, some of whom may be older, perhaps, and lacking physical fitness for strenuous field work, but who still are enthusiastic about furthering the study of ornithology. On the other hand, there are many capable young ornithologists with initiative and energy but with distinctly limited financial means. The W.O.C. is ideally situated to act in a liaison capacity for these two groups. In other words, why not make a definite effort to expand our program of research grants? This was exactly what was in the mind of one of our members when he anonymously contributed $500 back in 1947 for establishing the Louis Agassiz Fuertes Research Grant in honor of that outstanding bird artist. It was the donor's very laudable hope that this memorial grant might be perpetuated indefinitely through continued, but not necessarily anonymous, contributions from others. I feel that all too little publicity has been given to this project. Although there are comparatively few W.O.C. members today who knew Louis Fuertes personally, we are all very much aware of his remarkably life-like portrayals of our birdlife and a continuing memorial to Louis Agassiz Fuertes is certainly highly appropriate. At present only $25 remains in this fund; this is actually the amount of the only additional contribution that has been made to this fund to date, a contribution from one of our very active life members. Shall we award this small remaining amount to some promising candidate and allow this fine research grant to go out of existence? I say "No." Can't we find other generous contributors who will follow this member's lead and build up this fund again in order that further promising students may receive much-needed aid? Anyone interested in making such contributions, please contact me or our treasurer, Leonard Brecher.

All funds that W.O.C. members wish to contribute for such grants need not necessarily be placed in the Fuertes Fund. The Wilson Club will be happy to establish additional research grants either in the name of the donor or in honor of others. One such grant, the S. Morris Pell Fund, provides for $25 annual awards for three more years to be assigned to promising bird artists. This fund was established in 1948 by another anonymous donor in memory of S. Morris Pell, whose major interest was also in bird art. Applications for these awards should be sent to Dr. John Emlen, Department of Zoology, University of Wisconsin, Madison, Wisconsin.

Another grant, the Chalif Award, was an annual grant of $200 for research in Mexico, furnished by Mr. Edward Chalif, also a W.O.C. life member. Although this is not available this year, we understand that there is a possibility that next year it may again be awarded.

I hope that each year we can list an increasing number of research grants available for students in many ornithological fields. Won't you consider such contributions or talk to your friends who might be interested in extending such aid?

W. J. Breckenridge

GRAY HAWK
(Buteo nitidus)

Adult, sketched February 18, 1938, along the Rio Corona a few miles north of Victoria, Tamaulipas, by George Miksch Sutton. Fifth in a series of color-plates honoring the memory of Dr. David Clark Hilton.

GRAY HAWK

BY GEORGE MIKSCH SUTTON

THE northernmost of the five currently recognized races of the Gray Hawk (*Buteo nitidus*) has long been known as the Mexican Goshawk, a colorful name, but inappropriate since the bird is not accipitrine in shape, voice, or behavior. To more southward ranging races the name Shining Buzzard Hawk has been applied—again a not very satisfactory appellation. The species is about the size of the Red-shouldered Hawk (*B. lineatus*), and it is strikingly like that bird in that it is given to screaming loudly while circling above its nesting ground. It is especially noisy just before the season of egg-laying.

At a distance a perching adult Gray Hawk appears to be pearl gray all over. Actually, the upper parts of the body are gray; the under parts silvery white, finely barred with gray; the tail black, crossed with three white bands. The bill and claws are black; the cere, mouth-corners, tarsi and toes waxy yellow; the eyes dark brown. Seen from below, the wings of flying adults are white with black tips. Immature birds are pale buff below, boldly streaked on the throat, chest, belly, and sides (*barred* on the flags) with dark brown. Above they are dark brown with buff and rufescent markings. The tail (which is decidedly larger than that of the adult) is brownish gray, crossed with several black bars. Dickey and van Rossem (1938. *Zool. Ser. Field Mus. Nat. Hist.*, 28:115) inform us that "in those few individuals which breed the first year there is a partial body molt in which, in February and March, a few gray, adult feathers make their appearance." The Cornell University-Carleton College Expedition obtained two subadult males (with pearl gray feathers in the fuscous back plumage, and patches of gray-barred plumage on the chest and belly) on April 15 and 21, 1941, respectively, along the Río Sabinas in southwestern Tamaulipas (Sutton and Pettingill, 1942. *Auk*, 59:9). These individuals may or may not have been breeding.

Buteo nitidus is a bird of hot wooded lowlands. It breeds from the Lower Rio Grande Valley, southwestern New Mexico, and southern Arizona southward to "tropical eastern Bolivia" and "southern Brazil" (Peters, 1931. "Check-List of Birds of the World," 1:240–241). Its range is far from continuous throughout this vast area. In southern Arizona, where it appears to be commoner than elsewhere in the United States, it is virtually confined to the "grand mesquite forest" just south of Tucson (Brandt, 1951. "Arizona and its Bird Life," pp. 35, 75, 192–194). In parts of México visited by me I have found it principally along slow-moving streams, but it is decidedly local. Of its distribution in Central America, Griscom (1932. *Bull. Amer. Mus. Nat. Hist.*, 64:156) says: ". . . this hawk is found primarily in the Arid

Tropical Zone and is rare or absent elsewhere. It is . . . abundant on the Pacific slope of Guatemala, and occurs in the arid country in the interior, as at San Gerónimo and in the Rio Motagua Valley. It is most exceptional to find it above 3500 feet." Carriker (1910. *Ann. Carnegie Mus.*, 6:459) reports that it "does not occur on the Caribbean slope" of Costa Rica. Todd and Carriker (1922. *Ann. Carnegie Mus.*, 14:153), reporting on the birds of the Santa Marta region of Colombia, call it "a Tropical Zone bird, evidently regularly found only in the heavier forest of the lowlands."

In the United States, México, and at least some parts of Central America, it is migratory. For Sonora van Rossem (1945. *Mus. Zool. Louisiana State Univ.*, Occ. Pap. 21:57) reports "no northerly winter records." Arrival and departure dates for northern localities he gives for that State are March 29 (Nacozari) and October 26 (Oputo). According to Brandt (*op. cit.*, 193), the species returns to Arizona in April.

An adult Gray Hawk which I collected and sketched (see color plate) along the Río Corona, near Victoria, Tamaulipas, on February 18, 1938, apparently was not nesting (Sutton, 1951. "Mexican Birds," pp. 118-120). A male and female which I saw circling above the Río Sabinas later that spring (March 3) must, however, have been on their nesting grounds. The smaller bird "devoted itself to a beautiful courtship display. Swooping gracefully upward, it turned a backward flip, plunged deeply and again shot upward, letting momentum carry it to a position in front of the other bird before flipping backward or sideways again" (*ibid.*, p. 171). Swann, in his "Monograph of the Birds of Prey" (1930. 1:435–436), makes clear that there is a correlation between latitude and the season at which the species nests in North America: Arizona birds nest in May and June, southern Tamaulipas birds earlier (two eggs, Tampico, April 23), Guatemala birds still earlier (three eggs, April 3). Dickey and van Rossem (*op. cit.*, pp. 115) report that the nesting season in El Salvador is "in March or April, for young not able to fly were taken at Lake Chanmico at various dates in late May."

The nest is shallow, rather small, and not very strongly put together. Bent (1937. *U. S. Natl. Mus. Bull.* 167:265) tells of three Arizona nests (found May 19 and 20, 1922) respectively in a large mesquite, 40 feet up; a "giant hackberry," 60 feet up; and a large mesquite, 30 feet up. In each of these the lining was partly of green leaves. Swann (*loc. cit.*) describes a nest "composed of cottonwood twigs, broken off while green, with a lining of the leaves and bark-strips or willow tops." The eggs, usually two, sometimes three, are bluish white, occasionally flecked with pale brown, and usually more or less nest-stained. Neither the incubation period nor the fledging period has been ascertained, so far as I know. I have never seen a newly hatched young bird.

The Gray Hawk feeds on reptiles (especially lizards), insects, small mammals, and small birds. Otho C. Poling (in Bent, *op. cit.*, 266) observed a female "making daily trips to the mesquite plains for cottontails . . ." which she fed to her brood. On January 18, 1949, near Gómez Farías, Tamaulipas, I saw a Gray Hawk snatch at a branch and make off with a screaming small bird. Dickey and van Rossem (*op. cit.*, 116) tell of a Gray Hawk "shot as it was trying to carry off a white hen from the dooryard of the ranch house" at Volcán de San Miguel, El Salvador.

In northeastern México flocks of Brown Jays (*Psilorhinus morio*) frequently mob the Gray Hawk, screaming loudly but keeping at safe distance or hiding themselves in the foliage; they are especially bold if the hawk happens to be a "brancher" not long out of the nest.

Department of Zoology, University of Oklahoma, Norman, Oklahoma, March 1, 1953

HABITS AND HABITAT DIFFERENCES IN TWO RACES OF TRAILL'S FLYCATCHER

BY JOHN W. ALDRICH

I FIRST became interested in ecologieal segregation in races of Traill's Flycateher (*Empidonax traillii*) in 1931, when Roger T. Peterson called my attention to the differenee between the songs of Traill's Flycatehers breeding on the Appalaehian Plateau near Jamestown, New York, and those of the Lake Erie plain only a few miles to the north. The birds of the plateau sang slurred, three-noted songs, with the aceent on the second syllable, and the third syllable slurred to the extent that it was not distinetly separated from the seeond. This has been interpreted by Peterson as '*way-be-o.*' The birds of the lake plain uttered a distinctly two-syllabled, explosive '*fitz-bew*' with a sneezy quality and with the accent on the first syllable. Peterson suggested at the time that two races of Traill's Flycatcher might actually be represented and urged me to investigate it. This I have only reeently had oeeasion to do.

In addition to the song differenees noted above, Bent (1942:204) eomments on differenees in nests and nesting sites between Traill's Flyeatchers breeding in the Mississippi Valley and adjacent states, and those breeding east of the Appalaehian Mountains and farther north. He remarks that nests of the former are mueh like those from west of the Roeky Mountains. There are descriptions by a number of observers quoted by Bent, whieh indicate that there is a tendency for nests of Traill's Flyeatehers of the prairie regions to be located in dry, brushy habitats, as well as brushy swamps, and to be mueh more eompaet in eonstruetion, similar to those of the Yellow Warbler (*Dendroica petechia*), as eompared with the more loosely construeted nests similar to those of the Song Sparrow (*Melospiza melodia*). The latter type of nest is eharacteristic of Traill's Flyeatehers of the northeastern and Appalaehian Mountain regions. Arthur A. Allen has written me that he has found both the eompact, Yellow Warbler type and the more bulky Song Sparrow type of nests in the Ithaca, New York area. He asserts that the compact nest is eonstructed by the lowland breeding birds with two-syllabled songs, while the loosely eonstrueted nest is made by highland-breeding flyeatehers with three-noted songs. He further eomments that he has never heard the two-noted, lowland type of song in the Adirondacks or eastern Canada where the three-syllabled note is mueh in evidence. Aretas A. Saunders, who has made extensive records of bird songs, informs me (*in litt.*) that the three-noted song is the only one of the well-known songs he has heard given by Traill's Flyeatchers in the Adirondacks, Vermont, Connecticut, and northwestern New Jersey. However, in summer after breeding is established these birds

eall "que dee, two syllables, with the seeond higher pitched than the first." Birds at Sandy Lake, Minnesota, gave this '*que dee*' song also. At Chillicothe, Missouri, and Watertown, South Dakota, Saunders heard Traill's Flycatchers giving the '*fitz-bew*' song. At Fertile, Minnesota, he recorded a song that was halfway between the '*fitz-bew*' and '*way-be-o*' songs. McCabe (1951:91) described as '*creet*' a note which precedes the '*fitz-bew*' of southern Wiseonsin Traill's Flyeatehers when at the peak of singing.

McCabe (1951:90) organized various interpretations of Traill's Flyeatcher songs from the literature according to whether they were three- or two-syllabled. He noted that they did not appear to fall into geographically segregated groups but pointed out that this could have been the result of difference in interpretation of sounds by different observers. It would seem quite likely that some of McCabe's interpretations of published descriptions of the songs might be interpreted differently. It may be that distinction between the quality of the sound, as well as placement of the accent, is more useful than an attempt to break it down into syllables for purposes of correlating songs with distinet breeding populations. It is well known to field ornithologists that it is difficult to express in words the differenees in bird call notes which are quite obvious to the praeticed ear. It is the opinion of several ornithologists including Aretas Saunders, Arthur Allen, Roger Peterson, Robert Stewart, and Chandler Robbins, with whom I have discussed this problem that there is, in fact, a difference between songs of the breeding Traill's Flycatehers of the midwestern region in general and those of the Appalachian highlands and the New England states.

The above observations are indicative of two distinctly different populations of the Traill's Flycatcher, distinguishable on the basis of song, nest-building habits, and geographic distribution. One of these breeds primarily in the bog-shrub habitats of the more boreal coniferous forest region of northern and eastern North America, and the other primarily in the brushy habitats of the interior prairies and plains. A study of large series of breeding specimens from eastern North America has shown that two morphologically distinct raees are represented by these two segments of the population of Traill's Flycatcher, *Empidonax traillii traillii* and *E. t. campestris* (Aldrich, 1951:195), which have been shown to differ so noticeably in their habits.

It is possible that the western prairie population of Traill's Flyeatcher was formerly more completely isolated from the eastern boreal population, but has recently come into closer contact by infiltration from the west, along the plain of the Great Lakes, since removal of the original forest cover has produeed more satisfactory habitat for it. The relatively slight physiographic and ecologieal barrier which exists today between the Interior Lowlands and Appalachian Plateau physiographic provinees in western New York State ap-

parently has been sufficient to prevent complete genetic intermingling of these two populations as indicated by both specimens and field observation of song differences. It even seems that both races breed close together in one Lake Plain situation in northwestern Ohio, segregated merely by habitat differences. This was noted by Campbell (1936:164) who described differences in songs and nests of birds which nested in dry scrubby situations as compared with the more usual breeding habitat in wet brushy stream borders. Richard B. Fischer (1950) has given some evidence that the '*fitz-bew*'-singing race of Traill's Flycatcher may have even penetrated to the Atlantic coast and is establishing itself in areas south of the former range of the species at the lower elevations, although no specimens have been available for confirmation. In any case we know from specimens and field observation that both the pale interior prairie type with the '*fitz-bew*' song and the dark northeastern and highland type with the '*way-be-o*' song breed in close proximity today in western New York State, and the correlation of their distribution with the sinuous boundary between plain and plateau results in extremely interdigitated ranges. A parallel situation in mammals would seem to be that of the white-footed mouse, *Peromyscus maniculatus*, in which the range of the prairie race *bairdii* interdigitates with the range of the eastern boreal forest race *gracilis* in Michigan (Burt, 1946:206), and the race *osgoodi* with *artemisae* in Montana (Murie, 1933:4), as a result of occurrence of grasslands interspersed with forest areas. This situation of highly interdigitated ranges of two subspecies correlated with ecological differences has been noted in other species of birds, such as the Song Sparrows in the San Francisco Bay area (Marshall, 1948:209). Knowledge of these facts further suggests the probability that the ranges of *Empidonax traillii adastus* Oberholser and other western races of this species may have an ecological segregation, accounting for the confusion that has existed in the separation of races in the West. Further investigation in regions where two subspecies appear to overlap are needed to throw more light on this interesting problem.

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U. S. Fish and Wildlife Service, Washington 25, D. C., April 17, 1952

THE PTERYLOSIS OF *COUA CAERULEA*

BY ANDREW J. BERGER[1]

THE monotypic cuculiform genus *Coua* is restricted in range to the island of Madagascar. The genus and its ten species form the subfamily Couinae (Peters, 1940:64–66). Little has been written about the anatomy of the genus *Coua*. Milne-Edwards and Grandidier (1879) illustrated the skeleton of several species and presented measurements of certain bones. Beddard (1885:174 and 187) described the syrinx of *Coua ruficeps* from one of Garrod's manuscripts, and stated that the myological formula was ABXYAm. Pycraft (1903) illustrated the skull, sternum, and shoulder girdle of *C. reynaudi*. Grassé (1950:529) presented a photograph of palatal structures of a young *C. cristata*. So far as I can tell, this genus has been placed in a separate subfamily primarily because of its restricted range.

The pattern exhibited by the major feather tracts has long been used as an aid in taxonomy. The pterylosis of several genera of cuckoos has been described, and Beddard (1885:187) used the condition of the ventral feather tract as one of three characters in subdividing the family Cuculidae, although he stated (1898:275) that the pterylosis of *Coua* was unknown. On the basis of leg muscle formula and structure of the syrinx, he assumed tentatively (1898: 281) that the ventral feather tract of *Coua* was bifurcate and occupied the "whole of [the] space between [the] jaws." As can be seen from figure 1 and the description below, the latter part of his assumption was incorrect.

The two figures illustrating this paper make unnecessary a detailed description of the feather tracts. It does seem pertinent, however, to mention certain points not readily perceived by reference to the drawings, and certain features which I believe eventually may be of assistance in determining relationships within the family Cuculidae. Terminology used here follows that of Burt (1929).

Ventral tract. The inter-ramal region has a row three feathers wide on each side of the midline. There is a marginal apterion on the lateral sides of this tract; thus, the ventral tract does not occupy the entire inter-ramal space (see Lowe, 1943, text-figure 7, for an example of a completely feathered inter-ramal space). The ventral cervical tract is complete in the throat region, but bifurcates about 40 mm. caudal to the posterior margin of the gonys. At the junction of neck and thorax the cervical tract broadens out to cover nearly the entire anterolateral aspect of the thorax. As a result, a solid tract covers the lateral sternal and the axillary regions. Anteriorly, a single row of feathers passes laterad

[1] This study would not have been possible had it not been for the generosity of Dr. Jacques Berlioz, Muséum National d'Histoire Naturelle, Paris, who sent me an alcoholic specimen. I also am happy to acknowledge my indebtedness to my friend Mr. David F. Parmelee who made the feather-by-feather drawings. These were made with the greatest attention to detail and accuracy.

to become continuous with the ventral marginal coverts. Two abdominal branches, separated by a lateral abdominal apterion, arise from the posterior margin of the sternal-axillary region. The inner abdominal branch, consisting of a double row of feathers, forms two successive gentle curves as it passes caudad to terminate at the anterolateral margin of the anal eirelet. The outer abdominal branch, consisting of a double row of feathers anteriorly, but of a single row posteriorly, extends caudad parallel to the inner abdominal branch, which it curves inward to meet about 20 mm. anterior to the anus. There is a complete anal eirelet of feathers.

Capital tract. There is a small, triangular, median frontal apterion, and a much wider lateral apterion extending through the superciliary and occipital regions. Between the two lateral apteria there is a solid tract, covering the frontal, coronal, and occipital regions. This tract is continuous with the wedge-shaped *spinal cervical tract.* The latter is broadest at the base of the skull, and tapers to a width of two feathers a short distance posterior to the shoulder joint. The posterior half of the cervical tract is raised above the level of the surrounding skin, so that the break between the cervical tract and the feathers of the scapular region is even more pronounced than it was possible to indicate in figure 2. The scapular region is covered by four widely separated rows of four feathers each, and is connected with the cervical spinal tract by a single feather. Posteriorly, the scapular region is continuous with the more compact *dorsal spinal tract,* in which the rows contain six (anteriorly) or five (posteriorly) feathers. The two dorsal tracts converge at the midline to form a *median pelvic tract* which terminates anterior to the oil gland. A peculiar feature is the presence of a single row of feathers down the midline in the median dorsal apterion.

Humeral tract. The well developed outer, or major, humeral tract contains three (anteriorly) and four (posteriorly) rows of closely spaced feathers. This tract, also, is raised above the level of the surrounding skin. There is an inner, curved, humeral tract (not raised above the surrounding skin) consisting of a single row of feathers. Two pairs of widely separated feathers are located between the two humeral tracts.

Alar tract. There are ten primaries, ten greater primary coverts, and four or five middle primary coverts. There are five alula quills. A carpal covert and remex are present.

Like other cuckoos thus far studied, *Coua caerulea* is quintocubital. There are ten secondaries, 11 greater secondary coverts, 11 middle secondary coverts, and 11 lesser secondary coverts, although two shorter rows are interposed between the latter and the dorsal marginal coverts. The three rows of coverts are continuous with the tertials at the elbow.

Caudal tract. There are ten rectrices, but there are only eight upper tail-coverts. The oil gland is nude. It is, however, covered superficially by three feathers. One of these arises in the midline anterior to the gland, while the other two arise anterolaterally, and their shafts pass posteromesiad to cross near the posterior tip of the gland.

Femoral tract. This is an extensive, uniform tract covering the entire lateral and the upper half of the posterior aspects of the thigh.

Crural tract. This tract is strongest on the anterior and posterior aspects of the crus. Laterally the feathers form a symmetrical pattern, but they are more widely spaced. The central portion of the medial aspect of the thigh and crus is devoid of feathers.

A lateral view of the specimen reveals a wide lateral cervical apterion, widest at the junction of neck and thorax, and narrowest inferior to the ear opening. There is an extensive, pigmented bare area in the superciliary, sub-ocular, and occipital regions. Well developed "eye-lashes" are present on both lids—those on the upper lid being about 5 mm. in length; those of the lower lid are shorter. The lateral abdominal region is al-

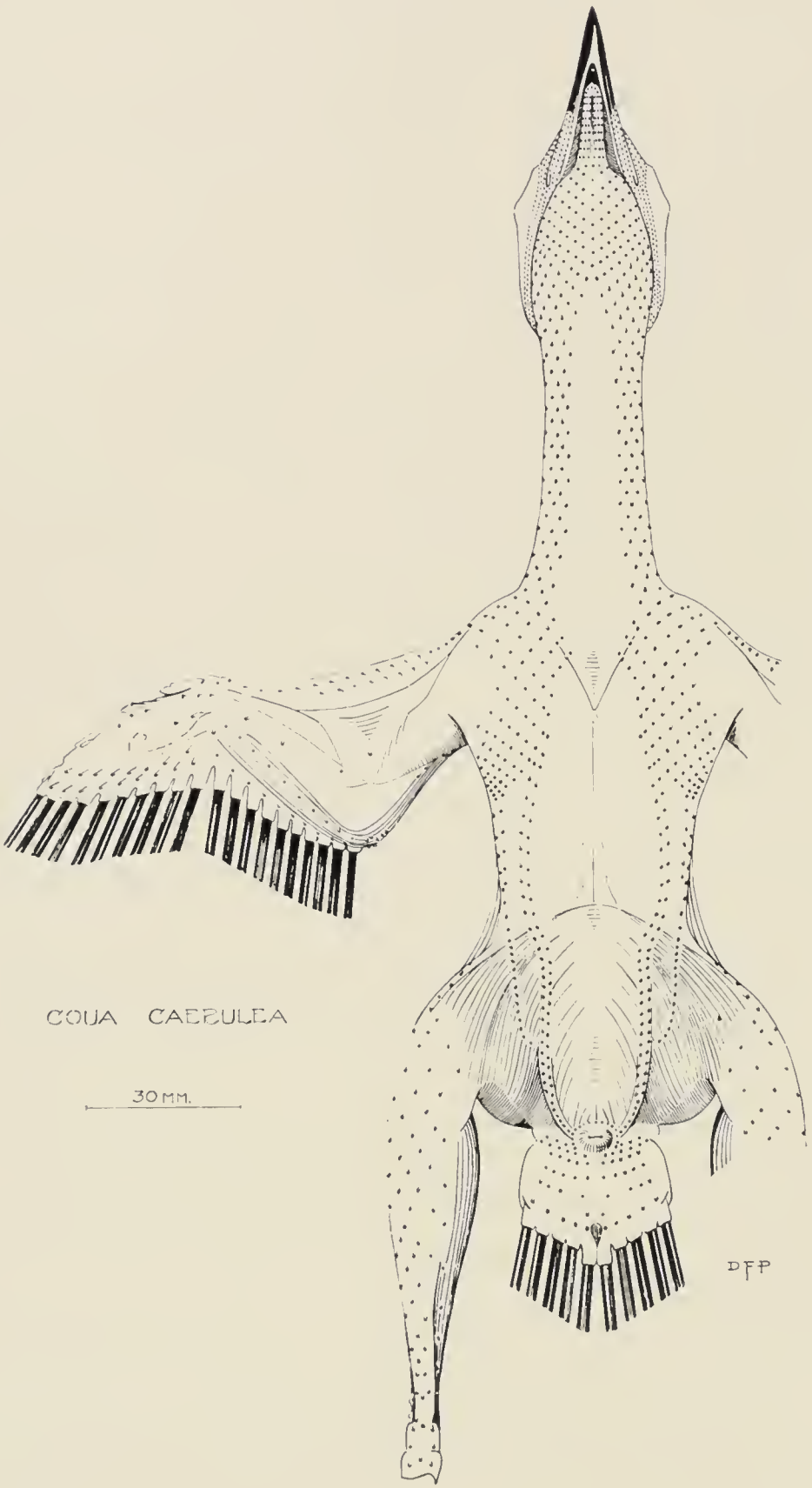

FIG. 1. Ventral view of *Coua caerulea* showing feather tracts.

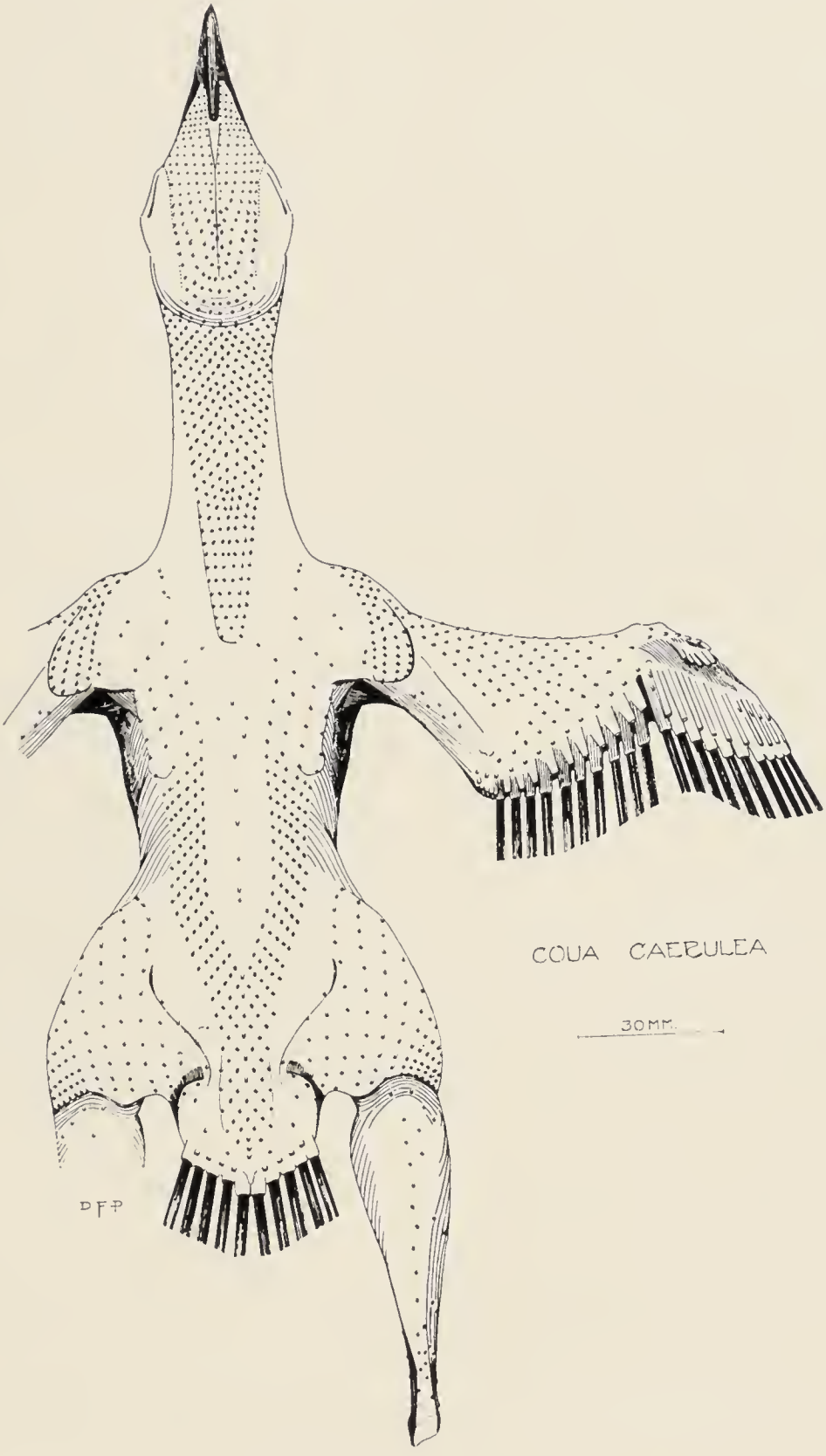

FIG. 2. Dorsal view of *Coua caerulea* showing feather tracts.

most devoid of feathers. There is, however, a loop formed by a single row of feathers, which is continuous below with the anterior tract of the thigh. Posterosuperiorly, the loop joins the upper margin of the femoral tract.

Notes on the molt. The specimen I had for study (No. 5529, Rand and Archbold collection) was collected May 10, 1930, 40 km. northwest of Maroantsetra, and exhibits an extensive molt. On the left wing, the fifth and seventh (innermost counted as first) primaries are nearly full length, but are sheathed at the base, while the fourth is only about 30 mm. in total length. On the right wing, the seventh primary is the only one still sheathed at the base. Of the secondaries (outermost considered as the first), the first of the left wing is nearly full length, but retains a sheath at its base; in the right wing, the first, third, and seventh secondaries still possess basal sheaths. The rectrices are nearly equal in diameter, but on the right side, the first (innermost) and the fourth possess basal sheaths, and on the left side, the second and fourth possess such sheaths. An extensive molt is evidenced throughout the dorsal regions, involving the capital, occipital, humeral, femoral, anterior crural, and the spinal tracts. There is likewise an extensive molt of the ventral tracts, extending from the inter-ramal region to the under tail-coverts.

Too little is yet known about the anatomy of *Coua* to permit any statement regarding its close affinities. It is interesting to note, however, that if we were to rely on the three anatomical features used by Beddard (1885:187; 1898:281), the presence of the marginal apteria bordering the inter-ramal tract would place this genus in close relationship with *Geococcyx, Crotophaga,* and *Guira,* three New World genera. The uncertain reliability of this single morphological character encourages caution in the selection and utilization of anatomical characters to determine relationships on the subfamily level.

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DEPARTMENT OF ANATOMY, UNIVERSITY OF MICHIGAN MEDICAL SCHOOL, ANN ARBOR, MARCH 11, 1952

NEW LIFE MEMBER

Born in Cincinnati, Ohio, on October 20, 1882, Mr. Christian J. Goetz became an extremely active bird bander in the late 1920's after acquiring a deep interest and knowledge of wildlife through various conservation projects and years of hunting and fishing. He retired from banding work in 1952 after ringing 31,181 birds in four states. Ducks were his favorites and of these he banded more than five thousand, mostly on the property of the Duck Island Hunting Club at Banner, Illinois. Mr. Goetz was a member of this club for many years. His plans for the future include many years of bird-watching and small-mouth bass fishing along the streams of southern Ohio. This photo was made as Mr. Goetz banded a hen Mallard at the Duck Island Club in December, 1938.

NOTES ON THE HAWAIIAN DUCK

BY CHARLES W. SCHWARTZ AND ELIZABETH REEDER SCHWARTZ

THE avifauna of the Hawaiian Archipelago contains three endemic members of the Anatidae. Of these, the Laysan Teal (*Anas platyrhynchos laysanensis*) and the Nene or Hawaiian Goose (*Branta sandwicensis*) are near extinction—only 30 teal existed in 1950 (Scott, 1951) and an estimated 33 wild and 24 captive Nene lived in 1952 (Smith, 1952); the Koloa or Hawaiian Duck (*Anas platyrhynchos wyvilliana*) is present in larger but still scarcely-safe numbers. Other species of waterfowl visit the Hawaiian Islands from North America but their sojourns are usually sporadic and brief. Although the Koloa occasionally joins flocks of migrant ducks during their island residence, it is not migratory.

Formerly, the Koloa occurred on all the major Hawaiian Islands and was common everywhere except on Lanai and Kahoolawe as reported by Perkins (1903), Munro (1944), and long-time residents interviewed during our game-bird survey (Schwartz and Schwartz, 1949). However, in recent years the population has been greatly reduced by draining of the principal breeding and feeding areas and by indiscriminate shooting. It is also likely that predation by mongooses, rats, feral cats, feral pigs, dogs, and humans, particularly on eggs and ducklings, has been instrumental in this decline.

The only numerical estimate of this bird's former abundance was given to us by Mr. Woodhouse of Kekaha Sugar Company. He reported about 400 ducks per square mile for the Mana Marsh area of Kauai prior to its drainage in 1923 and subsequent development into irrigated sugar-cane land. If this figure is reasonably correct, approximately 2,400 ducks may have resided in this tract of marsh which covered nearly six square miles and doubtless represented one of the best habitats of the Koloa. Our estimate was only five Koloa per square mile or a total of 30 for this same area in 1946–1947.

We found the Hawaiian Duck only on the islands of Kauai, Oahu, and Hawaii but it also is known to occur occasionally on Niihau (L. Robinson, in conversation; Fisher, 1951) and Molokai (J. D. Smith, letter). The possibility remains that the Koloa may still live on Maui where remnants of suitable habitat are found.

Almost all the present Koloa population inhabits Kauai where we estimated 500 birds remain. These figures are derived from our sample counts and information from resident hunters, plantation workers, and other observers. Probably more than half the ducks dwell on the major mountain streams from about 500 to 4,000 feet elevation where we found densities up to four birds per mile of stream. (The Koloa has been reported by Perkins (*op. cit.*) to

live as high as 8,000 feet above sea level; this must have been on Hawaii or Maui as only these two islands reach this height.) Some of its present mountain range receives as much or more than 200 inches of rain annually and at 4,000 feet the mean annual temperature is 60° F. During normal stage the mountain streams are seldom over 20 feet wide and consist of pools three

FIG. 1. Male Koloa or Hawaiian Duck. Kauai. March 23, 1947. This endemic member of Hawaii's avifauna has been practically extirpated from all islands except Kauai, its last stronghold. All photographs by C. W. Schwartz except Fig. 5.

to four feet deep alternating with small falls or shallow riffles studded with small cobblestones and boulders. Occasional patches of smartweed (*Polygonum* sp.) are found among the rocky beds, and grasses (particularly *Setaria* sp. and *Paspalum* sp.) grow among the rocks in the dry portion of the stream bed. The banks are generally heavily vegetated with native forest trees and shrubs and some ferns which trail in the water's edge. These brownish-colored streams are highly acid for the most part and possess very little aquatic vegetation or diversified animal life. Our superficial examination showed that the nymphal stages of damsel and dragon flies, snails (resembling *Melania mauiensis*), aquatic shrimp (*Gammarus* sp.), isopods, and a small leech were abundant. Earthworms were plentiful beneath the moss that covered the rocks above the waterline. This animal life together with the smartweed and grasses mentioned above probably furnishes food for the Koloa in these mountain

FIG. 2. Typical mountain habitat of the Koloa. Waialae Stream, Kauai. Elevation 3,600 feet. October 17, 1946.

FIG. 3. Irrigation ditch in sugar-cane field of the type frequented by the Koloa. Elevation, sea level, on the island of Kauai. November 21, 1946.

FIG. 4. Forested habitat through which many of the mountain streams supporting Koloa flow. Watershed of Koaie Stream, Kauai. Elevation, 3,500 feet. October 3, 1946.

FIG. 5. Mokulua Islands. The Koloa still occasionally nests on these two islets which lie three-fourths of a mile offshore from Oahu. The ducks lead the newly-hatched young to the nearby Kawainui Swamp on Oahu. Photograph by J. D. Smith.

areas. The highly acid, vast Alakai Swamp or Bog which exists between 4,000 and 5,000 feet on Kauai is not reported to support Koloa nor is it said to have been an important habitat of this bird in the past.

The rest of the population on Kauai occurs very sparsely below 500 feet and is found in the reservoirs, major irrigation ditches, the very few remaining marshy areas, the coastal portions of some of the larger streams, and some flooded rice fields. Temperatures in this general zone of low elevation have an annual mean of approximately 70° F., but rainfall may vary from less than 20 to 100 inches annually.

Eight was the largest number of Hawaiian Ducks we saw on any reservoir and this was on the 400-acre Koloa Reservoir. Smaller reservoirs of about two to ten acres occasionally supported from two to three ducks each. These reservoirs generally have fluctuating water levels and are mostly devoid of aquatic vegetation. Although they support some fish (bass, *Micropterus salmoides*, and bluegill, *Lepomis macrochirus*) and other aquatic animal life, their value as habitat for the Koloa appears poor.

From one to two Koloa were observed per linear mile of some of the permanently-fed large irrigation ditches which flow through the sugar-cane fields or connect one field with another. These ditches, from two to four feet deep and approximately ten feet wide, have a certain amount of aquatic life, principally filamentous algae, snails, aquatic insects, and fish (Mexican swordtail, *Xiphophorus helleri*, guppy, *Lebistes reticulatus*, and mosquito fish, *Gambusia affinis*). Our knowledge of the food habits of the Koloa is too limited to evaluate this habitat in terms of food availability but from all indications there is ample food here provided it is not destroyed by poisoning operations. But since the plantations periodically poison the vegetation along these banks as a means of controlling weeds and insects, and also spray the water surfaces to kill aquatic plant growth which clogs the ditches, it is likely that some harm befalls the ducks through loss of nesting cover and poisoning of their food supply. The practice of burning sugar cane prior to its harvest doubtless destroys some nests and ducklings.

The few remaining marshy areas now supporting ducks on Kauai have limited stands of bulrush (*Scirpus validus*) bordering small shallow expanses of open water. The rapid rate of reclamation of these areas will soon eliminate the birds from this habitat.

The fact that Kauai now has a larger population of Koloa than the other islands can perhaps be explained by the following circumstances. The habitat conditions with respect to amount and quality have always been more favorable on Kauai than on the other islands, and the mongoose, whose predation has contributed to the destruction of native ground-nesting birds on other islands, does not occur on Kauai.

On the island of Oahu, the Koloa is occasionally observed in the Kawainui Swamp at Kailua, the Kaelepulu Pond and its drainage area near Lanikai, and on the twin Mokulua Islands offshore of Oahu near Lanikai. These locations are practically all at sea level. Our estimate placed the population at less than 30 birds on Oahu in 1946–1947. Subsequent to our observation, those made by Mr. J. Donald Smith, Territorial Game Conservationist (letter), indicate that the Koloa population on Oahu is still declining.

Only rarely is the Hawaiian Duck observed on some of the reservoirs on the island of Hawaii. Fisher (1951) reported that the Koloa was scarce on Niihau probably because of a decrease in suitable habitat.

The crops of two Hawaiian Ducks we obtained in the lowland sugar-cane habitat on Kauai contained the shells and soft parts of the snail *Melania mauiensis*, and seeds of the grasses *Paspalum Urvillei* and *Echinochloa crus-galli* var. *crus-pavonis*. Two Koloas collected on Hawaii by Henshaw (1902) had their stomachs crammed with two species of fresh and brackish-water snails, *Melania newcombii* and *Hydrobia porrectamigh*. Perkins (1903) reported Hawaiian Ducks to feed on ripe grains of rice, various kinds of molluscs frequenting fresh or brackish water, the larvae of dragon-flies, and other foods accessible to them. Munro (1944) stated that the Koloa fed on earthworms and foraged on grass.

We usually saw the ducks as singles or pairs and only rarely in groups of three or four. The largest number observed at any one time was eight on the Koloa Reservoir referred to above. Our observations and the reports of others indicate that no large flocks are formed at any time of the year now, although in the past post-breeding flocks occurred. Palmer (Rothschild, 1893–1900) observed large flocks on a lake on Niihau, on some occasions not less than 100, and Wilson and Evans (1890–1899) reported flocks in the marshes near Waimanelo, Oahu.

The scant information reported to us concerning the dates of nesting and young suggests that the Koloa breeds throughout the year in both mountain and lowland areas but probably most breeding takes place in the spring. This agrees with Perkins (*op. cit.*) who reported the Hawaiian Duck to be very irregular in its nesting time but with the majority of breeding taking place between March and June. Following breeding the adults molt and years ago it was the custom for the Hawaiians to make annual trips to the mountains where the flightless ducks were easily captured, killed, and salted for future use. According to Mr. Eric Knudsen, a long-time resident of Kauai, two favorite spots for collecting ducks were the Kokee and Waialae regions of Kauai. Forays did not occur frequently into the marshy areas presumably because of the difficulty of catching the birds there.

Nests reported to us have been located in sugar-cane fields, the dense grass border of irrigation ditches, and the grassy slopes of Mokulua Islands. They contain from two to 12 eggs but according to Munro (*op. cit.*) eight is the commonest number. Broods ranging from four to eight young have been observed.

It is of interest that the Koloa nests on the twin islands of Mokulua (whose combined area is about ten acres) and leads its young to Oahu over approximately three-fourths of a mile of open ocean (Munro, *op. cit.*; others, in conversation). These islands are uninhabited by humans.

Two wild specimens we obtained on Kauai (September 26, 1946, and October 10, 1946) were females. The duck secured in September had no bursa. Her ovary contained many yolky follicles, the largest of which was 9 mm. in diameter and her oviduct was enlarged sufficiently to have recently passed an egg. The female acquired in October possessed a bursa 22 mm. in length. Several large yolky follicles, up to 19 mm. in diameter, were present in the ovary and the oviduct was greatly enlarged. Since the presence of the bursa of Fabricius is generally accepted as an indication of an immature duck (Hochbaum, 1942), the breeding condition of this Hawaiian Duck which possessed a bursa is noteworthy.

The September and October females measured, respectively, as follows: total length, 467 mm., 435 mm.; culmen, 45, 45; extent of wing, 707, 750; closed wing, 234, 230; tail, 80, 80; longest toe, 51, 49.

Infestations of lice were light on both birds. Two species, *Trinoton querquedulae* (L.) and *Anaticola crassicorne* (Scop.), identified by Dr. E. W. Stafford of the U. S. Fish and Wildlife Service, were found on the September bird while only the former occurred on the October bird.

Because the Koloa is one of the world's rare birds, every effort should be made to maintain the race. Illegal shooting still constitutes a serious hazard to its survival and rigid protection is absolutely necessary. Some of the remaining marsh areas and possibly some reservoirs, particularly on Kauai, should be improved to provide better habitat. Because the Koloa lives and breeds under captive conditions (one we acquired had been in captivity five and one half years after its capture as a duckling), a supply of these birds could be maintained for strengthening populations in managed range and for stocking suitable but unoccupied areas.

Without doubt the drainage project in progress (1952) of the major marsh areas on windward Oahu will extirpate the duck from that island within the next few years. This will leave Kauai as the last major stronghold of the Koloa. The Board of Agriculture and Forestry of the Territory of Hawaii has incorporated the recommendations given above into its game management

program and is now improving the carrying capacity of water areas on Kauai and Maui and raising Hawaiian Ducks in captivity for release into these managed areas. A small flock of Koloa is also being raised at Kapiolani Park, Honolulu, and a pair of birds has been taken to the Severn Wildfowl Trust, England, for breeding purposes.

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Conservation Commission, Jefferson City, Missouri, June 18, 1952

BEHAVIOR OF A YOUNG GYRFALCON

BY TOM J. CADE

In the course of field work supported by a grant from the Arctic Institute of North America and the Office of Naval Research, I had an opportunity in the last week of August, 1950, to visit the Kougarok region of Seward Peninsula, Alaska. I spent the week at the Rainbow Mining Camp, owned and operated by Frank Whaley and Sterling Montague and located on the Nuxapaga River at its confluence with Boulder Creek. These men owned a pet Gyrfalcon (*Falco rusticolus*), which I was permitted to handle and observe during my stay at the camp.

The history of this bird's capture and treatment in captivity is about as follows. On July 4, while on an excursion up the Nuxapaga River, Mr. Montague discovered a falcon aerie located on a steep bank in a bend of the river near Goose Creek. One of the parent birds, presumably the female, was shot on the nest. A single downy nestling found at the nesting site was taken back to camp and kept in a chicken-wire enclosure 3×5 feet in surface area, 3 feet high, and with an open top. Later, when the fledgling became active, a cross-bar perch was provided. Also a rag dummy was affixed to a pulley affair, by which it was jerked up and down in front of the falcon to "tease" her. (I judged the bird to be a female on the basis of size.) During the first weeks of captivity the bird was fed entirely on grayling trout and pike, and later, when she began to refuse this diet, on ground squirrels. The young bird had been fed by hand until I intervened and began requiring the falcon to tear her own food and feed herself, a habit which she was reluctant to acquire. As she began to fly, no restrictions were placed on her movements and according to Mr. Montague she had been in the air about a week before my arrival on August 23.

This Gyrfalcon was very gentle and seemed actually to seek human company. Because of this her actions were easy to observe.

Four days after my arrival, I introduced the falcon to the regular lure used by falconers in training their birds. Because of this bird's preference for being fed directly from the hand—and probably also because she was too fat—I had only mediocre success in getting her to respond to the lure. She did learn to eat from it, though never heartily, and she would fly to it from 25 or 30 yards, always landing on the ground by the lure, never attacking it directly with her talons. She would, however, respond readily to almost any other object that I might have at hand to toss into the air, including such things as a hat, gloves, an old sock, a crumpled piece of paper, or a stick. At most times of the day, whether well-fed or hungry, she would

chase such objects vigorously, striking them hard with her talons wherever they fell to ground. She would clutch my hat just as a wild falcon does its prey and attempt to tear it to pieces with her beak. By tossing a hat she could almost invariably be called from distances up to about 300 yards.

Because she would not respond well to the lure I decided to leave her alone until she had developed more interest in attacking and plucking her own prey.

As she began to develop speed and assurance in her flying, I often saw her attacking low bushes or clumps of grass. She would swoop suddenly down a slope, strike a bush, usually breaking off a branch, which she carried away in her talons, and then rise back up to her former position, all the while uttering high-pitched, rattling screams. Or she would fly into a clump of grass, strike it hard with both feet, tussle with it as though it were trying to escape, and go through the motions of breaking the neck or biting the head of her imaginary quarry, spreading her wings and tail over the clump in the characteristic attitude of a hawk hovering over its kill. Clods of dirt, conspicuous stumps, almost anything obvious in its relief received the same attention. She entered into these activities with an aggressive attitude.

During the latter stages of this period I once saw her chase a Robin (*Turdus migratorius*), and on several occasions Fox Sparrows (*Passerella iliaca*), Savannah Sparrows (*Passerculus sandwichensis*), and ground squirrels (*Citellus* sp.).

On August 28, the falcon followed me down to Goose Creek to the location of her parents' nesting site. Sitting on an outcropping of the lava flow across the river from the aerie was an adult Gyrfalcon—presumably the surviving parent. As soon as the wild falcon saw the tame bird in the air, it flew up to meet the newcomer. It rose above the pet bird and stooped in an attack, but the young falcon easily avoided the stoop by quickly maneuvering to one side, the attacking falcon thus falling below, leaving the advantage of altitude to the younger bird. The pet falcon then stooped at her parent (the first real stoop I had seen her execute), but pulled out of her dive before striking the older bird. There continued for several minutes the most spectacular and intense aerial "combat" that I have ever witnessed between two birds, each falcon attempting to rise above the other for the advantage of a stoop. Neither bird ever scored a hit and that did not seem to be their intention.

In the air the two were readily distinguished by their marked difference in size, the pet bird being considerably larger. This seemingly confirmed my opinion that the young bird was a female, while the parent seemed to be a male. They were also easily distinguished by their cries—those of the young falcon being much higher in pitch and more "squeaky" than those of the mature male.

In this combat the young falcon clearly had the advantage a larger percentage of the time, making three or four stoops to every one of the other. On two later occasions these two Gyrfalcons met in the air over Rainbow Camp to do battle. In each of these instances the juvenal bird appeared to come out victor, finally driving the adult away.

In the next few days the young falcon also had encounters with a Rough-legged Hawk (*Buteo lagopus*), a Marsh Hawk (*Circus cyaneus*), and a Pigeon Hawk (*Falco columbarius*). The Rough-legged Hawk and the Marsh Hawk were helpless against her attacks and could do nothing but flounder through the air until she tired of her activity. As far as I could determine she did not actually strike either of these birds, though presumably she could easily have done so. The Pigeon Hawk, however, was a different matter. Being smaller and more maneuverable, and perhaps just as swift, this little falcon easily kept above the Gyrfalcon and drove her mercilessly for several minutes until she was forced to seek shelter on the porch of the cook shack.

Two Herring Gulls (*Larus argentatus*) flying up and down the Nuxapaga River were attacked by the young falcon in the manner described above and were forced to take refuge by alighting in the water and waiting there until the falcon left the vicinity. Seven young Red-throated Loons (*Gavia stellata*) huddled in a group in the river were attacked and forced to retreat by diving.

On August 31, I left Rainbow Camp and could make no further observations on the behavior of this falcon.

Discussion

Two aspects of this falcon's behavior are worthy of additional comment—her attacks upon inanimate objects and her abortive attacks upon living animals with no apparent intent to kill. These behaviors possess most of the "commonly accepted characteristics" of play critically reviewed by Beach (1945:523–524): (1) they appear to express emotion or pleasure; (2) they are characteristic of an immature animal; (3) they do not terminate in immediate biologically significant action; and (4) they appear to be youthful attempts at adult activities. Beach rightly points out, however, that no one criterion, or one set of criteria, can be applied generally to playful behaviors in animals. This is especially important to keep in mind when comparing the behavior of birds and mammals, as Thorpe (1951:23) has indicated in regard to juvenile play.

Thorpe (1951:29) mentions in a footnote a paper in Dutch by L. Tinbergen in which he describes almost exactly the same sort of "playful hunting of inanimate objects by young Kestrels [*Falco tinnunculus*]," mentioning specifically such objects of attack as pine cones and grass roots. It should be pointed out, however, that these falcons were already engaged in the normal

amount of hunting activity for food. Bond (1942:87) discusses some similar activities of a captive young Goshawk (*Accipiter gentilis*) under the heading "Play," although he was not sure that a close analysis of the behavior would warrant the use of the term. M. W. Nelson (letter and oral communication) tells me he has frequently seen the same behavior indulged in by eyass Peregrines (*Falco peregrinus*) and Prairie Falcons (*Falco mexicanus*) in the Western States—mentioning specifically such objects of attack as sticks, clods of dirt, and horse manure. I have seen comparable antics performed by young Peregrines about their aeries along the Yukon River. Finally, Munro (manuscript) has observed a Prairie Falcon, of undetermined age, in British Columbia "playing" with cow manure, alternately swooping down, picking it up, dropping it, and picking it up again. Such behavior, therefore, seems to be frequent and widespread among the falcons, particularly among the juveniles, although Thorpe (1951:29–30) reached the conclusion that play generally is more prevalent among adult birds. M. W. Nelson (letter) tells me of one trained adult Peregrine that was extremely playful, and Bond (1942:87) mentions the case of Stabler's trained Goshawk, which showed "no diminution of play" at nearly five years of age.

Accounts of falcons and other hawks attacking live animals in a sportive or playful manner are so numerous in the literature that I think they need not be reviewed in this paper. Bent's "Life Histories" (1937; 1938) contain several.

These two kinds of aggressive behavior were categorized by Groos (1898: 120) under "Hunting Plays." The behavioral similarity of these responses to those of actual hunting led Groos (1898:75–76) to assume that they provide exercise and practice in perfecting the necessary skill to secure food. There seems to be little factual evidence to support this assumption at present, and it has been experimentally demonstrated that youthful practice is not necessary for the perfection of some types of behavior (Beach, 1945:535). But even should it be shown that play does perfect utilitarian behavior this would not explain the stimulus-response relationship involved.

Rand (1951:524–525) has shown the futility of attempting simple explanations of this type of behavior, pointing out that it may be "at times, the attack on an enemy; at times a response to a strange object; at times the result of over-belligerence; and at times play." He stresses variable and multi-factorial causation.

In the instances of attack upon inanimate objects, one wonders whether or not such behavior derives largely from "internal stimulation" and is akin to the type of behavior called *Learlaufreaktion* by Lorenz and "energy-accumulation activity" by Armstrong (1947:119). If such attack is primarily an instinctive reaction, one might hope to explain this behavior in terms of the

"releaser" school of thought. (See Tinbergen (1948) for a review of the basic concepts.) But then one is left in ever greater wonder, as Munro (manuscript) suggests, as to just what the stimulating nature of such objects as a hat, a sock, a clump of grass, or a clod of dirt might be to release aggressive behavior so nearly like actual hunting attacks. If one attempts an explanation in terms of recent conditioning theory (Skinner, 1938; 1950) then one must wonder how the probability of such behavior is increased by the "reinforcement" of non-utilitarian objects.

In the case of the young Gyrfalcon's attacks on living birds, the "combat" between the adult and the juvenile and between the young falcon and the other hawks might be ascribed to some sort of territorial defense on the part of the juvenal Gyrfalcon; and her attacks upon potential prey species merely as abortive or precocious attempts to secure food. There might be a strong case for the first point except that it seems unusual for an established adult falcon to be defeated by a young inexperienced juvenile, especially on the former's own ground. The second point seems to be negated by the fact that the young falcon at this stage of development did not appear to recognize intact birds as food, although it might be argued that the attacks showed recognition of moving objects as food.

The whole category of behaviors called play, particularly as manifested by birds, needs clarification. Beach (1945:538) emphasizes the importance of experimental definitions, and Thorpe (1951:28–30) has recently discussed play in birds in relation to learning abilities, pointing out on the one hand the need for distinguishing between cases of *Leerlaufreaktion* and true play and, on the other hand, between play and behavior that appears in the normal course of maturation. It seems to me that falcons and other hawks, birds that have highly developed and variable behavioral responses, are excellent subjects for such inquiry.

I wish to express my appreciation to W. H. Thorpe and R. M. Bond for critically reading the manuscript.

Summary

The behavior of a young, pet Gyrfalcon was observed from August 23 to 30, at a mining camp in the Kougarok region of Seward Peninsula, Alaska. This behavior consisted of (1) attacks on inanimate objects and (2) abortive attacks on living animals. References to similar behavior for other species of falcons and for the Goshawk are cited for the first type. It is shown that these behaviors fall within the category of responses generally called "play." Various possible interpretations of this type of behavior are discussed, but the present data are too meager for positive conclusions.

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Alaska Cooperative Wildlife Research Unit, College, Alaska, May 13, 1952

NESTING ECOLOGY OF THE PIED-BILLED GREBE IN NORTHWESTERN IOWA[1]

BY FRED A. GLOVER[2]

I OBTAINED nesting data on the Pied-billed Grebe (*Podilymbus podiceps*) from March to September, 1948, at Smith's Slough, Dewey's Pasture, and Mud Lake, typical prairie pot-hole marshes about four miles north of the

FIG. 1. Uncovered Pied-billed Grebe nest near Ruthven, Iowa, June 10, 1948.

town of Ruthven, Palo Alto County, Iowa. I am indebted to Dr. H. M. Harris, Head of the Department of Zoology and Entomology, Iowa State College, for encouragement during the work and to Dr. William Stadelman, Washington State College, for aid in searching for nests.

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Migration

In 1948, I first saw Pied-billed Grebes in the northwest Iowa lake region on March 29. This was approximately one week earlier than the date of earliest spring arrival given by Larson (1925) and two weeks earlier than Spurrell's (1917) earliest record for Sac County, Iowa. In the first week of their spring migration, I recorded less than a dozen individuals. Other spring migrants arriving in the area about this same time were the Lesser Yellow-legs (*Totanus flavipes*), Pectoral Sandpiper (*Erolia melanotos*), Wilson's Snipe (*Capella gallinago*), Great Blue Heron (*Ardea herodias*), and Whistling Swan (*Olor columbianus*). I noted an influx of about 200 grebes the second week in April. At this time, open water areas in the marshes that were relatively free of vegetation and varying in depth from 15 to 25 inches constituted the type of habitat used by the grebes. As nearly as I could determine by daily censuses, approximately 1,000 Pied-billed Grebes passed through the research area during spring migration in 1948.

Courting

The first evidence of courting and subsequent pair formation that I observed was on one of the ponds in Dewey's Pasture on April 20. My observations of Pied-billed Grebes indicated that they utilized the open-water areas in the marshes for courting. For the most part, the courting behavior was as follows: The male grebe, with his head held low and his bill slightly above the surface of the water, approached the female by swimming slowly. The wings of the male were arched slightly during his approach. When the male was about four feet from the female, he dived and came up at the side but slightly to the rear of the female. The female then made a short dash, varying from four to ten feet, propelling herself with rapid movements of the feet and wings. The male quickly followed and overtook the female at the end of her short dash. As the male then climbed on the female's back, she lowered the front part of her body and extended her neck, seemingly to offset the weight of the male. In lowering the front portion of her body, the female raised her tail slightly. The male grasped her at the nape of the neck with his bill and by beating his wings rapidly and using his feet maintained his balance on the back of the female. With both birds rolling considerably in the water, they united in copulation. The female was entirely submerged during the brief period of copulation.

Sometimes the male was thwarted in his courting attempts by the unreceptive female suddenly diving at the end of the short dash rather than remaining on the surface. In such cases, the male immediately dived and followed the female, but I did not observe copulation to follow this sequence of events.

On May 26, I recorded a pair of Pied-billed Grebes that copulated at least six times in one day. On another occasion. a pair copulated three times in less than five minutes.

The peak of the breeding activity, as shown by courtship and copulation, occurred during the last week of May and the first three weeks of June. Courting antics were not limited to the early part of the breeding season. In fact, I recorded Pied-billed Grebes in courtship. with decreasing regularity, up to August 5.

Territoriality

Pied-billed Grebes exhibited territorial behavior about their nests and I plotted a total of 44 territories. The area defended usually was included within an arc of about 150 feet around the nest. Since male Pied-billed Grebes are slightly larger than females, I could determine that the male was usually the one that defended the area. However, I observed the female to "back up" the male several times in his defense. In one instance a female defended her nesting territory against the intrusion of a coot. The female grebe pursued the coot for about 15 feet and then returned to the vicinity of the nest. Beyond the territorial limits, both sexes joined with other Pied-billed Grebes to feed together without strife. Most of the nests I located were near the shoreline and territorial defense was common in that area, but in the deep, open-water areas, I observed as many as eight pairs feeding together without conflict. The home range or area utilized for carrying on the daily activities was usually about twice the size of the nesting territory.

Nesting

From April 25 to 30, 1948, I found the nests of Pied-billed Grebes in all stages of construction on the study area. As nearly as I could determine, the male assisted the female in nest construction by gathering nesting material. The bulk of the nest material, however, was gathered by the female in the immediate vicinity of the nest. After forming a crude, circular platform of old but buoyant vegetation, frequently bulrush stems grown the previous year, the female continued to build the platform into a truncated cone until it would support her weight above the water. Then while standing in the center of the platform, she pulled the old, rotted vegetation up around the edges to form the cup. The water-soaked vegetation was pulled from the outside and draped towards the center. The time required for completion of the nest varied from three to seven days and appeared to depend upon the availability of nesting materials and possibly the physiological development of the individual female. Completed nests were sodden masses of decaying, aquatic vegetation (Fig. 1).

I took measurements on 138 Pied-billed Grebe nests in the course of this study and tried to determine the relationship of the nest site to the physical surroundings (Table 1). Eighty-seven per cent of the nests I located were within 50 feet of an open-water area in the marshes. The mean distance from nest to open water was 25.8 feet.

TABLE 1

LOCATION OF 138 PIED-BILLED GREBE NESTS, RUTHVEN, IOWA, 1948

Distance to Shore		*Distance to Open Water*		*Water Depth*	
Feet	Nests	Feet	Nests	Inches	Nests
1–100	63 (45.7%)	1– 20	84 (60.8%)	1–10	19 (13.7%)
101–200	16 (11.6%)	21– 40	26 (18.9%)	11–20	55 (39.9%)
201–300	13 (9.4%)	41– 60	14 (10.2%)	21–30	32 (23.2%)
301–400	13 (9.4%)	61– 80	6 (4.3%)	31–40	26 (18.9%)
401–500	33 (23.9%)	81–100	8 (5.8%)	41–50	6 (4.3%)

Egg laying began about the first week of May and I recorded the first nest with two eggs on May 2. I located a total of 137 nests that were built by Pied-billed Grebes but not utilized. This indicated that each pair of nesting pied-bills probably built at least two nests during the course of the breeding season, one apparently as an early nesting attempt while the other was the true nest with eggs. Data on the rate of egg laying revealed that usually one egg was laid each day but that sometimes a day was skipped towards the completion of the clutch. Mean measurements of 102 eggs were 43.53 ± 0.69 by 30.85 ± 0.44 mm. The size of the clutch varied from two to ten eggs with the mean for 97 successful clutches being 6.18 ± 0.40 and for 41 unsuccessful clutches, 4.34 ± 0.63.

During the period of egg laying and in the early stages of incubation, the grebes gave slight attention to the nest. This information I obtained by using a thermocouple concealed in the center of a nest containing a clutch of five eggs that had been incubated at least two days. The female came to the nest several times during the morning and late afternoon to rearrange or add material. On only four visits to the nest did the female attempt to incubate the eggs, and eight minutes was the longest time spent upon the eggs during this stage of incubation. Unfortunately, the nest was destroyed four days after the first data were collected and time did not permit further investigation along this line. Deusing (1939) reported that in the latter stages of incubation both sexes assisted in incubation and left the nest only for brief periods.

Just prior to the time of hatching, I observed the female removing the loose, protective covering of vegetation from around the eggs and making the interior of the nest smooth by adding small quantities of fibrous, green algae. The hatching period for a typical clutch of six eggs was spread over two days. From the first sign of pipping to the actual emergence of the young took from one-half hour to two and a half hours depending upon the climatic conditions. Each young emerged from its shell about as fast as its down dried. The embryonic membranes were shed last over the tail and around the anus. The first young of the season, which appeared to be two to four days old, I observed on June 16 on Smith's Slough. I think that the peak of hatching time was about June 26, but nests with eggs were recorded to August 8.

Productivity

Of the 138 Pied-billed Grebe nests with eggs examined in this study, 70.4 per cent (97 nests) were successful. A mean clutch of 6.18 ± 0.40 eggs were deposited in the 97 successful nests; of these 5.58 ± 0.46 hatched. From these data, I judged that approximately 541 young were produced from the nests studied.

Nest Losses

I attributed about 50 per cent of the nest destruction during the 1948 breeding season to climatic conditions such as wind and wave action and fluctuating water levels. Raccoons (*Procyon lotor*) were responsible for approximately 25 per cent of the nest destruction and were the major predator on the Pied-billed Grebe nests.

The location of the nest site seemed to affect the degree of nesting success. The 97 successful nests that I located were at a mean distance of 305.68 feet from the shore while the 41 unsuccessful nests had a mean distance from shore of 110.63 feet. Application of the "t" test to the data revealed a significant difference in the means ($t=66.34$, .01 level$=2.610$). My field observations substantiated these data, for the nests located nearest to the shoreline were those that both received the greatest predator pressure and were subjected most to stranding by fluctuating water levels. I did not find any significant correlation between nesting success and the distance the nest was located from open water. However, I did find a significant difference between successful nests (mean depth 24.2 inches) and unsuccessful nests (mean depth 16.4 inches) with regard to water depth at the nest site ($t=8.439$, .01 level$=2.610$).

A comparison of the nest measurements between successful and unsuccessful nests showed only slight and seemingly insignificant differences in construction.

Data on the 138 Pied-billed Grebe nests revealed the following general measurements: outside diameter, 15 inches; inside diameter, 5 inches; height of cup rim above waterline, 3 inches; bowl depth, 2 inches; and thickness of material under bowl, 2 inches.

Nesting Cover

From data obtained on 85, 1/4000-acre quadrats (measuring 3.3×3.3 feet), I was able to make a quantitative evaluation of the nesting cover utilized by the Pied-billed Grebe. I located each quadrat or vegetation study plot with the nest as the center and the sides oriented with the cardinal points of the compass. For each quadrat I recorded: the species of plants present, vegetation height, frequency of plant stems, per cent of plot cover formed by each plant species, and basal area of each plant species. I also made estimates of the density of the surrounding vegetative cover and the amount of floating, dead vegetation present in the water. Nineteen species of plants occurred in the 85 quadrats, but only six species were present on 20 per cent or more of the quadrats. The data are summarized in Table 2. Gabrielson (1914) reported that Pied-billed Grebes also utilized cattails (*Typha* sp.) for nesting cover.

Table 2

Nesting Cover Analysis of 85, 1/4000-acre Quadrats, Ruthven, Iowa, 1948

Plant Species	*Stem Frequency*			*Per cent of cover*		*Basal Area (square inches)*	
	Total	Plots	Mean	Range	Mean	Range	Mean	Range
Eleocharis macrostachya	17,705	46	384.8	13–1272	56.0	3–100	2.87	0.25–7.50
Scirpus acutus	5,967	33	180.8	4– 460	77.6	1– 50	4.16	0.50–7.00
Scirpus heterochaetus	4,300	20	215.0	6– 821	49.3	1– 90	3.87	1.00–9.75
Sparganium eurycarpum	2,283	18	126.8	8– 469	40.3	3–100	3.44	0.50–8.50
Sagittaria cuneata	619	21	24.7	2– 115	8.9	2– 30	0.92	0.25–3.00
Scirpus validus	611	29	21.0	2– 52	19.3	1– 50	1.54	0.10–3.50
Scirpus fluviatilis	591	15	39.4	2– 149	30.5	2–100	2.10	0.25–7.50

Not only was a wide variety of plants utilized by the grebes for nesting cover, but I noted also that there was considerable variation in the frequency, height, basal area, and per cent of plot cover of the various plant species on the quadrats. The mean number of plant stems per quadrat in utilized nesting cover was 396.8 stems with a range from 0 to 1,272 stems. The relatively high vegetation density used for nesting indicated that the grebes utilized the "fringe cover," which was characterized by the abundant spike rush (*Eleo-*

charis macrostachya). Statistical analysis of the pertinent data revealed no significant correlation between nesting success and vegetation density at the nest site.

Discussion

Since vegetation density did not apparently affect the nest success to a statistically significant degree, I believe that manipulation or control of the water levels to obtain the greatest development of vegetation consistent with optimum water levels would reduce the destructiveness of the climatic factors and would assist in reducing nest losses. Similarly, water level control to the point where fluctuations were at a minimum would also benefit the nesting Pied-billed Grebes. Increased trapping of fur bearers may alleviate some of the predator pressure on the nesting population.

Summary

1. Pied-billed Grebes arrived in northwest Iowa during the last week of March in 1948.

2. Breeding activity reached its peak during the last week of May and the first part of June.

3. Sometimes both sexes of Pied-billed Grebes took part in the defense of their nesting territories, but the male usually defended the area.

4. The Pied-billed Grebe nest was a floating, truncated cone of water-soaked vegetation and required from three to seven days for construction.

5. Over 85 per cent of the nests were located within 50 feet of an open water area in the marshes, the mean distance being 25.7 feet.

6. Egg laying began about the first week of May, 1948.

7. Of the 138 nests I examined, 97 (70.4 per cent) were successful. Approximately 541 young hatched from these nests.

8. Inclement weather was the major factor affecting nest loss (50 per cent).

9. The raccoon was responsible for about 25 per cent (10 nests) of the nest loss.

10. Analysis of the data indicated that those nests located near the shore were least likely to succeed.

11. Pale spike rush (*Eleocharis macrostachya*), hard-stemmed bulrush (*Scirpus acutus*), and soft-stemmed bulrush (*Scirpus validus*) occurred on more nest-containing quadrats than did other plant species.

12. Manipulation of the water levels appears to be the best means of making northwest Iowa marshes more attractive to breeding Pied-billed Grebes.

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Humboldt State College, Arcata, California, October 1, 1951

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GENERAL NOTES

Behavior of a female Eastern Kingbird.—On May 25, 1950, I saw a pair of Eastern Kingbirds, *Tyrannus tyrannus*, together in my study area at Pimisi Bay in central Ontario. On June 3, one of them, apparently the female, began carrying nesting materials to a telephone post that stood in a marshy spot along the highway. The other bird, apparently the male, sat on guard near by and occasionally accompanied the female on her trips to and fro. She placed the material among four insulators at the end of the horizontal crosspiece of the post. Immediately the wind flicked the material away to the ground.

Nevertheless, the female worked with great assiduity. Sometimes she succeeded in braiding a few strands of dead grasses around the insulators so that she could arrange the material, sit on it, and mold it energetically with her breast. But most often, having got thus far, she found herself molding nothing but the bare arm of the telephone post and she departed to return with another load. This unsuccessful building went on for 10 days with never-flagging energy. But at the end of this period, only an odd straw waving from the telephone post and sheaves of them scattered on the ground remained to tell of the kingbird's untiring efforts.

On June 12 she was alone and still building. It became obvious that the male had disappeared, probably the victim of a Sharp-shinned Hawk, *Accipiter striatus*, which hunted in the area. The next day the female had ceased building. She sat on the wires close to the nest-site, preened, and caught insects over the water. At one time she approached a male Red-winged Blackbird, *Agelaius phoeniceus*, whose nest was below in the reeds, uttering "chittering" notes, in the same way as she used to approach her mate. On two other occasions, one of a second pair of kingbirds was seen perched on the wires near the nest-site. But the female did not display, nor did she oppose the visits upon her territory.

On June 23, 11 days after the male disappeared, there was another kingbird perched on the wires with the female. This bird flew off northward and the female followed. But when the two were about 600 feet from the nest-site, the female turned about and came back.

Seven days after this she was still on guard by her post. A Yellow-bellied Sapsucker, *Sphyrapicus varius*, arrived and knocked a tattoo on the post. Immediately she flew at him and chased him back into the woods.

On July 19, 37 days after she gave up nest-building, the female kingbird gave "chittering" notes when the Red-wing male flew past her as she perched on the wire. Shortly after she apparently left the neighborhood, since I no longer saw her on the territory.

Nice, in her study of the Song Sparrow, *Melospiza melodia* (1943. *Trans. Linn. Soc. N. Y.*, 4:216–217), emphasized that in many birds "the attachment to the nest-site and the nest may become so great as to overshadow the attachment to mate, eggs or young." In the case of this female kingbird, with neither mate, eggs, nor young, nor even a nest to embody her tie to the nest-site, she remained faithful to it and defended it to some extent throughout the approximate natural length of her nesting cycle, and on one occasion, even though tempted, she forebore leaving it. Her displays to a male bird not of her own kind, perhaps prompted by the rough similarity to her own mate in coloring, size, and fluttering territorial flights, no doubt was a consequence of an unusual situation.—Louise de Kiriline Lawrence, *Rutherglen, Ontario, July 20, 1952.*

Feeding of Mallards prevented by Crows.—On January 28, 1952, I was observing approximately 250 Mallards (*Anas platyrhynchos*) on a slough one mile north and one and one half miles east of Lawrence, Douglas County, Kansas. Some of the ducks were standing on ice on the slough; others were circling overhead. The ducks on the ice suddenly took flight. The flock then began to alight and forage in a corn field adjacent to one end of the slough. In a few seconds several crows (*Corvus brachyrhynchos*) appeared and circled approximately four feet over the ducks. Almost immediately a crow swooped at a duck, flushed it, and chased it about 20 yards. The other crows also began to chase ducks. The few crows were soon joined by others until there were 20 of them, all chasing the ducks. After five minutes the entire flock of ducks took flight with all of the crows in close pursuit. After following the ducks for perhaps 25 yards, the crows returned and perched on broken corn stalks where they engaged in a short period of preening. They then flew off without feeding. The ducks had disappeared to the south toward the Kansas River.—Dennis Rainey, *University of Kansas Natural History Reservation, Lawrence, Kansas, June 15, 1952.*

Subspecific status of the Common Loon in Florida.—Howell (1932. "Florida Bird Life," p. 73) gives *Gavia immer immer* (Brünnich) as the only race of the Common Loon occurring in Florida. He cites numerous observations but records no specimens preserved nor any reasons for the subspecific identification. His determination of race has been followed by other workers on Florida birds without substantiating data.

I have examined nine specimens from Alachua, Brevard, Citrus, Levy, Marion, and St. Johns counties, Florida, collected between November 13 and June 9. The measurements of four males are: wing 348–364 mm., tarsus 82.5–96 mm. Five females measure: wing 312–328, tarsus 82.5–89.5. These nine birds agree in size with ten breeding United States specimens of the Lesser Loon, *Gavia immer elasson* Bishop. They are decidedly smaller than six skins of the Common Loon, *Gavia immer immer*, from Iceland, Greenland, Labrador, and northern British Columbia. Accordingly I suggest that *elasson* be added to the Florida list and *immer* be removed from lack of evidence as to its occurrence in the state.—Pierce Brodkorb, *Department of Biology, University of Florida, Gainesville, Florida, July 11, 1952.*

Possible commensalism between Myrtle Warbler and Yellow-bellied Sapsucker.—On January 6, 1952, I observed a Yellow-bellied Sapsucker (*Sphyrapicus varius*) feeding on hackberries (*Celtis occidentalis*) in a swamp at Seneca, Maryland. The bird would perch on a limb, then launch into the air and neatly pick off a berry as though catching a flying insect. Once the sapsucker flew with the berry to a nearby tree and spent some time searching up and down the bark. Finally locating a suitable crevice into which it wedged the berry, the bird hammered on the stone, of which the berry largely consists, to extract the seed. A Myrtle Warbler (*Dendroica coronata*) was attracted by the sapsucker as the latter left the tree and followed the sapsucker about closely—within two feet and once within six inches—during the whole time the larger bird hunted for a crevice and worked on the berry. As soon as the sapsucker had flown away, the Myrtle Warbler went directly to the crevice and apparently searched for leftovers. The sapsucker meanwhile picked another berry and flew with it to a tree 50 feet away. The Myrtle Warbler subsequently followed it, coming within six feet, but at this time both birds flew away.—Lawrence Kilham, *8302 Garfield Street, Bethesda, Maryland, July 11, 1952.*

Evening Grosbeak nesting in Montana.—The Evening Grosbeak (*Hesperiphona vespertina*) is a fairly common summer resident of the mountainous portion of western Montana. The nest of this species, however, has to my knowledge not previously been reported for this state. On July 3, 1952, a nest with five partly grown young was found by the ornithology class from Montana State College while they were on a field trip. Both parent birds stayed within a few feet of the nest while it was being inspected.

The nest was about 45 feet from the ground in a dense stand of Douglas fir (*Pseudotsuga taxifolia*). It was composed almost entirely of Douglas fir twigs and was lined with a few rootlets and two horsehairs. The nest was located about four miles north and east of Bozeman, Gallatin County, at an altitude of about 4800 feet.—Clifford V. Davis, *Department of Zoology and Entomology, Montana State College, Bozeman, Montana, July 18, 1952.*

Bird notes from the Texas coast.—The following records are based mainly on my observations while I was stationed at the Aransas National Wildlife Refuge, Refugio and Aransas Counties, Texas, from October, 1938, to October, 1941. This 47,000-acre preserve occupies Blackjack Peninsula, which extends into coastal bays of the Gulf of Mexico. I think that the following notes are of distributional interest or significant because of the relative rarity of some species listed in the central section of the Texas coast. Certain western forms referred to below occur at some time of year in the extreme southern part of the state (Brownsville-Harlingen region) but not regularly north or east of that area.

Mexican Grebe (*Colymbus dominicus*).—This grebe now nests regularly at Rockport, Aransas County. Everett Beaty, of the refuge staff, found several pairs nesting at Jones Lake on the refuge in the summers of 1942 and 1943. Several broods were reared. This lake lies 25 miles northeast of Rockport.

White-winged Scoter (*Melanitta deglandi*).—An immature male was shot by Jack Sanders in Aransas Bay near Lamar, Aransas County. December 31, 1940. The specimen is now in the Fish and Wildlife Service collection at the U. S. National Museum.

White-tailed Kite (*Elanus leucurus*).—In view of the rarity of this species in the Central States, mention is made of one seen near Roddy Island on the refuge by Robert P. Allen, the writer, and others, on April 20, 1940.

Swallow-tailed Kite (*Elanoïdes forficatus*).—This is a regular, although rare, migrant in Texas. Everett Beaty saw one on the refuge, March 26, 1940. Another was seen there April 31, 1941, by Albert Nutt.

American Rough-legged Hawk (*Buteo lagopus*).—Casual. A few winter sight records of refuge birds. Bent (1937. *U. S. Natl. Mus. Bull.* 167, p. 284) mentions several sight records and one specimen, the latter from the Aransas River in 1887, for Texas.

Prairie Falcon (*Falco mexicanus*).—A few refuge sight records. One was shot by a Mexican at Rockport, Aransas County, April 16, 1940; the specimen was preserved.

Duck Hawk (*Falco peregrinus*).—This regular winter visitor was observed on the refuge as late as May 30 (1940) and as early as July 21 (1940).

Golden Plover (*Pluvialis dominica*).—While this is a regular spring migrant along the Texas coast, it is rare in autumn. One was seen at Austwell, November 16, 1938.

Hudsonian Godwit (*Limosa haemastica*).—One seen at the refuge CCC camp, May 13, 1939. The writer and Phil Goodrum saw two at the refuge ranchhouse, May 11, 1941.

Avocet (*Recurvirostra americana*).—Common refuge migrant; one nesting record. Robert P. Allen observed a pair copulating at Rattlesnake Point on April 24, 1940. A

nest with four eggs was found there in a clump of saltgrass (*Distichlis*) on May 6. The eggs hatched successfully on May 25 and 26. Bent (1927. *U. S. Natl. Mus. Bull.* 142, p. 45) records the Avocet as breeding rarely to south Texas (Corpus Christi and Isabel).

Northern Phalarope (*Lobipes lobatus*).—This species is extremely rare in Texas. A female was seen at Shallow Lake on the refuge's east shore flats on April 24, 1940, by Everett Beaty and the writer. Another bird was found that day by Robert P. Allen at Rattlesnake Point. Seven birds, including both sexes, were found at Shallow Lake on April 25 and 29, 1940.

Buff-bellied Hummingbird (*Amazilia yucatanensis chalconota*).—This species is rare in the United States outside of the lower Rio Grande Valley in extreme southern Texas. One which fed at some turkscap bushes at the refuge ranchhouse daily from November 8 to 13, 1939, was found dead there November 14. The specimen, an adult male, is now in the Fish and Wildlife Service collection at the U. S. National Museum. It was identified as of this race by Harry C. Oberholser.

Say's Phoebe (*Sayornis saya*).—One observed at the refuge, November 4, 1938. Bent (1942. *U. S. Natl. Mus. Bull.* 179, p. 172) cites winter records east to San Angelo, Laredo, and Brownsville.

Red-breasted Nuthatch (*Sitta canadensis*).—Bent (1948. *U. S. Natl. Mus. Bull.* 195, p. 34) lists southern winter records of this nuthatch in Texas for San Antonio, Knickerbocker (Tom Green County), and El Paso. I saw one at refuge headquarters on October 15, 1941.

Cactus Wren (*Heleodytes brunneicapillus*).—Vagrant. Tarleton F. Smith identified one on the refuge December 13, 1938. Bent (*op. cit.*, p. 231) says that the Cactus Wren is found east to Runge (Karnes County) and Brownsville.

Sage Thrasher (*Oreoscoptes montanus*).—Two seen at Brahma Well on the refuge, December 30, 1938. Bent (*op. cit.*, p. 434) mentions no winter records east of Kerrville, Laredo, and "rarely" Brownsville.

Mountain Bluebird (*Sialia currucoides*).—Six were observed at the Brahma Well, Aransas Refuge, December 13, 1938.

Varied Bunting (*Passerina versicolor*).—Robert P. Allen saw a Varied Bunting in a thicket at Rattlesnake Point on the refuge, April 16, 1940.—James O. Stevenson, *U. S. Fish and Wildlife Service, Washington, D.C., March 20, 1952.*

Chuck-will's-widow in central Ohio.—At approximately 8:50 p.m. on June 7, 1952, I heard a Chuck-will's-widow (*Caprimulgus carolinensis*) singing close to my home in Upper Arlington, near the Scioto River, Franklin County, Ohio.

The bird sang for about four minutes. The night was cloudless and the temperature 70° F. During the performance I called Dr. Floyd B. Chapman, Ohio Division of Wildlife, on the telephone. He confirmed the identification, stating that he could hear the notes clearly in the receiver. Both Dr. Chapman and I have heard this species many times in southern Ohio and in the southern states.

Upper Arlington is about 85 miles northeast of the only known nesting colony of the species in Ohio, in the Ohio Brush Creek area of Adams County. It might be observed that the central Ohio bird was in a limestone area somewhat similar to the habitat in Adams County. This bird, evidently a straggler, constitutes the northernmost record for the species in Ohio.—William M. Gilbert, *2262 Yorkshire Road, Columbus, Ohio, June 22, 1952.*

White-rumped Sandpiper in Indiana.—The status of the White-rumped Sandpiper (*Erolia fuscicollis*) in Indiana has not been fully determined. Until comparatively recent years, little was known of the species in this state. Butler (1897. "Birds of Indiana," *Indiana Dept. Geol. Nat. Resources Ann. Rept.* 22:1173) knew of no record but carried the species on the hypothetical list.

Frederick M. Baumgartner first added the species to the state list with his observation of six birds in Marion County, April 10, 1926 (1931. *Proc. Indiana Acad. Sci.*, 402:298). Two records were obtained in Allen County in 1934, as reported by Frank Johnson (1938. *Yearbook Indiana Aud. Soc.*, p. 65). Harry M. Smith observed it in Lake County in 1936 (1936. "Notes on the birds of the Calumet and Dune Regions," mimeographed paper, p. 12). Donald H. Boyd observed it in Porter County in 1942. I can find no records for the years 1943 to 1948, inclusive.

From 1949 to 1952, inclusive, records have multiplied to such an extent that the White-rumped Sandpiper now appears to be a regular migrant in Indiana in both spring and fall. I have 28 records for that period, from various observers, and seven counties are represented. It has appeared most often in Lake County (13 reports), Marion County (7 reports), and Porter County (5 reports). All of the Lake County records have been obtained from Wolf Lake, which lies on the border of Illinois and Indiana. It has been found with the same regularity across the line in Illinois, as reported to me by T. J. Nork, Albert Campbell, Amy Baldwin, and others.

I took a female at Wolf Lake on July 20, 1950, which is apparently the first specimen for the state. It was one of two White-rumped Sandpipers observed that day and was feeding with a flock of Semipalmated Sandpipers (*Ereunetes pusillus*) along a sandy strip of shoreline. The other was with a group of Least Sandpipers (*Erolia minutilla*) in the same type of habitat. This specimen has been deposited in the Purdue University Wildlife Laboratory Collection, Lafayette, Indiana.

Val Nolan, Jr., has made some interesting observations on the White-rumped Sandpiper (1951. *Indiana Aud. Quarterly*, 29(2):21–22), from which I quote: "On September 8, [1950] at the Indianapolis Sewage Disposal Plant in Marion County, my attention was attracted to ten shore birds dropping from high in the air to one of the settling pits. They flew low over the area several times and finally lit on a pit beside me. Four were White-rumped, six Semipalmated Sandpipers. After resting no longer than thirty seconds the flock arose abruptly, mounted quite high, and flew straight away. The birds seemed to be migrating and to have been attracted for a moment by the pits. This observation was made at 9 a.m.; it had been raining heavily until a few moments before the birds appeared. Many other small shore birds were present on the pits."

Nolan obtained further information on September 14, 1950. Regarding this instance, he (*loc. cit.*) wrote, "I came suddenly upon and frightened away a mixed flock of small shore birds which included several White-rumps. About thirty minutes later I found what was probably the same flock, consisting of five White-rumped, five Semipalmated, and two Least Sandpipers. The birds of the species here under discussion were stepping about on the half-submerged foundation of a building. Their manner of feeding in this particular made them resemble Spotted Sandpipers [*Actitis macularia*]. Occasionally a bird would fly from stone to stone. They were apparently not disturbed by my presence, and I left them still feeding."

James B. Cope and I saw a lone White-rumped Sandpiper in a flock of 19 Semipalmated Sandpipers on a small pond in LaPorte County, June 3, 1951. We were able to study the bird for several minutes as the flock fed along a soft muddy area. It appeared

to feed at the edge of the flock or slightly away from the group, although it flew amidst the group when flushed.

Two White-rumped Sandpipers observed on May 30, 1952, by Charles M. Kirkpatrick, Marvin and Hubert Davis, Richard Phillips, and the writer, were feeding in a rain pool on a cinder flat. Their companions were Semipalmated Sandpipers and Red-backed Sandpipers (*Erolia alpina*). These birds called occasionally while wading about and while making short flights across the pool; the bat-like note was given perhaps six times.

The White-rumped Sandpiper is probably more common in Indiana than the foregoing records indicate. Its habit of accompanying similar, small shore birds in migration may have resulted in its being overlooked in some cases. From present records, it has been observed as early as April 10 (1926), seven times in May, five in June, three in July, six in August, five in September, and last noted October 20 (1951). Each flock of "peeps" should be critically examined for White-rumps. It has been found in small numbers, usually from one to six, but Boyd recorded 24 on one occasion.—Russell E. Mumford, *Route 1, Cortland, Indiana, November 19, 1951.*

"Cataleptic" behavior in the Hudsonian Chickadee.—On the morning of April 13, 1951, near College, Alaska, I saw a group of six Hudsonian Chickadees (*Parus hudsonicus*) in a mixed stand of spruce and birch. I shot three of these chickadees for specimens. One of the birds fell wounded into the snow, fluttering its wings and kicking its legs violently for several seconds. Two of the remaining chickadees, attracted by the actions of this wounded bird, flew down in great excitement. Hopping about on the lower branches of some trees only a few feet from the dying bird, they repeatedly fluttered their wings in the attitude of young birds begging for food and occasionally turned upside down on the branches, fluttering all the while. One of them finally dropped onto the snow, fluttering and jerking very much like the dying bird. As I approached to retrieve the specimen, the uninjured bird recovered and flew to a near-by branch to rejoin its companion, and as I picked up the then dead bird, the other two chickadees remained very near, constantly displaying with their wings. They remained in the area in an excited state for some time after I retreated from the scene.

Instances of unusual behavior are recorded in the literature for several species of *Parus*. Armstrong (1947. "Bird Display and Behavior," pp. 79–80) describes these "for want of better terms" as "shamming dead" and "cataleptic fits." He cites Wellman's note (1938. *Auk*, 55:673) concerning a Black-capped Chickadee (*Parus atricapillus*) that remained unconscious for about four minutes when frightened, and of another one that, when threatened by a Tree Sparrow (*Spizella arborea*), reverted to a cataleptic seizure similar to the one here described. More recently Hickey (1952. *Auk*, 69:88) has given an account of similar behavior of Black-capped Chickadees at her banding station, in which she cites also published descriptions of similar instances for *P. atricapillus* by Odum and for *P. hudsonicus* by Pettingill. Of a somewhat different but perhaps related nature is the account by Hunt (1951. *British Birds*, 44:278) of a female Great Tit (*Parus major*), which, while engaged in a wing-quivering displacement-display, induced the mounting response of a male Chiffchaff (*Phylloscopus collybita*).

From these accounts it is evident that several species of *Parus*, in widely separated regions of the world, are similarly affected by some sort of nervous seizures under emotional stress. It seems that such behavior would be distinctly dysgenic in nature.—Tom J. Cade, *Alaska Cooperative Wildlife Research Unit, College, Alaska, May 13, 1952.*

Some bird records of importance from New York.—There are several specimens in the Louis Agassiz Fuertes Memorial Collection of Birds at Cornell University which have not been previously reported, and which should be placed on record. Some corrections to earlier literature are also given below.

Ixobrychus "neoxenus". Cory's Least Bittern. Carpenter, in his summary of known records of this form (1948. *Auk*, 65:80–85), overlooked a specimen taken at Ithaca, New York, which was fully described by Allen (1913. *Auk*, 30:559–561). The Ithaea bird, captured May 17, 1913, was the next-to-last of the 31 known examples of Cory's Least Bittern; the last was taken in Illinois on May 23, 1914 (1915. Eifrig, *Auk*, 32: 98–99).

Stercorarius longicaudus. Long-tailed Jaeger. Eaton (1909. "Birds of New York," 1:118) listed only one definite record of this species from New York, a Long Island specimen in the Ameriean Museum of Natural History. Cruickshank (1942. "Birds Around New York City," pp. 221–222) listed an additional specimen and four sight records from Long Island. No specimen from the interior of New York seems to have been reported in the literature. There are two such specimens, both immature, in the Cornell collection. One was found by Peter Mattli on a breakwater at the head of Cayuga Lake in Ithaca, March 8, 1942. It obviously had been dead for some time, and has been preserved in its mummified condition. The specimen was identified by George M. Sutton.

The other Long-tailed Jaeger is from the collection of the late Frank S. Wright of Auburn, New York. It was taken on Owasco Lake, Cayuga County, on September 4, 1908, and remained in the Wright collection for many years as a supposed specimen of *Stercorarius parasiticus*. After the Wright collection was aequired by Cornell, this jaeger was examined by Dwain W. Warner and the writer, and its identification questioned. In 1946, the skin was sent to Robert C. Murphy and to George M. Sutton for reidentification. Both confirmed our suspicions that the bird was actually *S. longicaudus*.

Larus minutus. Little Gull. There is an example of this species in the Cornell eollection which has been mentioned only in the local list in Allen's "Ornithology Laboratory Notebook" (1947, p. 50). This speeimen appears to be the earliest known inland occurrence of this Old World gull in North America, and the third earliest from New York. It was taken on Cayuga Lake, near Cayuga, on May 20, 1916. An immature female, it was shot by Ludlow Griscom from a mixed flock of Bonaparte's Gulls (*Larus philadelphia*) and Common (*Sterna hirundo*) and Black Terns (*Chlidonias niger*). The spccimen was prepared by Fuertes, who did not realize that the bird was anything but an abnormally small Bonaparte's Gull. Its true identity was suspected and confirmed some years later by Arthur A. Allen.

Sterna paradisaea. Arctic Tern. In Griscom's note (1916. *Auk*. 33:319) on the capture of this speeimen, the year was given erroneously as 1915. This tern was collected from the same flock of birds as was the Little Gull mentioned above, on May 20, 1916, and was the second specimen for New York.

Dendroica nigrescens. Black-throated Gray Warbler. A male of this western spccies was taken in a pear tree in Arthur A. Allen's yard in Ithaca on November 15, 1932. A search of the literature and the U. S. Fish and Wildlife Service distribution files revealed no other New York record of this species. It has apparently been collected at only two other localities in eastern North America. One was found dead in Lenox, Massachusetts, Decembcr 9, 1923 (Vorhees, 1924. *Auk*, 41:348), and one was colleeted in Columbus, Ohio, November 15, 1950 (Thomas, 1951. *Wilson Bulletin*, 63:206). It

is noteworthy that all three of these specimens were taken at about the same time of year, long after most eastern warblers had left for the south.

Specimens examined by me in the collections of Cornell University and the American Museum of Natural History indicate that Oberholser (1934. *Sci. Publ. Cleveland Mus. Nat. Hist.*, 1:101) was probably justified in his division of this species into two races on the basis of size, although color differences claimed by Oberholser were not apparent to me. Arizona and New Mexico birds average larger than coastal birds in both wing and tail measurements. The Ithaca specimen is large (chord of wing, 65 mm.; tail, 55 mm.), and would be assigned to the southwestern population for which Oberholser revived the name *halseii* Giraud, should this subspecific division receive general acceptance.—Kenneth C. Parkes, *Laboratory of Ornithology, Cornell University, Ithaca, New York, April 1, 1952.*.

Notes on warblers in Colorado.—A female Hooded Warbler, *Wilsonia citrina*, was secured by the writers on May 3, 1952, at Barr Lake, 15 miles northeast of Denver, Colorado. This is believed to have been the first specimen taken in the state although Jean Sutherland (1927. *Bird-Lore*, 29:120) reported seeing a male on May 8 and 9, 1926, at Boulder, Colorado.

Our specimen was collected on the ground where it had been feeding in low weed tangles among the cottonwood trees of the lake shore. The habitual flashing of white in the tail distinguished it immediately from the female of the similar Wilson's Warbler, *Wilsonia pusilla*. The skin, No. 26599, has been placed in the collection of the Denver Museum of Natural History.

Mniotilta varia. Black and White Warbler.—A male was observed singing in the inundated trees of Barr Lake on May 11, 1952, by the advanced ornithology class of the University of Colorado, accompanied by A. Lang Baily and John Flavin. On May 14, three days later, a Black and White Warbler was heard singing in the same vicinity by the authors. This species is considered a rare migrant in the eastern part of the state.

Parula americana. Parula Warbler.—A female of this rare Colorado migrant was seen by Don Thatcher and John Flavin in the willows below the Barr Lake Dam on May 10, 1952. The bird was still there the following day when it was observed by the University class led by Gordon Alexander.

Dendroica magnolia. Magnolia Warbler.—A high-plumaged male was observed by authors at Wray, Yuma County, Colorado, on May 17, 1952. Robert J. Niedraeh observed another male on May 18 at his home 12 miles south of Denver. Mr. Niedrach reports that the species was seen there at the same time the previous year. From these and other recent records, we think that the Magnolia Warbler is a more common migrant in eastern Colorado than previously indicated in the literature.

Dendroica pensylvanica. Chestnut-sided Warbler.—The fourth Colorado observation of this species was made by Don Thatcher on May 15, 1951. The bird, a male, was seen at Sloan's Lake Park, Denver, where it was feeding in dense thickets. Previous records are: a male collected by Robert J. Niedraeh at Barr Lake, May 16, 1933; a sight observation by Margaret Pritchett near Denver, May 31, 1935 (1939. The Birds of Denver and Mountain Parks. *Colorado Mus. Nat. Hist. Popular Series*, No. 5, p. 141); and a male seen at Boulder by Fred M. Packard, April 29, 1942 (1943. *Auk*, 60:108).—A. Lang Baily and Robert P. Fox, *Denver Museum of Natural History, Denver, Colorado, June 3, 1952.*

Avocets in Alabama.—On October 15, 1949, Thomas A. Imhof, James Doubles, William E. Jernigan, and Atkeson were checking on migrating shore birds on the western part of the Wheeler National Wildlife Refuge. This refuge, located in the Tennessee Valley of northern Alabama, includes many acres of mud flats, which are used by various species of shore birds. In the late afternoon, while the party was in the Whitesides vicinity of the refuge in Limestone County about two miles north of Decatur, Imhof noted a single Avocet (*Recurvirostra americana*) feeding with a flock of Lesser Yellow-legs (*Totanus flavipes*). All members of the party observed the Avocet.

A close check failed to reveal any previous Avocet records for Alabama and it was considered advisable to collect the bird to verify the record. This was done by Ernest Byford on October 22, 1949, and the specimen is now in the Washington collection of the U. S. Fish and Wildlife Service.

On November 7, 1950, John H. Sutherlin and Henry H. Grammer noted a flock of ten Avocets on a mud flat along the southeastern shore of Garth Slough, in Morgan County, ten miles east of Decatur. The birds were observed at close range and with binoculars. On November 1, 1951, Grammer and both authors observed two Avocets in the same locality.

The occurrence of the Avocet in Alabama in each of three consecutive autumns indicates that the species may be an uncommon, but possibly a regular, fall migrant in northern Alabama.—David C. Hulse and Thomas Z. Atkeson, *Box 1643, Decatur, Alabama, April 22, 1952.*

European Tree Sparrow extending its range in United States.—The European Tree Sparrow (*Passer montanus*) has been included in the state lists of Missouri and Illinois and recent books have described it as localized about St. Louis, with a southern migratory trend into the Horseshoe and Reelfoot Lake areas of southern Illinois and western Tennessee. In 1949, I found a pair of European Tree Sparrows nesting behind a rain pipe on the Hannibal, Missouri, high school, 100 miles north of St. Louis. In 1950, a pair was recorded nesting at Hull, Illinois, 10 miles east of Hannibal. On June 6, 1951, Doctor James W. Chapman, of Jacksonville, Illinois, and I drove around Lake Mauvaisterre south and east of Jacksonville where we located a colony of at least eight pairs of European Tree Sparrows living in holes in soft maple trees about the lake. I believe this is the easternmost and northernmost record to date. Seemingly, the species is extending its range northward.—T. E. Musselman, *Quincy, Illinois, June 21, 1952.*

Chestnut-collared Longspur: an addition to the Louisiana list.—On the morning of March 23, 1952, while crossing a small airfield at Gilliam, Caddo Parish, Louisiana, about 23 miles north of Shreveport, I flushed a flock of six birds. As they bounded through the air, flashing white outer tail-feathers, they uttered a double call-note unlike any with which I was familiar. I approached close enough to obtain a good view of the birds on the ground. One of the six was a male sufficiently distinctive in plumage for me to identify it as a Chestnut-collared Longspur (*Calcarius ornatus*). The others appeared to be females of the same species. I returned in the afternoon and, with the assistance of John P. Everett, succeeded in obtaining a specimen which is now in the collection of the Museum of Zoology, Louisiana State University. This species was last seen on March 30, when I noted a flock of five in the same area. This apparently was a different group as none was in the spring plumage of the male.

Chestnut-collared Longspurs were also found in a pasture at Wallace Lake Dam, 36 miles south-southeast of Gilliam, on March 25 and 26, 1952, by Mrs. H. C. Hearne. I observed a flock of nine birds there on March 27, and five on March 29. None could be found on April 1.

The Chestnut-collared Longspur has not previously been recorded in Louisiana. While it seems unlikely that the species is of regular occurrence here, it should be noted that neither of the areas in which it was found has ever been visited previously during spring migration by an ornithologist.—Horace H. Jeter, *4534 Fairfield Avenue, Shreveport, Louisiana, April 21, 1952.*

Unusual behavior of Tufted Titmice.—On the afternoon of January 25, 1951, while looking for birds in a deciduous woods not far from Lancaster, Fairfield County, Ohio, I squeaked up five Tufted Titmice (*Parus bicolor*). I noticed that four of the five, in flying from tree to tree toward me, kept their wings and tails spread as they alighted, holding this rather extraordinary pose from five to eight seconds. Each time as they flew into a new tree they repeated the procedure. The fifth bird, although scolding and flying along with the others, did not put on the spread-wing act. When I stopped squeaking the birds stopped their spread-wing posing, though they continued to fly from tree to tree about me. I have read no other reports of this behavior in Tufted Titmice, nor have I previously seen this behavior in over 20 years of bird-watching.—Charles R. Goslin, *726 King St., Lancaster, Ohio, January 31, 1951.*

Pleistocene birds from Haile, Florida.—Vertebrate fossil remains occur in a fresh water deposit in a limestone quarry in Section 24, T 9 S, R 18 E, a little south of the village of Haile, and about four miles northeast of the town of Newberry, Alachua County, Florida. The altitude of the railroad station at Newberry is 83.5 feet. The fossil locality thus lies between the Wicomico (100 feet elevation) and Penholoway (70 feet) terraces of the Sangamon Interglacial Stage of the Pleistocene, as outlined by Cooke (1936. *Jour. Wash. Acad. Sci.*, 21 (21):503–589).

The stratigraphy is as follows:

5. 6 inches: surface layer of dark brown sand
4. 1½ feet: consolidated dark gray sand with charcoal
3. 8 feet: yellowish brown sand
2. 10 feet: bluish or yellowish clay with lenses of fresh water shells
1. White marine sand (Penholoway?).

Strata 2 and 3 both contain avian fossils. All of the birds identified occur in the county today, although the Mallard is present only as a winter visitant. One species had not previously been recorded in a fossil state, and two others were not known from Florida as fossils.

Podilymbus podiceps.—The Pied-billed Grebe is represented by the distal end of a right tibiotarsus and the proximal end of a left ulna, both pinkish brown in color. It has been previously reported from two other Pleistocene localities in Florida (Wetmore, 1931. *Smiths. Misc. Coll.*, 85 (2):12–13), as well as from other parts of North and South America.

Guara alba.—Cervical vertebra, reddish brown in color; collected by Jon L. Herring. The only previous record of the White Ibis as a fossil is that reported by Wetmore (*op. cit.*: 18) from Florida.

Anas platyrhynchos.—Two pale pinkish brown carpometacarpi, the proximal portion of a right one and the distal fragment of a left one. These bones were collected by Coleman J. and Olive B. Goin. The Mallard is widely known from the Pleistocene throughout the Holarctic Region.

Porphyrula martinica.—Distal end of a right humerus, pale pinkish brown. The Purple Gallinule has not definitely been reported before as a fossil, although Winge (1888. *E Museo Lundii*, (2):4) tentatively reported it from the Pleistocene of Brazil. My specimen is slightly smaller than the humeri of two modern birds from Florida. Its measurements are: transverse width through condyles, 6.4; width of shaft, 3.4; depth of external condyle, 3.5 mm.

Gallinula chloropus.—Cervical vertebra, pinkish gray in color; collected by the Goins. The Florida Gallinule has been reported from the Pleistocene of Florida, as well as other localities in North and South America and Europe.

Fulica americana.—Distal end of right tibiotarsus, dark gray in color. The American Coot has already been recorded from three other Pleistocene localities in Florida. Howard (1946. *Carnegie Inst. Washington Publ.* 551:182–183) separated the Pleistocene coots of Oregon as *Fulica americana minor* Shufeldt. This chronoclinal fossil coot had shorter wings and longer legs than the living coot. The only measurement of the tibiotarsus given by Howard is the length, but this is impossible to determine in the fragmentary bone at hand. In my specimen the bone is slightly more slender than the average for modern coots, although falling within the range of variation of modern birds. Its measurements are as follows: breadth through condyles, 7.6; depth of internal condyle, 7.8; depth of external condyle, 7.4; narrowest breadth of shaft, 3.3 mm. More material needs to be studied before the identification can be carried below the species level.

Ammodramus savannarum.—Right humerus, white in color but well mineralized. The Grasshopper Sparrow has not previously been recorded as a fossil. Measurements are as follows: length, 17.8; breadth of proximal end, 4.8; breadth of distal end, 3.5; breadth of shaft at middle, 1.4 mm.—Pierce Brodkorb, *Dept. of Biology, University of Florida, Gainesville, Florida, April 18, 1952.*

Black snake captures nestling Blue-winged Warbler.—On June 17, 1951, I was photographing Blue-winged Warblers (*Vermivora pinus*) at their nest, about four miles northwest of Brickerville, northern Lancaster County, Pennsylvania. I had taken some 50 feet of motion pictures when a black snake (*Coluber constrictor*) came into the blind from behind me, passed between my feet, and proceeded out of the blind in the direction of the warbler nest. It moved past the nest for a distance of about ten feet, then circled back directly to the nest, swiftly took one of the young warblers, and moved on with the bird held in its jaws.

The adult warblers were not near the nest when the snake first appeared. But before the nearly naked young warbler was removed from the nest both adults were there. They dived swiftly and excitedly over the nest throughout the time the snake was present and for some time thereafter. Meanwhile two of the remaining three nestlings climbed over the edge of the leafy nest and crawled over the ground to a distance of about four feet, where I found them later. One of the young remained in the nest. It appeared as if the behavior of the adult Blue-winged Warblers was designed to lead the nestlings away from danger rather than to drive off the predator.—G. E. Grube, *Biology Department, Gettysburg College, Gettysburg, Pennsylvania, April 19, 1952.*

Irazu Junco—a primitive member of the genus.—*Junco vulcani* (Boucard), the Irazú Junco, has been called by A. H. Miller (1941. *Univ. Calif. Publ. Zool.*, 44 (3) :233) "the most aberrant species of the genus." He also states (*op. cit.*:372) that *J. vulcani* "appears to represent a primitive, possibly aneestral, stage," but that (p. 233) it would be "highly desirable to compare carefully the internal strueture of *vulcani* with that of the other *Juncos*, ..."

In a recent study of the strueture of the skull of fringillids (*Univ. Mich. Mus. Zool., Misc. Publ.*, in press), I presented evidence to show that certain peculiarities of the palatal and squamosal regions of the skull of sparrows can be evaluated as to relative primitiveness. Although I concluded that lack of inflation of the squamosal region and incomplete fusion of the palato-maxillaries to the prepalatine bars of the palatines were primitive characters on the subfamily level (in the Fringillinae, as defined by me), I have since noted that the same criteria seem valid for groups of generic level. Of course, the amount of difference between primitive and advanced members of a single genus is much less, and interpretation correspondingly more difficult, than between extremes of a subfamily.

I discussed earlier (*op. cit.*) the functional significanee of the various modifications of the palatal and squamosal regions in sparrows. For present purposes, it is sufficient to point out that *Junco vulcani* shows slightly less complete fusion of the palato-maxillaries to the prepalatine bars (except that *J. vulcani* and *J. phaeonotus* are nearly equal in this respect) and also the least inflation of the squamosal region of the speeies of *Junco* which I have examined osteologically (*hyemalis*, 6 specimens; *aikeni*, 2; *oreganus*, 5; *caniceps*, 5; *phaeonotus*, 4; *vulcani*, 5). Miller's conclusion that *J. vulcani* is the most primitive member of the genus seems substantiated by the structure of the skull of the species.

I should re-emphasize Miller's thesis that the geographic position (Costa Rica to Panamá, in the mountains at and above timberline) of this "primitive, possibly ancestral," junco does not necessarily indicate that the genus originated in Central America. Instead, because of the probably greater environmental stability of southern regions, as opposed to regions nearer to glaciation in the Pleistocene, the modern occurrence of primitive forms in Mexico and Central America, even in genera of more northerly origin, is to be expected (Miller, *op. cit.*:371–372).—Harrison B. Tordoff, *Museum of Natural History, University of Kansas, Lawrence, May 20, 1952.*

Little Blue Herons in northwestern Pennsylvania.—In the afternoon of July 22, 1951, Robert L. Calvin of New Castle, Pennsylvania, Charles J. Shontz of the Pymatuning Laboratory, and I observed two Little Blue Herons (*Florida caerulea*) in adult plumage at Hartstown Swamp, Crawford County, Pennsylvania. The birds were seen in excellent light with a 26 power telescope.

Hartstown Swamp had been drained early in July and by July 22 there were many small pools of water. These small pools were probably rich in aquatic animal life since many Great Blue Herons (*Ardea herodias*), Green Herons (*Butorides virescens*), and American Egrets (*Casmerodius albus*) were concentrated in this area. The Little Blue Herons were observed for one-half hour before they flew northward in the direction of Pymatuning Lake. One adult was observed in the same area on the afternoon of July 29 by Charles J. Shontz.

All Little Blue Herons recorded previously in the area have been immature birds.—John F. Mehner, *Pymatuning Laboratory, Department of Biological Sciences, University of Pittsburgh, September 1, 1951.*

Wing-flashing of the Graceful Mockingbird, *Mimus gilvus*.—During the last several years notes on the wing-flashing of Mockingbirds, *Mimus polyglottos*, have appeared in this journal (1946, 58:206–209; 1947, 59:71–73; 1950, 62:41–42; 1951, 63: 204–206). I am now able to add an observation from which it is clear that this peculiar habit is found also in *Mimus gilvus*, the Graceful Mockingbird. The race *M. g. gilvus* is found in Surinam. It resembles the Northern Mockingbird, *Mimus polyglottos*, but is of a more uniform grayish color; it almost completely lacks the white on the wings and has much less white on the tail feathers. On December 9, 1951, I observed a Graceful Mockingbird on a burned over area on the savanna near Zanderij, Surinam. The bird was foraging on the ground. While pausing between foraging runs, it repeatedly lifted and spread its wings "archangel-fashion," in the same way as described and pictured by Sutton (1946. *Wilson Bulletin*, 58:206–209). Its behavior was like that of its northern relative, *polyglottos*, but the observer receives a different impression. Since *gilvus* lacks the white wing patches of *polyglottos* and the underside of the wing is of a uniform dull grayish white, when the bird flashes its wings there is no sudden exhibition of a striking wing pattern. In fact, there is no "flashing" at all. Indeed, the most striking thing to me was the peculiar movement of the wings when they were spread and lifted. It was this movement that first attracted my attention to the bird.

Halle (1948. *Wils. Bull.*, 60:243) has also reported wing-flashing in the dark-winged, South American Calandria Mockingbird (*Mimus saturninus*).—Fr. Haverschmidt, *P. O. Box 644, Paramaribo, Surinam, February 6, 1952.*

Aerial feeding of the Rusty Blackbird on mosquitoes.—On May 6, 1950, I observed a pair of Rusty Blackbirds (*Euphagus carolinus*), among the first to return that spring, on Blaine's Lake in the vicinity of College, Alaska. They were first seen perched on the floating ice, which still largely covered the lake on that date. As I approached, I saw the two birds repeatedly make nearly vertical flights into the air for about 15 feet and then glide down easily on extended wings. At the peak of their ascents I could hear a distinct "snap" of the mandibles, much like that made by a flycatcher when hawking insects. I watched these birds carefully for several minutes through a pair of 7×50 binoculars at a distance of about 20 yards and was shortly convinced that they were, in fact, catching large mosquitoes in the air. The mosquitoes, which had just begun to swarm over the lakes in rather large numbers, were plainly visible through the binoculars.

It has been known for some time that the Rusty Blackbird is a highly insectivorous icterid (see Beal, 1900, *U. S. Dept. Agric., Bio. Surv. Bull.*, 13:45–49). Recently Beecher (1951. *Auk*, 68:411–440) has described the anatomical adaptations for food-getting in the Icteridae, discussing the principal anatomical correlates of insect-eating in *Euphagus*. It seems likely that the increased kinetics of the upper mandible in this species is a distinct advantage in capturing insects on the wing.

It is not surprising to me to discover that the Rusty Blackbird has the ability to capture insects in the air, although Beal (*loc. cit.*) apparently considered it entirely a ground-feeding species and does not list flying insects among the principal kinds eaten by this bird. His data, however, did not include records for the months of June and July when flying insects are most abundant, and his material apparently did not include samples from far northern latitudes, where, among macroscopic forms, dipterous insects far outnumber other kinds and, therefore, assume greater importance in the diets of insectivorous birds than they do in more southerly latitudes.

It will be of interest to discover whether or not there exist geographic variations in the extent to which aerial feeding is indulged in by various populations of the Rusty Blackbird. In a region where flying insects are predominant over ground types, a behavioral modification for aerial feeding would be much more likely to evolve in this species than in a region where ground insects are more abundant.—Tom J. Cade, *Alaska Cooperative Wildlife Research Unit, College, Alaska, May 13, 1952.*

SEVENTIETH MEETING OF A.O.U.

At the Seventieth Stated Meeting of the American Ornithologists' Union recently held in Baton Rouge the following officers were elected for 1952-53: *President,* Josselyn Van Tyne; *Vice-Presidents,* Alden H. Miller and Ludlow Griscom; *Secretary,* Albert Wolfson; *Treasurer,* R. Allyn Moser; *Elective Members of the Council:* Jean Delacour, Harvey I. Fisher, Herbert L. Stoddard.

The Council elected Robert W. Storer, *Editor* of 'The Auk'; the 1952 Brewster Medal was awarded, by action of the Council, to Dr. John T. Zimmer of the American Museum of Natural History for his research on the systematics and distribution of South American birds, especially those of Peru.

The following Members were elected to the class of Fellows: Emmet Reid Blake, Paul Lester Errington, Elsie Margaret Binger Naumburg, William Henry Phelps, Sr., Robert Winthrop Storer, Albert Wolfson. The following persons were elected Corresponding Fellows: Armando Dugand, Colombia; Jack William Davies Goodall, Santiago, Chile; Alfred William Johnson, Santiago, Chile; Rodulfo Amando Philippi B., Santiago, Chile.

The following Associates were elected to the class of Members: William J. Baerg, Andrew John Berger, William Bertram Cartwright, Howard L. Cogswell, Joshua Clifton Dickinson, Jr., Harold Carsten Hanson, Margaret Brooks Hickey, M. Brooke Meanley, Robert James Newman, Raymond Andrew Paynter, Jr., Phillips Borden Street, George Guion Williams.

The Seventy-first Meeting will be held at the Los Angeles County Museum in October, 1953.

Albert Wolfson

ORNITHOLOGICAL LITERATURE

A Check-list of the Birds of Virginia. By Joseph James Murray. Virginia Society of Ornithology (obtainable from A. O. English, 2803 Rosalind Ave., S.W., Roanoke), 1952:6×9 in., 113 pp. $1.50.

This booklet (paper-bound, photo-offset) will be a definite asset to students of Virginia birds, who have long lacked an up-to-date, competently prepared summary of the avifauna of that state. Students in neighboring areas should also find it useful. A brief preface, a rather extensive and interesting survey of the long history and development of ornithology in Virginia, a short account of physical features and faunal zones (*i. e.*, the Life Zones of Merriam; biomes are mentioned but not discussed), and a selected bibliography are followed in the work by the accounts of 415 forms: 348 species (11 of which are indicated as being of hypothetical occurrence by the use of parentheses), 64 additional subspecies, 13 of them hypothetical, and 3 hybrids (counting Sutton's Warbler).

The accounts, in telegraphic form and usually less than a half page in length, summarize in the briefest possible way the known abundance, distribution, and seasons of occurrence of each form, giving citations for particularly interesting records and the names of authorities for many other statements. In the space employed it has obviously been impossible to give citations for much of the material. A more elaborate edition, said in the work to be under consideration, is to be hoped for.

Apparently most or all of the taxonomic work on Virginia birds has been done by others and has not been critically reviewed by the author. Some of the subspecies listed are of rather tenuous distinctness, or have been included on the basis of one or a few specimens identified years ago. The accounts of the subspecies are headed, in the time-honored fashion, in the same manner as those of the species, a usage that places undue emphasis on the minor categories, and which I hope to see gradually abandoned in the future. A map would have added to the usefulness of the volume.—Robert M. Mengel.

A Field Guide to the Mammals. By William Henry Burt and Richard Philip Grossenheider. Houghton Mifflin Co., Boston, 1952:4½×7¼ in., xxiv+200 pp., 24 color pls., 13 black and white pls., 168 maps, and numerous text figs. $3.75.

Occasionally there appears in the literature of field zoology a book of great usefulness to amateur and professional alike. Such a book is the new volume by Burt and Grossenheider. The authors have prepared a handbook employing for the North American mammals the same techniques of illustration and identification as those so successfully employed by Roger Tory Peterson for the birds. Additionally, maps are included which give the known—and in some cases the supposed—geographic distribution of the various species.

The text and maps by Burt are models of brevity and accuracy. Each species account includes a terse statement on characteristics, similar species, and remarks on distribution and habitat. In all, 373 species are treated—a most conservative number. A few other species are mentioned only casually, but for the most part these are small groups of interest mainly to the specialist. With the aims of the authors in mind, such a treatment needs no apology. Subspecies are completely omitted.

The distribution maps will be of great interest to mammalogists. Although the authors freely admit that some inaccuracies probably occur in the maps owing to omissions, com-

missions, and an outright dearth of published information on some species, still the maps are by far the most accurate reflection extant of the recorded facts of mammal distribution—more accurate, in fact, than one would ordinarily expect to find in a work designed primarily for popular consumption. It is always refreshing to find that some authors think that popular science should still be scientific.

The illustrations clearly demonstrate that Mr. Grossenheider is one of the truly outstanding painters of mammals to grace the pages of modern mammalogy. Not only do the illustrations look like the real animals, but to the practiced eye some are readily identifiable to subspecies. Textural qualities, shading, and color patterns are so skillfully treated that, even *sans* background, Grossenheider's animals seem to be alive. Particularly is this true of the smaller mammals, the mice, rats, and squirrels; the paintings of the larger animals, the ungulates and larger carnivores, although better than good, suffer by comparison. The illustrations of the chipmunks, squirrels, microtines, wolves, foxes, and ringtail cat are superb. Grossenheider has also provided a number of text figures that not only enliven the pages, but impart information worth ten thousand words.

Your reviewer can offer no important criticism of this book. The only really objectionable feature is the inferior reproduction of certain color plates. In all three copies examined, the plate of the rabbits is excessively pinkish and the plate of the insectivores is out of register. In two copies the plate of the deermice is out of register. This latter is most unfortunate because the original painting was one of the best of the entire set. Possibly in the interests of simplification, the scientific names of the animals do not occur on the legends of the plates or distribution maps. This will be a decided inconvenience to those professionals accustomed to using scientific names rather than common names, and especially so since for mammals many 'common' names are not in common usage. The bibliography is intended to be only the barest guide to a vast literature, but even so it seems excessively abbreviated. Another unfortunate discrepancy is the omission of Grossenheider's name from the cover although it is given on the title page and the dust jacket as co-author.

On the whole the book is very well done and the authors are to be congratulated. It fills an embarrassing gap in our literature in a highly satisfactory manner and is sure to enjoy a wide appeal.—Keith R. Kelson.

The Whooping Crane. By Robert Porter Allen. Research Report No. 3 of the National Audubon Society, New York, 1952: 7¾ × 10½ in., xxvi + 246 pp., color frontispiece, 17 black and white pls., and numerous text figs. $3.00 (paper).

This is the third of a series of life-history monographs published by the National Audubon Society. It should be of interest to the general public, as well as to ornithologists, in that it presents, under one cover, a detailed analysis of all available information regarding a species (*Grus americana*) that has been on the "near extinct" list for many years.

The Whooping Crane is discussed under eight major headings: (1) distribution, (2) abundance, (3) migration, (4) food habits, (5) winter life, (6) the breeding cycle, (7) molts, plumages, and anatomy, and (8) survival: protection and conservation. In addition there is an introductory chapter that includes a brief description and the geographic range of each of the cranes of the world.

The paper is adequately illustrated with photographs, paintings and drawings from various contributors, and a series of excellent pen-and-ink drawings by the author. The

figures and tables would be of greater value if they were serially numbered or lettered to permit easy reference in the text.

The author's views regarding the abundance of Whooping Cranes are very interesting. On page 85 he states, "A 'myth of superabundanec' has clouded the true facts and may stem from a misinterpretation of some of the early writings on the status of the species. Actually, there is evidenee that the Whooping Crane was never observed in large numbers, even one hundred or more years ago." He then points out that the population as of 1869 probably numbered only 1300 birds. According to his calculations we can hope for an inerease of only four Whooping Cranes in the next ten years, provided the rate of increase during that period equals that for the years 1940-1949.

A detailed knowledge and understanding of the life-history and ecology of any species is of utmost importance in its suceessful management. This is especially true in the case of the Whooping Crane, where even a minor error might have disastrous results. The author has taken this into consideration in presenting his suggestions regarding the future management of the Whooping Crane. His reeommendations include enlargement of the Aransas Refuge in Texas, minor improvements at the Aransas Refuge to insure further the safety of the wintering birds, development of a refuge on the Platte River in Nebraska, edueation of the publie, and further study.

Some readers will feel that Allen has avoided discussing the issue of placing the remaining Whooping Cranes in captivity in the hope that they might reproduee there satisfaetorily. Until further information is accumulated regarding the breeding behavior of these birds, it seems to me that Allen's eautious approach is safest.—Thane S. Robinson.

VOYAGEUR'S COUNTRY: THE STORY OF THE QUETICO-SUPERIOR COUNTRY

A contribution from the Wilson Ornithological Club Conservation Committee

Grand Portage, that mountainous earry from Lake Superior around the rapids of the Pigeon River to Fort Charlotte, was nine miles of as tortured paeking as there was on the continent. Even in the old days, it was something to boast about. To say, "I made Grand Portage" set a man apart. The French voyageurs judged a man by the way he took that trail, for two ninety-pound packets was the normal load and no Coureur du Bois who could not take the punishment was worthy of the name. Some men earried bigger loads and bragged of their feats around the campfires of the Voyageur's Highway for years afterward.

Today modern voyageurs again strain sinews in the country of the fur trading days, eruise thousands of miles along the delightful waterways of the international border between Lake of the Woods and Lake Superior. Like the Indians and voyageurs, they too love this eountry for the beauty of its lakes, its elean glaciated roeks, its tree-lined portages, and fascinating vistas. Primitive maps with great blank spaees are no more. Now there are excellent aerial photographs so aeeurate that every stream and pond is clearly shown.

Times have ehanged in the eanoe country, but the spirit of exploration and adventure is still there. In spite of logging and fires and exploitation in some parts of it, the area is still surpassingly beautiful and much of it unchanged. There are still the sounds of the wilderness, the wild ealling of the loons, the slap of a beaver's tail at dusk. The

White-throated Sparrow still utters its long plaintive notes and the Hermit Thrush makes violin music until dark has settled down. Eagles still soar and scream high above the ridges and back in the pines the Pileated Woodpecker hammers away at old dead snags.

At night the new explorers sit around their fires knowing that the spirits of the men of old are with them. It is still voyageur country, the country of Radisson and Groscilliers, Alexander McKenzie, Verendrye, and a host of others.

The effort to preserve this historic area began forty years ago when W. A. Preston, member of Parliament from Rainy Lake, watched with misgivings the illegal poaching of moose by hunters from the American side of the border. It was he who first conceived the idea of giving protection to the unusual area. Largely through his efforts, Quetico Provincial Park was established in 1909. Shortly afterward, President Theodore Roosevelt created the Superior National Forest directly to the south of the border and adjacent to the Quetico. It was recognized even then that these two areas, a fifth of the Rainy Lake watershed, were a geographical and historic unit even though divided by the International Boundary.

The creation of these two forest preserves gave the entire watershed its present name, "The Quetico-Superior Country." Since that time, there has been a constant effort especially on the American side to keep the Roadless Areas of the Superior National Forest free from the types of exploitation that threatened its uniqueness. The long effort is a remarkable story of the loyalty and devotion of thousands of public-spirited people on both sides of the border, people who realized that here was not only a great economic resource but a spiritual one as well.

When in the early 1920s, roads were proposed into the heart of the Superior National Forest, conservation groups fought them and finally won. As a result the United States Forest Service planned a roadless area of a million acres free from such developments for all time.

In 1925, a proposal was made to create a gigantic power reservoir along the border by building seven dams impounding some of the waters as high as eighty feet. Whole river systems would have been flooded, countless islands, campsites and beaches submerged, thousands of miles of shoreline changed into a morass of dead snags and stagnant water. Arthur Hawkes, newspaperman from Winnipeg and Toronto, was determined that this should not be done. Together with such men as Ernest Oberholtzer of Ranier, Fred Winston, Charles Kelly, and Frank Hubachek, of Minneapolis, they organized Canadian and American support, told the story of the Quetico-Superior to all who would listen. As a direct result of their work, an organization was created known as the Quetico-Superior Council which proposed a long range plan of management based on sound policies of balanced use for all the resources of the area which would perpetuate rather than destroy them. It also proposed a program of land zoning which would preserve the rare wilderness values of the interior lake regions. This plan is now known as the Quetico-Superior Program.

The Canadian and American Legions, aware of the constant threats which faced the area, endorsed this proposal in 1929 and suggested further that the international forest, should it come into being, be dedicated to the war veterans of Canada and the United States who served in World War I.

It was then that the dream of a living memorial was born. This would be different than anything ever proposed, not just another stereotyped monument of concrete and steel, but a wilderness playground dedicated to the youth of the future. Here was something alive and real that would bring happiness to generations, a symbol of the meaning

of freedom itself and the international unity of purpose that had come out of the great conflict.

In 1931, the Congress of the United States passed a law, the Shipstead-Nolan Act, which gave protection to the shorelines of federal lands from logging or flooding on the Minnesota side of the border. The State Legislature followed with a similar law in 1933 giving similar protection to the state lands within the area.

In 1934, President Franklin D. Roosevelt, aware of the great interest in the area and its preservation, appointed the first President's Quetico-Superior Committee to work toward the realization of the program as proposed earlier by the Council, the adoption of sound policies of resource use and the eventual dedication of an International Peace Memorial Forest.

The same year, after nine years of deliberation, the International Joint Commission denied the long pending application for power development. Lawrence Burpee, Canadian historian, then Secretary of the Commission, advised both governments at that time that nothing should ever be allowed to interfere with the broad policies of management as outlined in the Quetico-Superior Program.

After this period, the United States Forest Service began acquiring private lands within the Superior National Forest. To date through this acquisition program and in many other ways the United States government has evidenced its determination to carry this program to completion. In 1948, the Thye-Blatnik Bill authorized an additional half-million dollars specifically to purchase private holdings within the Roadless Areas. At the present time almost 95% of the private lands and developments within the wilderness canoe country have been purchased. Remaining are several camps within the canoe country proper, some private cabins and choice lake properties. Negotiations toward the purchase of such holdings are going forward as rapidly as possible. The Izaak Walton League has contributed over $100,000 during the past eight years toward this program.

The most recent effort to preserve the canoe country was precipitated by the unrestricted use of airplanes to service resorts and to bring fishing parties to the interior. Not only were seaplanes based locally, but they came from neighboring states in ever-increasing numbers. Air traffic became so great that the Forest Service, with the backing of the President's Quetico-Superior Committee, conservation groups, and civic organizations, urged the establishment by Executive Order of an Air Space Reservation over the Roadless Areas of the Superior. President Truman signed the order in December of 1949 and a two year moratorium was given to resorts and flyers before the order went into effect.

On January 1st of 1952, the opponents of the Air Space Reservation announced that they would violate the Executive Order and bring the matter to court. This was done and the defendants appeared before Federal District Court in Duluth. In September, 1952, Judge Gunnar Nordbye rendered his historic decision in which he held that the preservation of the wilderness character of the Roadless Areas was a long established governmental purpose and that the President had the power to issue the order concerned.

Canada has banned from Quetico Provincial Park commercial aircraft flights originating on the American side of the border and it is the hope that eventually other wilderness canoe regions of the watershed will receive similar protection. Both Canada and the United States have seen what unrestricted airplane use can mean to the wilderness character of the interior lakes.

The flyers appealed to a higher court and a hearing was held in St. Louis on March 13, 1953. Pending a decision by the Circuit Court of Appeals, affected resorts will

be allowed air transportation to service their caretakers and to protect their properties, but no commercial use will be permitted. While the flyers and the resorts employing them may carry their fight to the Supreme Court, the Government is confident of ultimate victory.

The utmost vigilance is necessary to preserve this area from continued attacks. Within the past few months a deliberate effort has been made to nullify the gains of the past twenty-five years by proposing that the Forest Service eliminate the 360,000 acres set aside as a No-Cut Area to preserve the last stands of virgin timber along the border, that the land exchange program of the federal government be ended, that the Air Space Reservation be severely modified, that a special use permit be granted for a hydro-electric line into the Roadless Area.

Those who see in the Quetico-Superior Region and its incomparable wilderness interior only an opportunity to exploit its resources, have even suggested recently a modification of the Shipstead-Nolan Law which will permit power development as well as cutting of shorelines.

Until there is an international agreement on wise management and zoning principles for the area, such threats will continue. While the President's Committee, cooperating with the Canadian Quetico-Superior Committee is trying to bring the program to a successful conclusion through study, education, and research, individuals who feel deeply about the region can also contribute much.

During the effort to secure the Air Space Reservation, it was such devoted organizations as the Izaak Walton League, Friends of the Wilderness, Chambers of Commerce, Garden Clubs, Legion Posts, the Ely Rod and Gun Club, Farm Bureaus, and other community organizations which made it possible. The cooperation of such men as Chester S. Wilson, Commissioner of Conservation for Minnesota, Frank Robertson who showed the film "Wilderness Canoe Country" over 500 times, William Magie with his news releases, many of the men of the U. S. Forest Service, and others too numerous to mention, turned the tide.

And so it will be in all future efforts to preserve the area. People who feel deeply that the Quetico-Superior and its wilderness canoe country core is a national heritage worth protecting at all costs, can through their organizations as well as their individual efforts help in achieving the ultimate goal, the establishment of the International Peace Memorial Forest.—Sigurd F. Olson, *Wilderness Ecologist, Izaak Walton League of America.*

THE SCIENTIFIC VALUE OF A GROUP COLLECTION OF LIVE ANIMALS

BY KONRAD Z. LORENZ

This article is reprinted here, with a few minor changes, from The Fourth Annual Report of the Severn Wildfowl Trust, 1950–1951, *with the permission of the author and of the Director of the Trust. In these times when "taxonomy" is often misconstrued by well-intentioned but poorly informed persons, these words of a scientist who has attained singular eminence in the apparently quite different field of animal behavior support and explain progressive systematics very effectively.*—Eds.

All biological science has begun its career with *collecting*, and it is worthy of psychological consideration that nearly all really successful biologists have, in their own lives, gone through a period in which they repeated, individually, the history of their science.

There are very few of them, indeed, who have not been given to collecting, as a hobby, at an early stage of their scientific development. It is not only legitimate, but absolutely necessary, that the study of animals or plants should begin with simply and modestly collecting knowledge of 'all there is' before proceeding to the more ambitious task of causal analysis. If some modern physiologists show a certain tendency to look down on museum collection, systematics, and comparative anatomy, they forget that these particular branches of biological science have given to all others their common fundamental—the theory of evolution.

For certain reasons, which need not concern us here, the study of animal behavior did not, until a very recent date, introduce the evolutionary viewpoint into its consideration—very much to its own detriment. The fact that all the innate traits of animal behavior can—and therefore must—be studied from the common viewpoint of phyletic descent, remained necessarily hidden from scientists who never studied the behavior of a whole group of species, but confined themselves to just one kind of animal, chosen exclusively for the single reason that it was the easiest to obtain, to keep, and to breed. The basic discovery which has since given rise to a new branch of behavior study—Comparative Ethology—is, in itself, very simple: certain innate behavior patterns are not only common to all the individuals of a species, but very often to much more comprehensive groups of animals as well. In other words, these innate behavior patterns have, among the several species, genera, families, and still larger groups of animals, exactly the same type of distribution and, with decreasing relationship, the same grading of similarity into dissimilarity, as we find in the comparison of bodily characters.

From this the important inference is, obviously, that these behavior patterns are just as old as any structural properties whose systematic distribution is about the same. To people who regard animal behavior as something extremely variable and unrestrictedly modifiable these facts seem very surprising and even unbelievable. Yet, so far from being 'slippery stuff' to use in systematic comparison, innate behavior patterns are, in most cases, extremely conservative characters; indeed, much more so than the specific form of bones and other hard structures. What is hardest and least perishable in the museum, need not necessarily be so in evolution.

Let us look at just one example: since the very beginnings of ornithological systematics, the structure and proportions of the skull and bill have been considered as characters of paramount importance and reliability. A group of Anatidae, the so-called 'Geese,' were lumped together on the strength of just one character: in all of them the lamellae of the bill have been converted into sharp, horny teeth in adaptation to grass-eating, while their skull has assumed, for the same reason, a typical high profile, calculated to heighten the chewing pressure of the mandibles. With the true geese, like the Greylag, Bean, White-front, Pinkfoot, Snow, Bar-headed, Canada, Brent, Barnacle, etc., were included the Andean, Upland, Kelp, etc. (genus *Chloëphaga*), the Abyssinian Blue-winged Goose (*Cyanochen*), the Australian Cape Barren Goose (*Cereopsis*), the Spur-winged Goose (*Plectropterus*), the Maned Goose (*Chenonetta*), and even the tiny Pygmy Geese of the genus *Nettapus*. All were considered as one subfamily. Subsequent close investigations, in which the consideration of innate behavior patterns played an important part, revealed the indubitable fact that these birds, so far from being closely related to each other, really belong to at least three different groups, the true Geese, the Sheldrakes, and the Perching Ducks. The genus *Chloëphaga*, the Abyssinian Blue-winged, and the Cape Barren Goose, have, all of them, evolved from the Sheldrake group, but, in all probability, independently from each other and in very different parts of the world. The Spur-winged

Goose belongs to one group of the Perching Ducks and is allied to the Muscovy Duck, while the Maned Goose and the Pygmy Geese belong to another, and are closely related to the Mandarin and Carolina [=Wood] Ducks. All instinctive behavior patterns of these birds, particularly those of courtship display, are quite typical of the respective groups to which they belong. None of these innate movements is common to all so-called 'Geese.' The fact that the latter do not, by any means, represent a phyletically coherent subfamily is further emphasized by a great number of other morphological characters.

It is, on principle, impossible to attribute a fixed and constant systematic value to any single character, because one and the same structure may, in different groups, undergo evolutionary change at quite different speeds. What is an exceeding conservative, slow-changing property in one family or order, may be very plastic in another. In the Anatidae, for example, the color markings of the downy young are evidently most resistant to evolutionary change, while the form of head and bill is extremely plastic; in the family of Rails (Rallidae) the very opposite is true. The 'relative conservativity' of every single property must, therefore, be gauged in every single instance by a thorough comparison with as many other characters as possible. If, in a group of animals represented by a considerable number of forms, we amass as many comparable characters as possible, our conclusions become more reliable in geometrical proportion to the number of characters considered. The historical correctness of our conclusions increases not only with the number of agreeing 'documents' which point in one direction, but the significance of each document is increased with the number of others with which we are able to compare it, in order to ascertain its particular age and value.

This is precisely why the phylogeneticist is forever on the lookout for new, comparable characters; and also why he prefers to work on groups which are rich in species. A group consisting exclusively of one or two isolated species with nothing but 'missing links' to join it together, and on to other groups, is obviously not a favorable object for evolutionary studies. On the other hand, in a group with many species, every taxonomic character can be studied in many different forms and stages of differentiation. Charles Otis Whitman and Oskar Heinroth, the pioneers of Comparative Ethology, both chose for investigation a group which fulfilled these requirements: the former worked on the pigeons, the latter on the ducks and geese. It is an interesting historical fact that both these scientists were primarily phyleticists rather than behavior students and that it was their assiduous search for comparable characters that induced them to bring innate behavior patterns into consideration. Thus, Comparative Ethology originated in the service of the study of evolution.

Thus we may infer that the studies of evolution in general and of comparative ethology in particular are dependent on a suitable object of study which possesses certain essential qualities. The discovery of a law of nature has always been dependent upon the selection or discovery of a favorable object of study. If we review these essential qualities we find ourselves simultaneously expounding the scientific value of collecting and keeping live animals belonging to one systematic group. For the purpose of the studies in question it is necessary to keep live animals in perfect condition, in order to investigate their innate behavior patterns. It would be absolutely impossible to acquire an extensive comparative knowledge of these patterns by field observation alone, even if one genus were not, as it so often is, distributed all over the globe. The group chosen for an object of a study ought, therefore, to be technically easy to keep and to breed; only if the animals display the whole inventory of their instinctive activities are we furnished with a solid basis for our comparison of behavior. The group must also be rich in innate behavior patterns and,

last but not least, it must contain an abundance of sub-orders, families, genera, and species, and there must be enough gradations and transitions which link up the under-groups.

There can be hardly any doubt that, among all the groups of animals which are available in captivity at present, the family Anatidae is the one which fulfills all these requirements in the most ideal manner. Though C. O. Whitman worked on pigeons and though valuable work has been done on Cichlid fishes, the Anatidae still rank first as an object of evolutionary and ethological study. A number of prominent phylogeneticists such as Heinroth, Mayr, Delacour, von Boetticher, and others have given special attention to this family. The writer of these lines, as a comparative ethologist, has found the unique collection of Anatidae at the New Grounds a wonderful subject for his investigations. The word 'unique' is not used here in the complimentary but in the literal sense. There is not, in all the world, another collection of Anatidae as complete, and what is more, there is no other collection of any group of live animals which could, for the type of evolutionary investigations sketched in this article, be exploited to such advantage as that of the Severn Wildfowl Trust.

Systematics and taxonomy are regarded by many people as tedious subjects. Some biologists even think that phylogenetic investigations performed by the method of systematic comparison are something rather antiquated, something that was all right in the days of Darwin and Wallace, but rather out of date at the present time. So far from having shot its bolt, however, phylogenetics is only beginning to get, from other branches of biological science, the consideration which it merits. The current modern physiology of the central nervous system, to cite only one instance, would do well to give more thought to phylogenetic considerations. The 'simple' reflex-arc, still regarded by many physiologists as *the* basic element of all central nervous structures and functions, is, in reality, a phyletically extremely 'young' acquisition which does not occur at a lower stage of evolution than birds and mammals. But apart from their everlasting scientific value, phylogenetic studies done by the good old method of comparison of homologous characters are a superlatively alluring occupation. The attempt to disentangle the course which evolution has taken ages ago, by the simple means of comparing the similarities and dissimilarities of living animals, and thus delving into times a thousandfold more remote than the earliest dawn of human history, is among the most fascinating enterprises that the human mind can undertake. To me, at least, it always causes a truly reverential thrill, whenever comparative study leads to some real insight into the blood-relationship of different species and allows us, to a certain extent, to reconstruct their latest common ancestor!

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ROBERT M. MENGEL

Suggestions to Authors

Manuscripts intended for publication in *The Wilson Bulletin* should be neatly typewritten, double-spaced, and on one side only of good quality white paper. Tables should be typed on separate sheets. Before preparing these, carefully consider whether the material is best presented in tabular form. Where the value of quantitative data can be enhanced by use of appropriate statistical methods, these should be used. Follow the A. O. U. Check-List (fourth edition) and supplements thereto insofar as scientific names of United States and Canadian birds are concerned unless a satisfactory explanation is offered for doing otherwise. Use species names (binomials) unless specimens have actually been handled and subspecifically identified. Summaries of major papers should be brief but quotable. Where fewer than five papers are cited, the citations may be included in the text. All citations in "General Notes" should be included in the text. Follow carefully the style used in this issue in listing the literature cited. Photographs for illustrations should be sharp, have good contrast, and be on glossy paper. Submit prints unmounted and attach to each a brief but adequate legend. Do not write heavily on the backs of photographs. Diagrams and line drawings should be in black ink and their lettering large enough to permit reduction. The Illustrations Committee will prepare drawings, following authors' directions, at a charge of $1 an hour, the money to go into the color-plate fund. Authors are requested to return proof promptly. Extensive alterations in copy after the type has been set must be charged to the author.

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of the

WILSON ORNITHOLOGICAL CLUB

UNIVERSITY OF MICHIGAN BIOLOGICAL STATION
DOUGLAS LAKE, CHEBOYGAN, MICHIGAN

SUNDAY, JUNE 14, TO WEDNESDAY, JUNE 17

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June 1953

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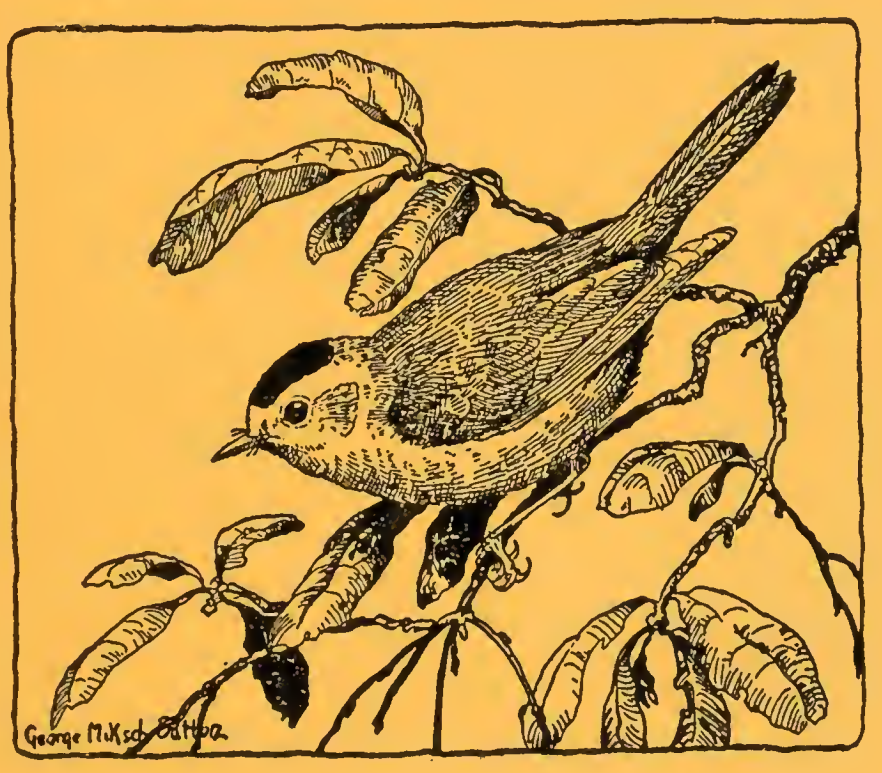
The Wilson Bulletin



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The Wilson Bulletin

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BRONZED WOODPECKER

(Piculus aeruginosus)

Adult male, sketched February 10, 1938, on the Mesa de Chipinque, near Monterrey, Nuevo Leon, by George Miksch Sutton. Sixth in a series of color-plates honoring the memory of Dr. David Clark Hilton.

BRONZED WOODPECKER

BY GEORGE MIKSCH SUTTON

The Bronzed Woodpecker (*Piculus aeruginosus*) is an uncrested Mexican woodpecker about ten inches long. It is known also as the Lichtenstein's Woodpecker and Bronze-winged Woodpecker. In conversation I have recently heard it referred to as the Green Woodpecker or Mexican Green Woodpecker —apt enough names, to be sure, but unacceptable since the much larger, wholly different *Picus viridis* of the Old World has long been known as the Green Woodpecker.

The Bronzed Woodpecker's callnotes and behavior instantly remind the newcomer to México of a flicker (*Colaptes*). It is not white-rumped; it has no predilection for ants, so far as I know; and I have never seen it feeding on, or flying up from, the ground; but it has a flickerlike way of sitting quietly on a horizontal dead branch in the very top of a tree. tail not propping it against its perch, but hanging straight down. It also has a flickerlike courtship display. Three or four birds gather, spread their wings and tails, and bob and bow at each other while calling excitedly, interrupting their 'dance' with brief periods of statuesque motionlessness. A display of this sort I observed on April 18, 1941, along the Río Sabinas, in the Gómez Farías region of southwestern Tamaulipas (Sutton and Pettingill, 1942, *Auk*, 59:19).

When one sees the Bronzed Woodpecker for the first time one is apt to notice the bird's greenness. Actually, the crown is slate gray; the face white, passing from pale buff on the lores to grayish white on the auriculars; the throat grayish white streaked with dusky; the rest of the under parts olive, irregularly barred with yellowish white—but what one first sees, as the bird bounds along in flight, or hitches up a tree, is the mossy green of its upper parts. The wings have a golden brown, or bronzy, cast. In both the male and female the whole of the nape and hind neck are bright red. The moustaches of the male are red, of the female ashy gray, streaked with dusky. Young birds are strikingly similar to adults, sex for sex. A nestling male (wing and tail feathers much sheathed at base) in my collection is as brightly red on the hind neck and moustaches as the brightest adult male in my series. The specimen was taken May 27, 1949, at the Rancho del Cielo (elevation 3300 feet), near Gómez Farías, Tamaulipas, by Paul S. Martin. The nest, which held "at least three young" on that date, was near the top of a stubby dead 40-foot sweet gum (*Liquidambar styraciflua*). Ridgway (1914. *U. S. Natl. Mus. Bull.* 50, Part 6, p. 130) states that in the young male the red of the nape extends "forward, along sides of crown and forehead, to base of bill." In the specimen to which I have just referred the red extends no farther for-

ward than the eyes. Dr. Herbert Friedmann informs me that the immature specimens Ridgway described may have been examples of *Piculus rubiginosus yucatanensis*. Two such specimens (from Chiapas and Tuxla, Veracruz) have been in the U. S. National Museum collection "from early enough to have been available to Ridgway and are probably the basis for his statement."

The Bronzed Woodpecker ranges from central Nuevo León and southern Tamaulipas southward through San Luis Potosí to Puebla and northern Veracruz. At the northern frontier of its range it is found only in the mountains. E. A. Goldman, in "Biological Investigations in México" (1951. *Smithsonian Misc. Coll.*, Vol. 115), calls it a species of the Humid Lower Tropical Subzone (p. 326) as well as of the Arid Upper Tropical Subzone (p. 330). It is non-migratory, but birds which summer high in the mountains may seek lower elevations in winter. In the Gómez Farías region of Tamaulipas, in the spring of 1941, the Cornell University-Carleton College Expedition found it "on the mountain as well as at river-level." That year, on March 27, in heavy forest about a thousand feet above the Sabinas, Dwain W. Warner collected a male with not very distinct brood-patch at a recently finished nest near the top of a 30-foot dead stub. On April 24, at river-level, Olin S. Pettingill, Jr. discovered a nest which probably held eggs or small young on that date (Sutton and Pettingill, *loc. cit.*). C. Richard Robins and William B. Heed (1951. *Wilson Bull.*, 63:266) inform us that at La Joya de Salas, Tamaulipas, at an elevation of 5500 feet, they observed a young bird "not long out of the nest but by itself" on May 25. On the Mesa de Chipinque (5300 feet), in the mountains just southwest of the city of Monterrey, Nuevo León, the species is fairly common, but I have never seen it thereabouts at city-level (1700 feet) even in winter. On May 7, 1941, I found two nests on the Mesa de Chipinque, each in the main trunk of a large oak about 12 feet above strongly sloping ground. A male specimen which I collected that day had greatly enlarged testes and well defined brood-patch. I found the nests by following the adults about, and I believe they were feeding young, but so far as I could tell they were not carrying food in their bills. Possibly they regurgitate food at the nest, again in the manner of a flicker.

Immediately to the southward of the range of *P. aeruginosus* lives another 'green' woodpecker, *P. rubiginosus*, which is very similar to the Bronzed. This form, called by E. R. Blake (1953. "Birds of Mexico," p. 290) the Golden-olive Woodpecker, ranges eastward to Yucatán and southward well into South America. So far as I have been able to ascertain, its range does not overlap that of *aeruginosus* in Veracruz or Puebla. A third and also very similar species, the Gray-crowned Woodpecker (*P. auricularis*), is confined to western México (Guerrero to southeastern Sonora). These three

woodpeckers may possibly be conspecific. They are much alike morphologically and what I have heard and read indicates that they are similar in behavior (see Sutton, 1951. "Mexican Birds," pp. 220-221). Blake (*loc. cit.*) states that *rubiginosus* is "more decidedly a bird of the lowlands" than *aeruginosus*, but Wetmore (1943. *Proc. U. S. Natl. Mus.*, 93:273) informs us that Carriker found *P. rubiginosus yucatanensis* "fairly abundant in the forest over the higher elevations of the Sierra de Tuxtla" in southern Veracruz, and the fact that Carriker obtained specimens on the Cerro de Tuxtla (elevation of peak proper about 4000 feet) and Volcán San Martín (elevation of peak proper about 5500 feet) but not, apparently, on lower slopes, forces us to question whether *rubiginosus* inhabits the lowlands of the Sierra de Tuxtla at all.

Department of Zoology, University of Oklahoma, Norman, Oklahoma, May 22, 1953

NEW LIFE MEMBER

Karl William Haller was born October 12, 1916, at Wheeling, West Virginia. In 1939, he received the degree of Bachelor of Science in Biology from Bethany College, West Virginia. Two years later he was granted the degree of Master of Science in Zoology from West Virginia University. In 1937 he was a member of the Carnegie Museum—Cornell University expedition to Oklahoma, and in 1941 was a member of the Carnegie Museum expedition to Hudson Bay. After returning from more than four years service with the Air Force in World War II, he became an instructor in Biology and Zoology at Washington and Jefferson College, Pennsylvania. He subsequently returned to active duty with the Air Force. His active interest in birds extends over a period of 20 years. He is a member of the A.O.U., British Ornithologists' Union, and Cooper Ornithological Club.

THE WHITE-THROATED MAGPIE-JAY

BY ALEXANDER F. SKUTCH

More than 15 years have passed since I was last in the haunts of the White-throated Magpie-Jay (*Calocitta formosa*). During the years when I travelled more widely through Central America I saw much of this bird, and learned enough of its habits to convince me that it would well repay a thorough study. Since it now appears unlikely that I shall make this study myself, I wish to put on record such information as I gleaned, in the hope that these fragmentary notes will stimulate some other bird-watcher to give this jay the attention it deserves.

A big, long-tailed bird about 20 inches in length, with blue and white plumage and a high, loosely waving crest of recurved black feathers, the White-throated Magpie-Jay is a handsome species unlikely to be confused with any other member of the family. Its upper parts, including the wings and most of the tail, are blue or blue-gray with a tinge of lavender. The sides of the head and all the under plumage are white, and the outer feathers of the strongly graduated tail are white on the terminal half. A narrow black collar crosses the breast and extends half-way up each side of the neck, between the white and the blue. The stout bill and the legs and feet are black. The sexes are alike in appearance.

The species extends from the Mexican states of Colima and Puebla to northwestern Costa Rica. A bird of the drier regions, it is found chiefly along the Pacific coast from México southward as far as the Gulf of Nicoya in Costa Rica. On the Caribbean side of Central America it occurs only in the more arid country back from the coast, as in the semi-desert portion of the valley of the Río Motagua in Guatemala. It is absent from the humid districts of the Caribbean littoral, where the White-tipped Brown Jay (*Psilorhinus mexicanus*) is at home.

These two big jays occupy complementary parts of the Central American lowlands, and are found together only in narrow zones of transition between the wet and dry regions. Thus in clearings amid the heavy rain-forests of the lower Motagua Valley, from the sea coast as far inland as Quiriguá, only the Brown Jay resides. Above Quiriguá the vegetation gradually becomes lighter, and between this point and Gualán the two species mingle. From Gualán to Progreso the vegetation of the valley consists largely of thorny scrub and cacti, with somewhat heavier woods in the river bottoms; and here the Magpie-Jay is abundant but the Brown Jay is absent. Likewise at Matías Romero, in the center of the Isthmus of Tehuantepec, the Brown Jay from the rainy Caribbean side intermingles with the Magpie-Jay from the dry Pacific side, the former living chiefly amid the heavier vegetation

on the lower lands; but farther toward the west, at San Gerónimo, I found only the Magpie-Jay on the hot, arid plains overgrown with cacti and thorn-scrub. So, too, on the Pacific slopes of the Cordillera of Guanacaste in Costa Rica, the Brown Jay, pushing over from the Caribbean side through the low passes, dwells alongside the Magpie-Jay; but at points in Guanacaste farther west and with a more arid type of vegetation, I met only the latter. In the western part of the Pacific slope of Guatemala the Magpie-Jay extends upward to at least 3700 feet above sea-level, and here it resides in a region where more abundant rainfall has produced forests as heavy as those of the Caribbean slope. In this district I found the larger, brighter blue Nelson's White-throated Magpie-Jay (*C. f. azurea*) common among the shade trees of the great coffee plantations.

Wherever it dwells, a bird so big, handsome, active, and noisy as the Magpie-Jay is sure to attract attention and make its presence known. In the hot, dry portion of the Motagua Valley, where much of the low vegetation bristles with forbidding thorns, and impenetrable fences of close-set cacti bar the way of the bird-watcher who would pursue his hobby off the beaten path, this is one of the first birds to stir the enthusiasm of the new arrival. Nor can one wander far beneath the tall shade trees of the beautiful coffee plantations of western Guatemala without becoming aware of this remarkable bird. For the keen-eyed jay is quick to detect the man who intrudes into his haunts, and shouts his disapproval in harsh language which all can understand. In small, straggling flocks he follows the trespasser, assailing him with a volley of abuse, and warning all other birds that a possible enemy is at hand. Because he is so excitable and ill at ease in the presence of man, I have learned little of the Magpie-Jay's diet, but presumably it is as varied as that of most members of the family. On the Isthmus of Tehuantepec I surprised a Magpie-Jay in a tree beside a field of maize. As it flew out it dropped a heavy object which proved to be a small ear of corn about three inches long, still enclosed in the husks. In Guatemala I saw a jay with berries in its bill.

The Magpie-Jay has a vocabulary far more varied than that of the Brown Jay. When scolding its notes are painfully loud and harsh. After enduring this hard language for a while, one does not expect to hear the big bird give voice to a variety of mellow, liquid calls, one of which sounds like *weep weep weep*. It also utters a medley of low, queer notes while resting inconspicuously amid the foliage. Sitting on the nest or resting near it, the breeding female repeats incessantly a loud cry of hunger, audible for a quarter of a mile, and so like the *pee-ah* of the Brown Jay that at first I mistook it for the note of the latter, and discovered my error only after I had followed to its distant source and found a blue rather than a brown jay

on the bulky pile of sticks. As they flee their nest, Magpie-Jays utter a soft and somewhat plaintive cry.

Nesting

The Magpie-Jay's nesting-season is long. At Nicoya, Costa Rica, I saw two birds carrying nest-material at the end of November, 1937. Near Colomba, Guatemala, at an altitude of about 3000 feet, I found four nests between December 20, 1934, and the following January 2; and in at least two of these incubation was going on. In El Salvador, Dickey and van Rossem (1938:415) discovered a nest with young on April 16, 1912. On the Caribbean side of the continent, at El Rancho in the Motagua Valley, the Magpie-Jays were still nesting in June and July, 1932. The first bird nest that I discovered upon my arrival at El Rancho on June 23 was one of this jay; earlier that same year the first nest that I found in the wet lower valley had been one of the Brown Jay. Incubation was apparently in progress in this inaccessible Magpie-Jay's nest. On June 26 I found another nest in which the Magpie-Jay had not yet completed her set of eggs. That the jays about El Rancho had already been breeding for a number of months was attested by the fact that at the same time full-grown young were flying about with their parents and being fed by them. Much the same situation was found at Matías Romero on the Isthmus of Tehuantepec on July 11, 1934. Young birds on the wing were being fed, but one Magpie-Jay was sitting, apparently incubating, in a nest about 50 feet up in the top of a tree beside a stream.

The two nests at El Rancho were in trees standing in pastures. The lowest, only 20 feet up, was in a *Pereskia* bristling with sharp spines; the other was 30 feet high and far out on a slender branch which held it beyond reach of a human climber. Of the nests at Colomba, one was in the top of a clump of tall bamboos growing beside a stream in a narrow valley; the other three were in shade trees of the coffee plantations, at heights estimated to be 40, 75, and nearly 100 feet. The nest of the Magpie-Jay resembles that of the Brown Jay but is often less bulky. The framework is a pile of coarse sticks, within which is a neatly finished cup of wiry roots and fibrous material, measuring about five inches in diameter.

The only nest that I could reach was the lower of those at El Rancho (belonging to the race *C. j. pompata*), and this when revisited on July 4 contained four eggs, so sharply pointed as to be almost top-shaped, in color gray, finely, densely and evenly flecked with brown. They measured 35.7 by 23.8, 35.7 by 23.8, 34.1 by 23.0, and 34.1 by 24.2 millimeters. The nest reported from El Salvador by Dickey and van Rossem contained three nestlings.

Incubation appears to be performed by the female only. On December 25 and 26, 1934, I devoted nearly 14 hours to watching the highest of all the nests I found. The lofty, white-barked trunk of the tree which bore it rose clean, straight, and branchless for about 80 feet and gave no encouragement to a climber, but the nest was in an exposed position and could be observed from a neighboring hillside. Although I could not examine the contents, it was evident that it held eggs. Of the four full-grown jays which frequented the vicinity and scolded when I came near, the one which I felt sure was the female could be distinguished by the loosely spreading feathers of her crest; the crest-feathers of the other three formed a more compact cluster. The loose-crested jay alone warmed the eggs. When hungry—as she seemed to be much of the time—she uttered loud cries which, although harsh in tone, were yet somewhat pleading. In response to these cries, the other jays brought food to her. Because of the great height of the nest and the limited time at my disposal, I was not able to determine just how many served her; there were certainly two and probably three; that is, she was fed by her mate and one or two helpers. One of the attendants had blackish feathers around the eyes (a sign of immaturity?), while the face of another was pure white.

During the course of 13 hours and 41 minutes the female jay was fed 47 times. The food was delivered to her while she sat in the nest or, rarely, while she rested near it. Often when she saw an attendant approach she would spread her wings over the sides of the nest and flutter them, at the same time crying loudly and hoarsely. Sometimes if she espied another jay coming with food while she rested near the nest she flapped her wings and cried, then hurried back to the nest to receive the morsel there. Once while the female was preening her feathers among some bushes below the nest, an attendant flew up with a bill full of berries. For about ten minutes he waited in the vicinity, then advanced to a branch about a yard distant from the nest. At last the female took notice of him and with a little whine flew directly to the nest, settled upon the eggs and received the berries. Once two jays came to the nest with food at the same time; a minute later the female was fed again, most probably by a third attendant. Once she was given food five times in four minutes.

So much food was brought to the incubating female that she did not find it necessary to hunt for herself and could devote nearly all of her time to incubation. During 13¾ hours, divided between two mornings and an afternoon, I timed 10 completed sessions on the eggs, ranging from 25 to 88 minutes and averaging 54.6 minutes. Thirteen recesses ranged from 1 to 21 minutes and averaged 8.6 minutes. She covered the eggs for 86.4 per cent of the time. Her absences generally began just after she was fed. During

her short recesses she occupied herself chiefly with preening her feathers and stretching her limbs on some convenient perch within sight of the nest, usually in the nest-tree itself. Sometimes she continued to cry for food while preening or resting near the nest. Only rarely did she fly out of sight, and then only for a part of her brief absence from the eggs; sometimes these excursions lasted only a minute or two.

The female Magpie-Jay was so jealous of her nest that she seemed to resent the approach of any of her helpers to it during her absence, and if she saw one go near it would hurry back to sit in it. This was not merely for the purpose of receiving food on the nest. Once the jay that I took to be the male fed her on the nest, then flew to a neighboring tree. The female then left the nest, and upon noticing her departure the other returned to the nest-tree and approached the nest. When she saw him going toward the nest, the female jay hurried back and settled on her eggs before he could reach them, whereupon he departed. Although the attendants freely approached the nest-tree and even the nest itself so long as the female sat in it, other Magpie-Jays which apparently did not belong to this group were repelled. Once the female left her nest to join the bird that I believed to be her mate in driving away a jay which had come into the next tree. She also jumped from the nest to drive off a Black Vulture which had come to rest on the supporting branch about fifteen feet away. The carrion-feeder took wing with a surprised grunt, then the jay returned to her eggs.

Although this Magpie-Jay received food far more frequently than any of the Brown Jays that I watched, she spent somewhat less time on the eggs. This nest differed from Brown Jays' nests in that the male did not stand guard over it during the female's recesses. But because she spent them almost wholly within sight of the nest, she could keep watch over her eggs without his assistance. Indeed, she probably would have objected to his standing close to her nest in the manner of the sentinel Brown Jay.

I found Magpie-Jays far more shy at their nests than Brown Jays. The wariness of those in the middle Motagua Valley contrasted sharply with the confidence of their brown relatives less than a hundred miles downstream. The extreme timidity of the Magpie-Jays about El Rancho frustrated my attempts to study their nest-life in pastures where I was a trespasser and accordingly handicapped in using a blind. But at one nest I watched the female incubate for more than 95 minutes continuously, when only two of her four eggs had been laid. The male fed her on the nest and twice stood guard on the rim while she was away, once for six and once for twelve minutes. This female also drove another of her kind from the nest-tree—something I never saw a Brown Jay do. But the trespassing Magpie-Jay was reluctant to go and eluded the pursuer by hopping from branch to branch in

the same tree. Great-tailed Grackles (*Cassidix mexicanus*) were chased if they came within 50 feet of the nest.

Helpers at the nest have been discovered in several other species of the Corvidae. A pair of Central American White-tipped Brown Jays may be assisted in their nesting operations by from one to five unmated helpers, which can in many instances be distinguished individually by the peculiar distribution of yellow and black on their bills, naked orbital rings, and feet; apparently these are yearling birds who will not breed until two years old. These helpers may occasionally bring a stick to the nest during construction and feed the female while she builds or incubates; but they are chiefly in evidence after the young hatch, when they bring food and guard the nest as zealously as their parents (Skutch, 1935:261–265). Grimes (1940:433–435) found three adults bringing food to a nestful of young Florida Jays (*Aphelocoma coerulescens*), and at least two of them took turns at brooding. Three American Crows (*Corvus brachyrhynchos*) fed the young at a nest in Connecticut (Forbush, 1927, 2:395). It would be interesting to know more details of the nest-life of the Australian White-Winged Chough (*Corcorax melanorhamphus*), of which it has been reported that a whole flock assists in building the nest (Mathews, 1925-1927:417), and also of the Tufted Jay (*Cyanocorax dickeyi*), at one nest of which Moore (1938:238–239) found three individuals whose mutual relations were most intimate—two of them even sat side by side on the eggs for a short period. The statement of Forbush (1927, 2:380) that Blue Jays (*Cyanocitta cristata*) "are said to care for the aged and infirm" is not out of keeping with what we know of the social habits of the Corvidae. The brief account given by Bent (1946: 118-120) of the nesting habits of the Arizona Jay (*Aphelocoma ultramarina*) suggested interesting forms of cooperation between a number of individuals; and later Gross (1949:242) watched seven or eight of these jays, including two yearlings, take part in building a single nest.

Acknowledgment

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Summary

The White-throated Magpie-Jay inhabits the more arid lowland districts of Central America and southern México. Its breeding season is extended, nests with eggs have been found in various parts of Central America from December to July. The nest, usually placed high, is a pile of coarse sticks holding a neat cup of wiry roots and fibrous materials. One clutch consisted

of four eggs. Apparently only the female incubates. While engaged in this duty she is fed not only by her mate but by other, apparently unmated, individuals. One female in Guatemala was nourished by certainly two and probably three or more other jays, who fed her 47 times in 13¾ hours. During this period she sat for intervals of from 25 to 88 minutes, took recesses of from one to 21 minutes, and covered her eggs 86.4 per cent of the time. So much food was brought to her that she found it unnecessary to hunt for herself, and devoted her short absences from the eggs largely to preening and stretching her limbs. Instances are given of helpers at the nests of a number of other species of Corvidae.

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Finca 'Los Cusingos,' San Isidro del General, Costa Rica, January 29, 1953

AUDIO-SPECTROGRAPHIC ANALYSIS OF THE SONGS OF THE ALDER FLYCATCHER[1]

BY PETER PAUL KELLOGG AND ROBERT CARRINGTON STEIN

It is generally recognized that Alder Flycatchers (*Empidonax traillii*) in the eastern United States have more than one song. Differences in song types have been described, but McCabe (1951) indicated that while two song types exist, there is very little agreement about the verbal description of these songs. These differences in description McCabe attributed primarily to differences in human interpretation. We would further suggest that there may be a basic difference in what individuals hear, which points up North's (1950) suggestion that all observers should check their response to audio-frequencies as a means of obtaining a better understanding of descriptive differences. A third possibility, as suggested by McCabe, is that there may be more than two recognizable song types used by Alder Flycatchers. Snyder (1953) agrees that there are two distinct types of regular song east of the Rockies and that each covers a broad geographic range.

In beginning this preliminary study, we selected four songs from the bird song collection at Cornell, one each from four different Alder Flycatchers, two of the *fee-be-o* type and two of the *fitz-bew* type. With the two songs of each type, an effort was made to select samples separated as far as possible in both time and space, since this would give us the best opportunity to observe differences. With the *fee-be-o* song, one example chosen was recorded at Ithaca, New York, May 30, 1952, probably of a migrating bird, and the other was recorded at Bay Pond in the Adirondack Mountains of New York on June 22, 1941, a separation of 200 miles in distance and 11 years in time.

One of the *fitz-bew* songs was recorded on June 7, 1947, at Ithaca, while the other was recorded at the Lower Souris National Wildlife Refuge, North Dakota, on June 12, 1949, a separation of 1200 miles in distance and two years in time.

The four songs thus chosen were analyzed with an audio-spectrograph and the results are shown in Figures 1 and 2. This technique is described and discussed by Potter (1945, 1947) Koenig *et al.* (1946), Joos (1948), and Bailey (1950).

The clear-cut differences between the songs of different types and the surprising similarities in the songs of widely separated individuals singing the same type of song, suggest the possibility that this method of study may have much use in clarifying the confusion concerning this group of birds.

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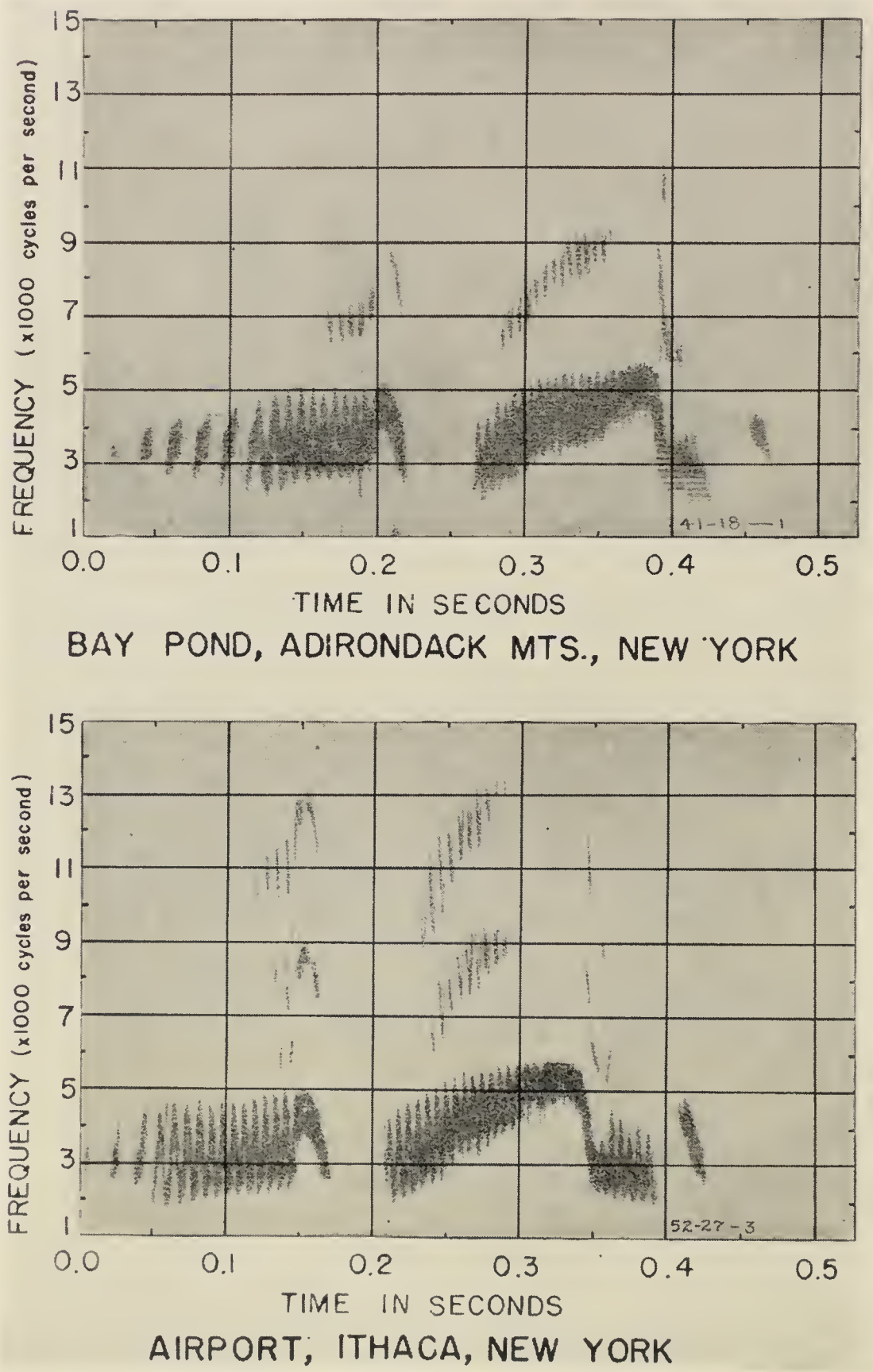

FIG. 1. Audio-spectrographs of the *fee-bee-o* song of the Alder Flycatcher.

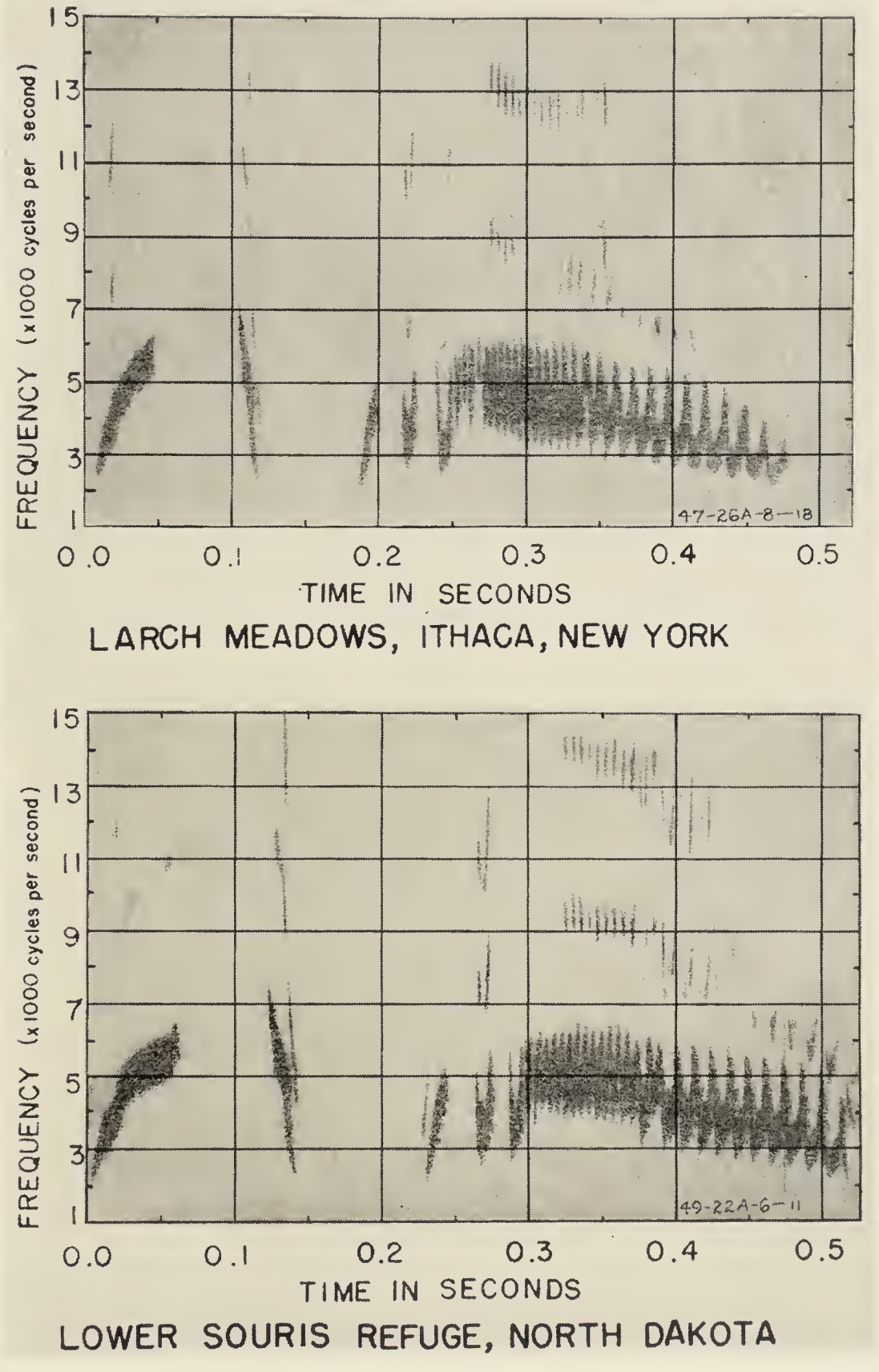

FIG. 2. Audio-spectrographs of the *fitz-beu* song of the Alder Flycatcher.

The following observations on the spectrograms should be of interest:

1. *Frequency Scale.* This vertical scale is linear rather than the logarithmic musical scale. While accurate, this scale appears to distort the musical values of the recording. This is especially noticeable in the harmonics or overtones which are shown as faint replicas of the song at double or triple the fundamental frequencies. These harmonics appear to change pitch faster than do the fundamentals. In a musical scale these octaves would all be equal and the lines of harmonics would all be parallel.

2. *The horizontal time scale* shows that the songs presented vary in length from a little over 0.4 seconds to a little over 0.5 seconds. The *fitz-beu* type of song is slightly longer than the *fee-bee-o* type, but there is considerable individual variation in the length of notes and in spacing.

3. *Filter Band Width.* These spectrograms were made by inspecting each song over and over again with a variable filter. This filter passed a band of frequencies 300 cycles wide at the half-power points. This filter band width results in a picture of the frequencies present slightly wider than it actually should be. However, this broadening of the picture is not serious and seldom amounts to as much as 1/16 of an inch added to the top and bottom of the trace, as presented here.

4. *Volume or Loudness Range.* This method of presentation does not give a good indication of the intensity of different parts of the song. To some extent intensity is indicated by a difference in the grayness or blackness of the trace. Other techniques of indicating the intensity range are available and will probably be combined with the present technique in some manner as this study progresses.

5. *Similarities of Song Types.* Both songs are characterized for the most part by a very rapid succession of tones (notes), alternating between a higher and lower frequency or pitch. These changes in pitch take place in short time intervals; from about 40 or 50 changes per second to nearly 200 changes per second. The pitch changes of these rapidly uttered notes may be as much as an octave, and probably account for the rough or reedy quality of the songs. These pitch changes are not necessarily perceived by the human ear as individual notes, since they occur so rapidly.

Both songs begin and end on a frequency close to 3000 cycles per second.

6. *Differences of Song Types.* In the *fee-bee-o* type song (Fig. 1), the first note is long, gradually increasing in frequency as much as three or four musical intervals, and finally terminating in an abrupt downward slur to about the starting pitch. The second note, clearly separated from the first, begins on about the same pitch as the first, but rises more rapidly, traversing about

six full intervals of the musical scale and then drops abruptly to the starting point and continues in what is probably interpreted as a third short note of gradually descending pitch. A fourth, very brief note or click of descending frequency is obvious on all of our spectrograms. This final note is probably not of audible importance but it may prove to be of interest in critical analyses.

In the *fitz-beu* type of song (Fig. 2), the first note appears to be sharp and short, rapidly rising in pitch about a full octave. This first note is followed by one of descending pitch with a drop of more than an octave. These two short notes, taken together, probably produce the sound usually referred to as *fitz*. Or should we say, *fitz-it*? The next note, usually thought of as the second, begins in a ragged or buzzy manner with the pitch increasing rather rapidly three or four full tones and then gradually decreasing in pitch to about the starting point or slightly below and becoming more buzzy towards the end.

7. *Differences in Individual Songs of a Type.* These differences are observable and may later prove useful in the study of individual variation. At present they appear to be over-shadowed by the similarity in songs of the same type.

8. *Harmonics or Overtones.* These are observable in all of the recordings as fainter partial repetitions of the song at double or triple the original frequency. Since it would be possible to produce these effects by a distortion of song at any of the several steps between the original song and the final trace on the spectrograph, further study and a better understanding of the equipment will be necessary before much confidence can be placed in any interpretation of these harmonic traces. It is of interest, however, that the Bay Pond spectrogram (see Fig. 1) shows fewer harmonics than any of the other traces. A possible explanation of this is that the recording equipment used in 1941 did not respond well to frequencies above 9000 cycles per second.

As an aid to further study of the songs analyzed in this paper, the actual recordings are, or will be, made available on phonograph discs. The song presented from Bay Pond is the first Alder Flycatcher song appearing on record 1-B of Volume 1. "American Bird Songs" (Kellogg and Allen, 1941). The other three songs will be published in a revision of Volume 1, or tape copies for study can be obtained from the Laboratory of Ornithology at Cornell University.

The preliminary nature of this study should be emphasized. Plans are being made for an intensive study of the songs of the eastern forms of this species in the near future. Cooperation in the form of recordings from any part of of the United States or Canada is invited.

Summary

Songs of four individuals of *Empidonax traillii* were recorded and analyzed on an audio-spectrograph. The four spectrograms, two of the *fitz-beu* type and two of the *fee-bee-o* type are presented. The spectrograms show great similarity in the songs of different birds singing the same song type and conspicuous differences in the two song types. The actual recordings on tape are available from Cornell for further study, and these are, or will presently be, published on phonograph discs.

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Laboratory of Ornithology, Department of Conservation, Cornell University, Ithaca, New York, March 30, 1953

THE QUESTION OF TEN-DAY INCUBATION PERIODS

BY MARGARET MORSE NICE

THE EGGS of a number of birds have been reported as hatching in ten days or even less. These short incubation periods are reported in two connections. One is the baffling method of some authors of counting incubation from the laying of the last egg to the hatching of the first egg—the so-called *Kurzbrutdauer*, which Swanberg (1950:65) rightly calls "meaningless." The other is the genuine belief in a particularly rapid development of the embryo in the species in question. It is the latter question that I propose to discuss here.

First, we must have a definition of incubation period. Here we may well follow Swanberg (1950:75) who adopts Heinroth's (1922) rule: *By incubation period is understood the time which, with regular, uninterrupted incubation of a newly laid egg, elapses until the young has left the egg.* In nature this can be checked by counting the time from the laying of the last egg to the hatching of the last egg, when all eggs hatch. This criterion is used by Moreau (1940), Nice (1937a), Skutch (1945), Sutter (1946), and many others.

A firm conviction has existed that little birds must have short incubation periods. Yet before the 19th century I can find no published statement of an incubation period shorter than 11 days. Audubon (1831:251) seems to have been the first to report a ten-day incubation period and this was for the Ruby-throated Hummingbird, *Archilochus colubris*: "Ten days are required for their hatching. . . . In one week the young are ready to fly, but are fed by the parents for another week." The male feeds his mate and "hurries the Bluebird and the Martin to their boxes . . . all these proofs of the sincerity, fidelity, and courage, with which the male assures his mate of the care he will take of her while sitting on her nest." It is clear that the whole story was spun out of his head; the male does not feed the female or the young; he takes no interest in her nesting; she incubates for 16 days; the young are fledged in 21 to 24 days (Kendeigh, 1952). Audubon's misstatements concerning incubation and fledging periods were incorporated into Nuttall's volume (1832) and appeared without change in the 1840 edition and also in "The Popular Handbook," edited by Chamberlain that came out in various editions from 1891 to 1919. Audubon's figure of ten days was given by Evans (1891) and copied by Bergtold (1917).

Others believed hummingbirds must have even shorter periods. A. E. Brehm (1861:262) suggested that "Hummingbirds perhaps need hardly eight days." Gentry (1876, 1882) stated that the female Ruby-throat incubates

eight days, the young leave at eleven days, both parents build the nest, and both feed the young.

The first European bird to be credited with a ten-day incubation period appears to have been the Wren, *Troglodytes troglodytes*. In 1841, Yarrell wrote, "The young are hatched after about ten days' incubation, during which time the male feeds the female" (1841:176–177); both statements are incorrect. This abbreviated period appears in the lists of Davy (1863:750) and Owen (1866:257). Evans (1891) quotes Yarrell and Owen, while Arrigoni degli Oddi (1902:48; 1904:130) gives Evans as his authority. The European Wren really incubates for 14 to 16 days (Niethammer, 1937; Witherby, *et al.*, 1938).

It is not only very small birds that have been said to hatch in short order. One of Gigliogli's (1890:187) correspondents assigned eight days to the Cirl Bunting, *Emberiza cirlus*, both European kinglets, *Regulus*, and four of the Sylviidae, birds that really incubate 12 to 16 days. The same correspondent also gave 10 days for 20 passerine species and 10 to 12 instead of 18 (Heinroth, 1922) for the European Quail, *Coturnix coturnix*. (In the same volumes other correspondents gave ridiculously *long* incubation periods for many of these same birds.) Even seven day incubation periods have been reported in this country: White-eyed Vireo, *Vireo griseus* (Dugmore, 1900), and Hutton's Vireo, *Vireo huttoni* (Wheelock, 1904); seven days is about half the actual period in these species.

Ten day incubation periods were given for 7 species by Gentry (1876), for 15 North American species by Burns (1915), and for 28 species (half of them from Burns) of birds of the world by Bergtold (1917). Groebbels (1937) gives a few among the two thousand or so of the incubation periods he quotes. Kendeigh (1952: table 51), in summarizing incubation periods of 107 families, gives none. Nowadays it is chiefly our sparrows and warblers that are supposed to develop so quickly.

It would be wearisome to deal with many of these guesses, most of them on species that have been found to incubate from 11 to 14 days or longer. Most of these records have something uncertain about them, usually some assumption as to the start or finish of incubation. This is true of Skead's (1952) ten-day incubation periods of the Bronzed Cuckoo, *Chrysococcyx caprius*, and of Gross' (1921) and Crabb's (1923) ten days for the Dickcissel, *Spiza americana*, while Bowdish (1906) does not state whether all five eggs of his Blue-winged Warbler, *Vermivora pinus*, hatched. In some cases, although the dates published plainly give eleven days between the laying and hatching of the last egg, the authors say incubation lasted ten days; examples are: Robert's Yellow Warbler, *Dendroica petechia* (1932:210), Dubois' Horned Lark, *Eremophila alpestris* (1935:58), and Wright's Blue-winged

Warbler (1909)—"ten or eleven days," interpreted by Bergtold as 10-14 days. Skutch (1945) said the Ruddy Quail-dove, *Oreopeleia montana*, hatched in ten days but later (1949) found it to be over eleven.

With two non-passerine species there are records which appear to be well-authenticated cases of ten day incubation periods. In his intensive study of the development of the Great Spotted Woodpecker, *Dendrocopos major*, Bussmann (1946:146) recorded six eggs laid April 26 to May 1; four young hatched May 10, and the last two were out by 10 a.m. May 11. Spencer (1943:14) observed 10 and 11 day incubation periods in nests of the Black-billed Cuckoo, *Coccyzus erythropthalmus*. A nest with one egg was found July 2, additional eggs were laid July 3 and 6, the last hatching July 16. The other nest also contained one egg when found July 7; other eggs were laid July 8 and 10, the second egg of the set hatching July 19.

Woodpeckers are well-known to have short incubation periods (Heinroth, 1922), hatching in a slightly less developed state than most altricial nestlings. The Black-billed Cuckoo egg that hatched in ten days was laid three days after the previous egg; it may have been retained in the oviduct for an extra 24 hours and thus have been at a more advanced stage when laid than the egg that hatched at 11 days.

It is neither a woodpecker nor a cuckoo, however, that is the most famous example of a reputed ten-day incubation period. Two passerines vie for the distinction of holding the record for "the shortest incubation period of any bird"—the White-eye and the Cowbird.

Incubation Period of *Zosterops*

White-eyes or Silver-eyes, of the family Zosteropidae, are small birds, four to five inches in length. The family, comprising one genus and 80 species, is widely distributed throughout Africa, southern Asia, Australasia, and many islands of the Pacific. White-eyes have long been cited as having the shortest incubation period of any birds—nine to ten days. We find this statement in books and articles from New Zealand and Australia to England, France, Germany, and North America.

What is the basis of this belief? Its source is a statement by Buller in his "History of the Birds of New Zealand" (1887–8, 1:86) in regard to *Zosterops caerulescens* (=*lateralis*)—a bird self-introduced from Australia—"Mr. Potts informs me that, in Canterbury, this species begins nesting early in October. In one instance, within his observation, the birds commenced incubation on October 16, the young were hatched on October 25, and left the nest on November 4." We are not told when the nest was found nor when the eggs were laid.

This supposed nine-day period might well have passed unnoticed, as so many statements, bad and good, have been, had it not been for William Evans, who published an important and influential review of incubation periods in *The Ibis* in 1891. He said: "The shortest period I have seen recorded is that of the tiny New Zealand *Zosterops caerulescens*, namely 9 to 10 days, as given by Buller on the authority of Mr. Potts, evidently a careful and systematic observer" (this characterization of Potts being quoted from Buller).

This 9-10 day period was included in Gadow's (1891) resumé of Evans' table. Campbell (1901) in "Nests and eggs of Australian birds" noted that "Mr. Potts observes that incubation in the case of the White Eye lasts about ten days." Bergtold (1917) quoted 9-10 days from Evans and 10 days from Campbell.

A ten day incubation for *Zosterops* received support from reported experiences in some aviaries. Perreau (1911) wrote that "incubation lasted ten days" with his pair of the Indian White-eye, *Z. palpebrosa*, but gave no details. Page (1911) gave June 27 as the date of finding the nest of his pair of the same species with its full complement of three eggs which hatched ten days later: "I regret that my data are somewhat modified by the fact that the birds had commenced to incubate, but I think it may be safely assumed that they had but just begun their incubatory duties when the nest was discovered." He reported the same event in another journal (1912a), saying his data were "somewhat doubtful." Bergtold quoted from Page's book (1912b) the period of 10-11 days for *Zosterops palpebrosa*.

The African White-eye, *Z. virens*, bred in Lovell-Keay's (1915) aviary. The date of laying of the first egg is given, but not the date of hatching: "The incubation period is almost exactly 10 days, certainly not more, as I watched the hen feeding 11 days after the first egg was laid." Neunzig (1921:130) gave the incubation period of the Cape White-eye, *Z. capensis*, as 10 days, but with no details or authority. Note that the only aviculturist who gave the date of hatching was not sure of the date of laying.

To return to the Antipodes, Oliver (1930) stated that the period of incubation of *Z. lateralis* in New Zealand "as observed by Mr. Wilkinson of Kapiti Island is ten days," and this was reiterated by Mrs. Wilkinson in 1931. Serventy and Whittell (1948) wrote in regard to the Silver-eye, *Z. australasiae*, "Incubation takes 9 to 10 days"; in 1951 they say "9 to 12 days." The nine to ten-day period for *Zosterops* has been quoted far and wide. To give only two examples: Baerg (1941) tells us, "The shortest period on record is nine days, for the Silver-eye of Africa," while Grassé (1950:614) writes "*Zosterops* furnishes us with the lowest figure with ten days."

Zosterops is a widely distributed genus, abundant in some places. What careful studies have been carried out on its nesting?

Schmitt (1931) bred *Z. japonica simplex* in his aviary in Hungary. The birds attempted seven nestings in three years, the eggs hatched in five cases. Many details are given of behavior and development. Schmitt says, "After eleven days the naked young hatched."

In New Zealand, Fleming (1943) made a study of the Silver-eye based on color-banding. He watched two nests. "In one case the time from the appearance of the last egg of three to the hatching of the last chick was 11 days (± 12 hours): in another clutch of two eggs the same period was 12 days (± 12 hours). In the former instance each egg had 10 days' incubation, and the two oldest hatched a day before the third."

Mr. Fleming kindly looked up his original notes and wrote me (June 3, 1952) that in the "Swing" nest the eggs were laid October 12-14, two young hatched October 24 and the third October 25. In the "Eugenia" nest the eggs were laid October 29 and 30 and both hatched November 11. "I think that the period for the 'Swing' pair is 11 days, not 10 as published, and for the 'Eugenia' nest 12 days. Please use these data and correct my misstatement. It would always pay to publish actual data!"

Mr. Robert Stidolph of Masterton, New Zealand, gave me an important record from the notes of Mrs. Wilkinson on a nest watched by her after her 1931 paper had been published. She made daily visits to it from November 20, 1931; the three eggs were laid November 23, 24, and 25; on December 5 no eggs were hatched, but on the 6th there were two young. One egg did not hatch. This gives a minimum period of eleven days.

As to Australia, Dr. Serventy wrote me on June 28, 1952: "The incubation period of *Zosterops australasiae* in our book appears to be an error. The only definite records which I can personally give are 12 days."

After I had traced the course of the nine to ten-day tradition for *Zosterops* as outlined above, I received very interesting information from Mr. W. R. B. Oliver of Wellington, New Zealand. He quoted two statements made by Thomas Henry Potts himself. In 1870 Potts published an account of a newly finished nest of *Zosterops lateralis* found December 4, which he visited daily: "On the 8th it contained three eggs; the next day a fourth egg was laid; on the 19th one callow nestling was exhibiting its ugliness. . . . The day following his ugliness had a companion." The other two eggs did not hatch. Mr. Oliver comments: "This account shows that the minimum incubation period is 11 days. And if the eggs laid presumably on the 5th and 6th were the ones that hatched, the incubation period would be 13 days."

Strangely enough, in 1884, Potts wrote that in this species, "Incubation lasts about ten days." Between 1870 and 1884 he must have found the nest

that started all the trouble; he assumed that incubation had just begun and evidently had forgotten his own daily observations on the first nest.

So here in four nests of the New Zealand Silver-eye recorded from 1870 to 1943 and in five nests of *Z. japonica simplex*, incubation was found to last at least 11 days, and in *Z. australasiae*, 12 days. The original nine day period was based on a guess as to when incubation started and the same was true of the ten day period reported by Page in his aviary. Perreau's and Lovell-Keay's statements appear to be of the same character. Mr. Oliver (personal letter) in his new edition of "New Zealand Birds" is "giving eleven days, occasionally twelve, as the time taken to incubate the eggs of the Silver-eye."

Incubation Period of the Cowbird

The tradition of the ten day incubation period of *Molothrus ater*, like that of *Zosterops*, is traceable to two sources, both ambiguous. Alexander Wilson (1810:145) was the first ornithologist to publish on the parasitic habit of the species; he observed it himself and had been told "in a vague way, that the Cowbird laid in other birds' nests. . . . From twelve to fourteen days is the usual time of incubation with our small birds; but although I cannot exactly fix the precise period requisite for the egg of the Cow Bunting, I think I can say almost positively, that it is a day or two less than the shortest of the above-mentioned species!" He quotes from the experiences of his friend, Dr. Nathaniel Potter of Baltimore, who tried to determine the incubation period, but the two nests he was watching came to grief. In his third attempt, "Being obliged to leave home, I could not ascertain precisely when the process of incubation commenced, but from my reckoning, I think the egg of the Cowbird must have been hatched in nine or ten days from the commencement of incubation. . . . I ought to acknowledge here, that in none of these instances could I ascertain exactly the time required to hatch the Cowbird's eggs" (p. 158). All this was repeated in each edition up to the last in 1879, but I can find no quotations of this presumed nine to ten day incubation period.

In the meantime Audubon (1831:497) had given the incubation period as "nearly a fortnight," although he also said, "In every case the Cow Bird's egg is the first hatched." This period was quoted by Evans (1891) and by Bergtold (1917) who attributed it not to its original source but to Evans; otherwise it appears to have been ignored.

The next year Nuttall (1832:192) wrote: "the young of the Cow-bird, I believe, appears about the 12th or 13th day of sitting," and this was reprinted until 1919. I cannot find that this guess made any more impression than Wilson's shorter and Audubon's longer guesses. I have not found the subject mentioned in any other 19th century book until Bendire.

Bendire evidently was the main source of the ten day belief, as he was of so many of our statements as to length of incubation. Whether he was influenced by Wilson we cannot say; he very seldom mentioned sources for any of his assertions. In "The Cow-birds" (1895a) he said that the egg "usually hatches in from ten to eleven days." He quoted M. A. White of Matthews, Virginia: "It was on the 9th of June, 1891, that I placed a fresh egg of the Cowbird in the nest of a Chipping Sparrow containing two of her own that had an advance of one and a half day's incubation. About the 19th Mr. Cowbird emerged from his prison walls, large and vigorous. A day later a little sparrow came forth from his delicate shell." The same story is repeated verbatim in Bendire's "Life Histories of North American Birds" (1895b:438). There are two ambiguities here. We do not know when the Cowbird's egg was laid; the "fresh" egg might have already been incubated for a day or two. And why "*about* [italics mine] the 19th"? All in all, a shaky foundation on which to base a categorical assertion.

Many books now began to give the incubation period of the Cowbird as ten days, although no one cited evidence or even any authority. Coues had given no incubation period for this species in his first four editions from 1872 to 1892, but in his fifth in 1903 he said 10 or 11 days. Knight (1908) gave 10 days, Eaton (1914) "about ten," Burns (1915) 10, Forbush (1927) 10-12, Roberts (1932) 10, and Chapman, who from 1897 to 1912 had not mentioned the matter, wrote in 1932 "ten days, about the shortest period of any of our passerine birds."

Unfortunately Friedmann accepted the consensus of opinion. He even wrote a paper (1927) on "A case of apparently adaptive acceleration of embryonic growth in birds," giving the incubation periods of the South American cowbirds as 11½ to 13 days, but of *Molothrus ater* as 10 to 10½ days. "No bird in the world is known to have a shorter incubation period; few have one as short." In his book, "The Cowbirds," (1929:187) he says, "The incubation period of the Cowbird is ten days, about the shortest of any of our passerine birds."

All this time collectors were collecting sets with Cowbird eggs, while other observers regularly removed the abhorred object. Friedmann (1929:305) wrote of "the great number of bird-students and bird-lovers who invariably, and not without some reason, throw out Cowbird eggs when they find them." This "enemy [that is, the egg-removers] also affects nestling Cowbirds and in regions where nature study is commonly indulged in, this class of enemies is of no small importance as a check upon the species." No one thought of verifying the accepted incubation period.

The first instance of leaving a Cowbird's egg alone and reporting when it hatched since the days of Dr. Potter and Mr. White seems to have occurred

at the Iowa Lakeside Laboratory on Lake Okobojii in 1917. On June 27, Nelle E. Shaver (1918) who was studying under Dr. T. C. Stephens, found a nest of the Maryland Yellow-throat, *Geothlypis trichas*, containing three eggs of the host and one of a Cowbird. The nest was visited daily and on July 8 the Cowbird was hatched and on July 9 two of the Yellow-throats were hatched. This gives an incubation period of at least eleven days for the Cowbird. No one seemed to notice that it was longer than it should have been. Eleven years later Hoffman (1929) reported a Cowbird egg in the nest of a Song Sparrow, *Melospiza melodia*, hatching in twelve days, the host eggs hatching in thirteen.

Up to this time I had been one of the Cowbird-egg-removers, but when I started my study of Song Sparrows, I realized that I should not interfere. To my astonishment I found the Cowbird *never hatched in ten days*. I first published my observations in 1933, saying that with the Song Sparrow as host Cowbird eggs hatched in slightly over eleven or twelve days, occasionally more, never less (p. 594). Four years later (1937a:153) I wrote: "It has long been believed that the one respect in which *Molothrus ater ater* was specialized was that of a short incubation period—'only 10 days.'" With the Song Sparrow as host Cowbird eggs hatched as follows: 5 eggs in 11 days, 9 in 12, 3 in 13, and 2 in 14, an average for the 19 of 12.1 days. Twice again (1937b, 1939) I crusaded against the myth of the Cowbird's ten-day incubation period.

Packard (1936) found on May 25 two Cowbird and four Black-capped Chickadee, *Parus atricapillus*, eggs in a nest box; on June 6 the Cowbirds hatched, on June 8 two chickadees, making a twelve day incubation period for the Cowbird. In his detailed study of the Ovenbird, *Seiurus aurocapillus*, Hann (1937:204) found "that the incubation period of Cowbird's eggs ranged from approximately 11.1 days to 11.8 days, with an average of 11.6, which is 0.6 of a day less than the average for the Ovenbird's eggs." Dr. Hann writes me that these averages are based on 15 Cowbird eggs. Finally, Norris (1947:95) in his study of Cowbirds with a variety of hosts writes: "I have recorded the incubation period accurately for only 10 eggs, but none of these hatched in 10 days. Five hatched in 11 days, one in 11.5 days, one in 12 days, two in 12.5 days, and one in 13 days. This gives an average of 11.6 days, exactly Hann's figure."

Thus, between 1918 and 1947 *47 records of 11 to 12 day* (and occasionally longer) *incubation periods were published for this species*, yet still the fable goes on. I have also received 15 unpublished records: 12 days in a Cardinal, *Richmondena cardinalis*, nest (Amelia Laskey), 11 days, 22 hours, 36 minutes in a House Sparrow, *Passer domesticus*, nest (W. E. Schantz), four 11 and three 12 day periods in Indigo Bunting, *Passerina cyanea*, Song Sparrow,

and Bobolink, *Dolichonyx oryzivorus*, nests (John L. George), and four of 11 days, one of 11-12, and one of 13 in Yellow-throat nests (P. B. Hofslund). Let us hope that these 62 observations of 11 days or more, and not a single one of 10 days, will make some impression.

Does the Cowbird's incubation period show any adaptation to parasitism? *Molothrus ater* and the Shining Cowbird, *Molothrus bonariensis*, (Friedmann, 1929:89) have similar periods—11 to 12 days. As to other icterids, at least two have equally short periods: Tricolored Red-wing, *Agelaius tricolor*, 11 days (Emlen, 1941:216), and Red-winged Blackbird, *Agelaius phoeniceus*, 11 days in twelve cases, 12 days in two cases, as reported to me by Edwin Willis of Baltimore, Maryland. I think we can answer our question in the negative.

Discussion

Thomas Henry Potts was an important ornithologist, called by Buller a "careful and systematic observer" and by Oliver (1930) "one of the truest naturalists New Zealand has had the good fortune to possess." Major Charles Bendire was a distinguished ornithologist, a founder of the American Ornithologists' Union, and Honorary Curator of the Department of Oology in the United States National Museum. The words of these men carried weight. People thought they were safe in believing such eminent authorities and the reported ten day incubation periods for *Zosterops* and the Cowbird were copied throughout the world.

Ten day incubation periods should not be lightly assumed; any such report should be accompanied with fullest detail and be scrutinized with extreme care. Very occasionally an egg may be retained for 12 to 24 hours in the oviduct (Sutter, 1946). Hoffman (1929) caught a Cowbird that appeared to be egg-bound and kept her over night; next morning he found two eggs in the cage. One of these eggs would have had an extra day of development before it was laid, and, if immediately incubated, might conceivably have hatched in ten days.

Let *Zosterops* and the Cowbird be a lesson to us. Leaders in ornithology must be especially careful of their pronouncements, for they have a heavy responsibility. And the rest of us must leaven our respect with a measure of skepticism. Instead of accepting everything in print we must demand the evidence and weigh it, and ourselves observe and experiment. Remember Louis Agassiz's precept: Study Nature, not books.

Summary

Incubation period can best be determined by counting the time from the laying of the last egg to its hatching.

Audubon in 1831 appears to have been the first ornithologist to assign a ten day incubation period to any bird. Since then many such assertions—and even of shorter periods—have been made both in the Old and New worlds, but authenticated incubation periods of less than 11 days prove to be rare.

Zosterops, the White-eye or Silver-eye, has attained world-wide fame for the shortest period of any bird—9 to 10 days. This rumor started in a careless observation in New Zealand in the 1880's. In eleven or more nests that have been carefully watched from 1870 to 1943 the incubation period lasted 11 to 12 days.

For sixty years Cowbird eggs have been stated to hatch in ten days—"about the shortest period of any of our passerine birds." This myth was started through a guess by a friend of Major Bendire and was generally accepted, although no good evidence was ever produced. From 1918 to 1952 there have been 62 cases reported of Cowbird eggs hatching in 11 to 12 days and not one case in ten days.

The unquestioned acceptance of these blunders for 60 to 80 years clearly shows that we need greater care in observation and less reliance on the printed word.

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A PLIOCENE GULL FROM FLORIDA

BY PIERCE BRODKORB

FEW fossil gulls have been described and none is known from the Pliocene Epoch. The only Pliocene record for the Laridae as a whole is that of Wetmore (1944), who examined an undetermined tern from Kansas. Collections made by Mr. George C. Elmore in Middle Pliocene deposits of southern Florida include several specimens of a medium-sized gull which is described in the present paper.

Larus elmorei, new species

Type.—Distal end of right humerus, No. 140, collection of Pierce Brodkorb; Middle Pliocene (Bone Valley formation); one and one-half miles south of Brewster, Polk County, Florida, in Sec. 5, T. 32 S, R. 24 E. Collected February, 1952, by George C. Elmore (locality 2).

Description.—Shaft wide, somewhat flattened on anconal surface; olecranal fossa wide, gradually merging into shaft without abrupt depression; external tricipital groove pronounced; internal tricipital groove scarcely separated from olecranal fossa, except for a raised area at base of shaft.

Palmar surface of lower portion of shaft somewhat convex, for reception of *brachialis anticus*; brachial depression deep and wide, its external portion crossed by two complete and one incomplete diagonal ridges; ridge bordering internal side of brachial depression pronounced, the distal portion of the ridge with surface for attachment of anterior articular ligament broadened distally, and sloping distally and toward brachial depression; attachment for *pronator brevis* bounded by a raised area on summit of ridge, its surface sloping proximally; internal condyle a flat oval; external condyle diagonal, its distal end not extending quite as far as end of internal condyle; entepicondylar prominence well developed, with two depressions on its side; ectepicondyle large, extending at an angle of about 45 degrees from palmar surface, and situated relatively high on shaft, its proximal edge being in line with proximal boundary of brachial depression; a round scar for *supinator brevis* prominent at base of ectepicondyle.

Color white; well mineralized.

Measurements of the type humerus are the maxima in Table 1.

Comparisons.—Distal end of humerus most similar to that of Recent *Larus delawarensis* Ord. Differs in larger average size; in having the internal tricipital groove broader; internal condyle relatively shorter; brachial depression deeper; surface for attachment of anterior articular ligament broader and less sloping distally; surface for attachment of *pronator brevis* broader.

The fossil species is more distantly related to other living gulls. From *Larus canus*

brachyrhynchus Richardson it may be separated by its larger size; wider distal end; deeper brachial depression; relatively shorter internal condyle.

It differs from *Larus heermanni* Cassin in larger size; relatively shorter internal condyle; more projecting entepicondyle. *L. heermanni* has a deep brachial depression as in the fossil, but the distal end of the humerus is more compressed than in *elmorei*, with the entepicondylar prominence not visible in palmar view.

FIG. 1. *Larus elmorei*. Type humerus (left) and referred coracoid. Three times natural size.

The fossil may be separated from *Larus californicus* Lawrence by the smaller size and relatively wider internal tricipital groove in the fossil. Other living gulls are either considerably larger or smaller than the Pliocene species.

The new species differs from *Larus oregonus* Shufeldt (1892:398), of the Pleistocene of Oregon, in lesser width of distal end (15.3–16.0 mm. in *oregonus, fide* Howard, 1946:

186). Only the proximal portion of the humerus of *oregonus* has been figured (Shufeldt, 1892:pl. 15, figs. 3 and 4), so that other differences which may exist in the distal end are not known.

The humerus of *Larus robustus* Shufeldt (1892:398), of the Pleistocene of Oregon, is unknown. The type coracoid, however, is from a very large gull.

Larus vero Shufeldt (1917), of the Pleistocene of Florida, was based upon a carpometacarpus. According to Wetmore (1931:16) this bone came from a Yellow-crowned Night Heron, and therefore the name is a synonym of *Nyctanassa violacea* (Linnaeus). I have examined a cast of the type, No. V320 in the collection of the Florida Geological Survey. The cast shows some slight discrepancies from Shufeldt's figure. Apparently the tuberosity of the second metacarpal was broken off between the time of preparation of the figure and casting. The cast appears inaccurate in having more distal fusion between the shafts of the second and third metacarpals than appears in the figure. The only published measurement of the type is the length, which Shufeldt gives as 5.75 cm. My measurements of the cast are as follows: length 58.8 mm, height of proximal end 10.8, width through trochleae 5.3, width of second metacarpal 4.1, width of distal end 4.2, length of fusion of second and third metacarpals 8.8. It is obvious that *Larus vero* is not a gull, since it differs in the shape of the process of the first metacarpal and in the course of the tendinal groove. As far as can be determined from the cast, I agree with Wetmore that it is not separable from *Nyctanassa violacea*.

In the same paper in which he described *Larus vero*, Shufeldt (1917:38, pl. 1, fig. 12) listed *Larus*? (sp. ?) from the Pleistocene of Vero, Florida. The specimen on which this record is based is the distal half of a right tibiotarsus (not the tarsometatarsus as stated). I have studied this specimen, which is now No. V3500 in the collection of the Florida Geological Survey. It is not a gull, since it has the internal condyle relatively shorter, stouter, and with a less prominent notch on the distal end. The fossil came from a small duck and shows close similarity to the tibiotarsus of *Lophodytes cucullatus*. This raises the question of the identity of *Querquedula floridana* Shufeldt, the only currently recognized species of the three supposed new birds from Vero. Wetmore noted certain differences between the type humerus and that element in living *Anas* [*Querquedula*] *discors*. He has identified as *Q. floridana* material from other Pleistocene deposits in Florida. From a study of two casts of the type and other material I am struck by the similarity of the humeri to those of *Lophodytes*. This point will be elaborated upon in another connection at a later date.

The humerus of *Larus pristinus* Shufeldt (1915:54), from the Oligocene of Oregon, is unknown. According to Miller and Sibley (1941:566), the type tibiotarsus is of doubtful allocation.

Several species from the Oligocene of Europe have been described in the genus *Larus*. All are either larger or smaller than *elmorei*, and several of them probably should be referred to other genera.

Gulls from the Miocene are *Gaviota niobrara* A. H. Miller and C. G. Sibley (1941), from Nebraska, and *Pseudosterna dejener* and *P. pampeana* Mercerat (1879), from Argentina. In these genera the spur is located more proximally than in *Larus*. *Gaviota* differs further from *Larus elmorei* in much larger size, in smaller spur, and in having the scar for *pronator brevis* situated on the medial side of the ridge instead of on the summit.

Referred material.—Other material referred to this species includes three specimens from Elmore's Locality 1, in the NE corner of the NE ¼ of the SW ¼, Sec. 32, T. 31 S, R. 24 E, one and one-half miles southeast of Brewster, Florida.

TABLE 1

MEASUREMENTS (in mm.) OF *Larus elmorei* AND *Larus delawarensis*

	elmorei (1 or 2 specimens)	*delawarensis* (8 specimens)
Humerus:		
Proximal base of spur to end of external condyle	12.7 (12.4, 13.0)	12.3 (11.0–12.8)
Width across condyles	11.8 (11.5, 12.0)	11.6 (10.3–12.1)
Width of distal end	14.0 (13.7, 14.3)	13.4 (12.5–13.8)
Width of shaft above spur	9.1 (8.8, 9.3)	8.7 (8.3–9.2)
Width of inner tricipital groove	5.9 (5.5, 6.3)	5.1 (4.8–5.3)
Diagonal length of external condyle	8.4 (8.3, 8.5)	7.9 (7.3–8.4)
Length of internal condyle	3.8 (3.7, 3.9)	4.0 (3.7–4.2)
Depth of external condyle	8.1 (7.9, 8.2)	8.2 (7.6–8.5)
Depth of internal condyle	4.4 (4.3, 4.5)	4.2 (4.0–4.3)
Coracoid:		
Brachial tuberosity to furcular facet	4.4	4.2 (3.8–4.7)
Furcular facet to head	6.5	6.0 (4.6–6.8)
Head to glenoid facet	5.6	5.3 (4.8–5.7)
Glenoid facet to scapular facet	8.6	8.6 (7.8–9.2)
Furcular facet to glenoid facet (width of head)	10.3	9.6 (8.3–10.5)
Brachial tuberosity to glenoid facet	9.2	9.2 (8.5–9.7)
Head to scapular facet	12.7	12.3 (11.2–13.4)
Width of shaft through scapular facet	5.8	5.3 (4.8–5.6)
Narrowest transverse diameter of shaft	3.7	3.8 (3.4–4.1)
Narrowest depth of shaft	3.0	2.9 (2.6–3.2)
Breadth of furcular facet	9.0	8.4 (7.1–9.2)
Carpometacarpus:		
Width of second metacarpal	4.0	3.9 (3.5–4.1)
Height of distal end	6.8+	7.2 (6.4–7.8)
Width of distal end	5.5	5.5 (5.1–6.0)
Distal fusion of second and third metacarpals	6.3	6.1 (5.7–6.5)

The distal portion of a left humerus (P. B. No. 176) is similar to the type but comes from a slightly smaller individual. The spur has been broken off near its base.

The proximal three-quarters of a right coracoid (No. 134) resembles the corresponding bone in *Larus delawarensis*. It differs in being somewhat more robust; in having the internal border of the glenoid facet convexly oval instead of nearly straight; and in having the head of the bone relatively wider, particularly the median portion.

The coracoid of *elmorei* differs from that of *L. robustus* in much smaller size and in configuration of the head as described above.

The coracoid of *L. oregonus* has not been figured and has only briefly been described. From the ratios published by Howard (1946), it appears that the breadth of the furcular facet and the distance from the distal end of the scapular facet to head are less in *elmorei*.

The distal end of a left carpometacarpus (P. B. No. 178) is not separable from the corresponding element in *L. delawarensis*.

For the loan of specimens for comparison I am indebted to Dr. Robert O. Vernon of the Florida Geological Survey, Dr. Frank A. Pitelka of the

Museum of Vertebrate Zoology, and Dr. Herbert Friedmann of the United States National Museum. The drawings (Fig. 1) were made by Miss Esther Coogle.

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A LIFE HISTORY STUDY OF THE YELLOW-THROAT

BY ROBERT E. STEWART

DURING the spring and summer of 1938, I studied the habits and behavior of the Northern Yellow-throat (*Geothlypis trichas brachidactyla*) in southern Michigan. General observations were made throughout Washtenaw, Jackson, and Livingston counties, and detailed notes were obtained on a breeding population of Yellow-throats in a marshy area adjacent to Geddes Pond, one mile east of Ann Arbor. Nesting activities were studied from blinds placed within a few feet of active nests in the Geddes Pond area. Supplementary information on nest-building, egg-laying, and incubation periods of a closely related subspecies, the Maryland Yellow-throat (*Geothlypis trichas trichas*), was recorded at Arlington, Virginia, in 1940, and at the Patuxent Research Refuge near Laurel, Maryland, in 1947. Grateful acknowledgment is made to Dr. Josselyn Van Tyne for helpful advice given during the course of this study.

Breeding Season

The resident male Yellow-throats were found to establish breeding territories almost immediately upon their arrival in the spring. At Ann Arbor, in 1938, the first record of a Yellow-throat in the spring was on April 29. On April 30, another was seen and on May 1, three were found with established territories adjacent to each other. The three birds were definitely resident males as they remained in their respective territories during the summer. They were easily recognized because of their distinctive songs. It would appear, therefore, that some of the resident males arrive on their nesting grounds at least as soon as, if not before, the transient males that nest farther north. Breeding territories were occupied and defended by male Yellow-throats from the time of their arrival in the spring until the advent of the post-nuptial molt which occurred during the first two weeks of August. At this time, territorial boundaries were no longer recognized and most of the Yellow-throats, even those still caring for young, wandered about a good deal.

In 1938, most female Yellow-throats arrived about one week after the first general appearance of the males. One lone female was seen on May 3, but this was, no doubt, an unusually early arrival as no others were seen until May 7. This early female was also peculiar in that it remained unattended by a male for over two weeks after its arrival although it was surrounded by males.

The first nest, containing eggs, was found on June 3. On June 7, another nest, containing nestlings, was located, while on June 10, a pair of Yellow-

throats was found tending young birds out of the nest. These records would indicate that the nesting actually started during the middle of May, probably about May 15. A nest with 4 eggs was reported near Ann Arbor on May 23, 1903 (Wood, 1951:417). July 27 was the latest date on which a nest with viable eggs was observed, and young birds were last seen as nestlings on August 3. From the evidence presented, I think that the period in 1938 during which occupied nests occurred extended from approximately May 15 to August 7. Adults were observed tending young out of the nest as late as August 20, and on August 29 an adult male was observed feeding a young Cowbird (*Molothrus ater*).

Habitat

The typical Yellow-throat habitat in southern Michigan develops on sites with damp or wet soil. It is characterized by a mixture of dense, rather lush, herbaceous vegetation and woody plants, chiefly shrubs and small trees. This type of habitat is usually found along the margins of streams, ponds and lakes, in open bogs, and in seepage areas below springs. In life form the habitats were found to range from an open savanna-like type with scattered groups of shrubs or trees from 3 to 15 feet in height, to a fairly dense thicket of small woody plants, usually less than 3 feet in height. Although definite evidence is lacking, it may be, as suggested by Kendeigh (1945b:430), that the habitat requirement of the Yellow-throat is the dense growth of low vegetation, which is more prevalent in wet areas, rather than the moisture itself.

Numerous species of plants characterize Yellow-throat habitats. The following names of some of the more numerous ones are taken from Gray's Manual of Botany (Fernald, 1950). Near Ann Arbor the more important woody plants include *Salix cordata*, hoary willow (*Salix candida*), speckled alder (*Alnus rugosa*), red osier dogwood (*Cornus stolonifera*), shrubby cinquefoil (*Potentilla fruticosa*), and buttonbush (*Cephalanthus occidentalis*). The many kinds of herbaceous species were found to be extremely variable in their occurrence and abundance from one area to another. In the Geddes Marsh area the more important herbaceous species are as follows: *Dryopteris Thelypteris, Sphenopholis intermedia, Glyceria striata, Leersia oryzoides, Calamagrostis canadensis, Carex cristatella, Carex stipata, Carex vulpinoidea, Carex steralis, Carex stricta, Carex leptalea, Eleocharis palustris, Juncus Dudleyi, Juncus nodosus, Thalictrum polygamum, Anemone canadensis, Fragaria virginiana, Desmodium* spp., *Pycnanthemum virginianum, Pedicularis lanceolata, Galium boreale, Eupatorium purpureum, Eupatorium perfoliatum, Aster puniceus, Aster novae-angliae,* and *Solidago* spp. The pre-

dominant herbaceous plants are grasses, sedges, rushes, composites, and a few representatives of other families.

The local distribution of Yellow-throats overlapped the local ranges of numerous other species of birds. Since the areas occupied frequently included portions of marsh, sedge-meadow, shrub swamp, and forest edge, many of the associating species were those that are characteristic of these various habitat segregates. Due to the lack of uniformity of most of the areas occupied by Yellow-throats the species composition of birds was found to vary greatly from one place to another. The more common associating species were: Traill's Flycatcher (*Empidonax traillii*), Long-billed Marsh Wren (*Telmatodytes palustris*), Short-billed Marsh Wren (*Cistothorus platensis*), Catbird (*Dumetella carolinensis*), Yellow Warbler (*Dendroica petechia*), Red-winged Blackbird (*Agelaius phoeniceus*), Cowbird (*Molothrus ater*), Cardinal (*Richmondena cardinalis*), Indigo Bunting (*Passerina cyanea*), American Goldfinch (*Spinus tristis*), Eastern Towhee (*Pipilo erythrophthalmus*), Henslow's Sparrow (*Passerherbulus henslowii*), Field Sparrow (*Spizella pusilla*), Swamp Sparrow (*Melospiza georgiana*), and Song Sparrow (*Melospiza melodia*). Other birds occasionally noted within Yellow-throat habitats include: American Bittern (*Botaurus lentiginosus*), Black Duck (*Anas rubripes*), Marsh Hawk (*Circus cyaneus*), Ring-necked Pheasant (*Phasianus colchicus*), Virginia Rail (*Rallus limicola*), and Sora (*Porzana carolina*).

Population

The Yellow-throat, one of the more common species of the warblers (Parulidae) that nest in the Ann Arbor region, varies greatly in abundance from one area to another, depending on habitat conditions. A census of breeding Yellow-throats in the Huron River valley was conducted in an area comprising six adjoining sections (six square miles) that extend eastward from Ann Arbor. These sections were covered systematically on foot and all habitats that appeared suitable for Yellow-throats were thoroughly searched during several visits. Because of the intensive coverage, I think that the census totals are fairly accurate. The total number of territorial males in the entire area was found to be 58 (average of 9.7 males per square mile). These birds were unevenly distributed, being concentrated in their restricted habitats which occurred only along portions of the Huron River and its tributaries. An indication of this variation in occurrence and abundance is shown by the number of territorial males in each of the six sections: 21, 10, 9, 9, 9, 0.

Although most of the areas of Yellow-throat habitat in this region are quite local and restricted in size, there are a few fairly large tracts that are popu-

lated by them. One such area, which covered a little more than one square mile was adjacent to Portage Lake in Jackson County. More than half of this area was made up of suitable habitat and here the birds were nesting in profusion. While no detailed census was made of this plot, I estimate that well over 100 territorial males were present.

In the Geddes Marsh study tract all of the habitat that appeared to be suitable for breeding Yellow-throats was occupied by them. This would indicate that the local breeding population in 1938 had reached the saturation point. The total area of suitable habitat was approximately 16 acres, while the number of territorial males present was 11. On the basis of these figures, the population density of territorial males on land that supports appropriate habitat is about 69 per 100 acres.

All of the 11 territorial males in the Geddes Marsh study tract were mated. One male was definitely polygamous, having two mates, while nine males were monogamous. The remaining male was also probably monogamous since not more than one female was seen in its territory at one time. However, two nests were found in its territory within a very short period which might indicate the presence of a second female. Young birds were fledged from the first of these nests on June 22 while on June 27 the other nest was found a relatively short distance from the first, containing two young Cowbirds and one Yellow-throat egg.

Songs and Call Notes

Upon their arrival in spring, the male Yellow-throats frequently sang while establishing their territories. The songs were then continued through summer until the advent of the post-nuptial molt in August. The latest adult song was heard on August 19. These songs apparently serve as proclamations of ownership of territory and, in the spring, probably also function in advertising the male's presence to any newly-arrived females.

The typical common song may be represented phonetically either as *wit-cha-ree, wit-cha-ree, wit-cha-ree, wit* or as *wheet-to, wheet-to, wheet-to, wheet-to.* However, there are many individual variations in the number of phrases, the number of syllables in each phrase, and in the tone and pitch. In the Geddes Marsh area, seven males had songs that were composed chiefly of three-syllable phrases while four males had songs made up of two-syllable phrases. The song of each male was distinctive enough to be readily recognized.

Ordinarily the males paused only momentarily to sing and then continued with whatever activity they were engaged in. Occasionally they stopped for a much longer period to sing, generally mounting to a perch several feet higher than usual, and there bursting forth in song at fairly regular intervals,

remaining stationary throughout. Mousley (1919) studied the relationship between location of favorite singing trees and nest sites. His observations on four nests showed distances between singing trees and nests of 4, 7, 10, and 11 yards. In the present study, most males were observed to sing in spurts, singing actively at fairly regular intervals for a considerable period and then abruptly ceasing to sing for another period. While actively singing, the interval between songs frequently was from 10 to 20 seconds with the period of song delivery lasting from 1.5 to 3 seconds. In mid-July, the total number of common songs sung by one male during nine hours of observation in the afternoon was 558 (an average of 62 per hour). The greatest number of songs recorded for this bird during one five-minute period was 26 (an average of one song every 12 seconds); the longest period of silence lasted for 85 minutes.

Male Yellow-throats were also occasionally observed performing flight songs. The procedure usually was for the bird to start from a perch in a low shrub, rise with undulating flight to a height of from 25 to 100 feet and then swoop downward to a new perch near the ground. During the ascending part of the flight the bird uttered several sharp, short notes which resembled the sounds, *teenk, teenk, teenk.* Near the apex of the flight, a somewhat discordant, garbled group of call notes, song phrases, "chuckles," and "gurgles" were uttered; during the descent the bird was completely silent. A modification of the typical flight song was noticed once when a male was observed singing the characteristic notes while flying to a perch near the top of a tall willow tree. The season of the flight song coincided with the season of the common song, although my records indicate that flight songs were given more frequently in late July and early August than earlier in the season. Usually more flight songs were heard in the afternoon and evening than in the morning. In nine hours of observation during which the songs of one male were recorded (see above) only 10 flight songs, or one flight song to 56 common songs, were given.

Another type of song which seemed to be more or less intermediate in character between the common song and flight song, was heard from a few adult males during the last half of July. This song was made up of a conglomeration of many unharmonious, squeaky, harsh, and melodious notes and was sung in diminished volume while the bird was perched. Several young males in first-winter plumage, were also heard singing similar songs during the first two weeks in September. Their songs were not very loud and lacked the well-balanced timing of the common song of the adult.

The vocabulary of call notes, which is shared by both sexes, is quite varied. Apparently many of these notes either have special functions or represent outward expressions of distinct "emotional states" of the bird. Probably the

most common of the call notes may be described phonetically by the sounds *stagt - stagt.* They evidently represent expressions of "suspicion" or "distrust" and sometimes of "annoyance." The sudden appearance of anything at all unusual or unnatural is likely to evoke an outburst of *stagts.* Sometimes a female when closely followed by a male will give vent to a few *stagts* as if she were annoyed with him. Often other birds of even smaller size were greeted with these notes when they approached a Yellow-throat too closely.

The harsh notes *ste-de-de-de-de-de-de-deet* are used by Yellow-throats when they appear to be communicating with each other. They are given in rapid succession and considerable effort seems to be involved in their utterance, as is evidenced by the noticeable vibration of the tail and lower part of the bird's body. Occasionally these notes are abbreviated to a mere *ste-deet.* They might be considered as being true call notes, since they are often employed by either sex in calling the mate. In spring, before the arrival of the females, these same notes were often used in verbal duels between two males in such a manner that they seemed to represent notes of challenge. Sometimes such a verbal duel would lead to actual physical combat. The use of these notes by a Yellow-throat as warning signals to its mate was also apparent since the presence of an enemy, such as man, seemed to furnish the stimulus for their delivery as if the bird were attempting to warn its mate of impending danger. The incubating female also appeared to use these notes as a warning to the male whenever he attempted to sing too close to the nest. If the male failed to heed the initial warning, the female would repeat the notes.

The alarm notes of the Yellow-throat may be represented by the sounds *steek-steek-steek* or *shtip-shtip-shtip* or *speenk-speenk-speenk.* They were uttered only when the bird was "alarmed" or "frightened," such as when the nests or young were approached too closely. The barely audible notes, *che-che-che-ca-r-r, ca-r-r, che-che-ca-r-r,* which are delivered in a slow and drawn-out fashion, might be considered to be "parental love" notes since they were often uttered by the parents while attending the young in the nest. Still another call, represented by the sounds *zee-eet, zee-eet, zee-eet,* was sometimes given by the adults when approaching fledglings with food.

Territories

The resident males, upon their arrival in spring, almost immediately began to establish their breeding territories. For one of the first arrivals, this seemed to be a rather simple procedure. The bird merely picked out a plot of ground which it deemed suitable, and then defended the plot against other males. This newly acquired "sovercignty" was proclaimed by almost continual song. For later arrivals the establishment of territories appeared to be

more complicated because much of the suitable habitat had already been claimed for territories by earlier males. As a result the late-comers often had to struggle vigorously to obtain adequate territories of their own. This often entailed a shifting of the boundaries of territories already established and sometimes resulted in a reduction in their size as well. In New York, Kendeigh (1945a:158) noted a period of territorial readjustment for second broods shortly after the first broods left the nest.

Observations of encounters between two established males along the border between their respective territories indicated that the males became extremely nervous and fidgety when they met. They moved quickly around each other, darting and alighting here and there, and at the same time displaying a peculiar flicking movement of the wings and tail. Ordinarily, while going through these antics the birds were completely silent, although on a few occasions one was heard singing a low, barely audible song. This display of rivalry apparently was usually mere "bluster and bravado" since actual physical combat was seldom noted. As a prelude to an encounter of this type the rapidly repeated challenge or warning notes were often uttered by both males when they were first approaching each other.

I seldom saw a male trespassing on another male's territory. When this happened, however, the intruder usually was soon discovered by the owner. Then the trespassing male was likely to retreat hastily with the other male darting after him and if the intruder was overtaken a short but vicious battle would ensue. In all cases observed the original owner emerged as the victor.

The territories of ten monogamous males in the Geddes Marsh study area were found to range in size from .8 to 1.8 acres (mean, 1.26±.12 acres; standard deviation, .39). The territory of the one polygamous male in the Geddes Marsh area occupied 3.4 acres—nearly twice as large as any of the others. The home ranges of the two females in this case were entirely separate from each other; the birds probably were unaware of each other's presence. This male's favorite singing perch was located near the top of a large dead tree midway between the home ranges of the two females. The male and one of his mates were color-banded in order to facilitate identification.

During most of the summer the male Yellow-throats seemed to be completely tolerant of neighboring species of birds. However, during early May, before the arrival of most of the females, the territorial instincts of the males were at a peak and as a result the birds were somewhat pugnacious, even toward other species. At this time male Yellow-throats were observed on a few occasions chasing four other species: Black-capped Chickadee (*Parus atricapillus*), Yellow Warbler, Field Sparrow, and Henslow's Sparrow. Yel-

low-throats were in turn observed being chased by Catbirds and Song Sparrows.

In only one instance did I see a male showing antagonistic actions toward a female. This took place while I was walking near a nest containing young birds. My presence caused such a commotion from the parent birds that a neighboring female was attracted to the spot. The attention of the two parents then was turned toward this new trespasser. The female parent became especially excited and soon both females were actively chasing each other back and forth through the area. The male meanwhile stood passively by, watching, and occasionally voicing his displeasure with a few characteristic *stagts*. Finally, as if losing his patience, he darted after the intruder with determination that could not be denied, forcing her to flee to her own territory.

Courtship

Courtship activities began as soon as the females arrived. Ordinarily after a few preliminary bouts between contending males along the boundary between their territories, the newly-arrived female chose her mate (or territory) with little delay, usually within a day or two. As soon as a male acquired a mate, he exercised a constant vigil over all of her activities for the next six or seven days, closely following her wherever she went. At this time the male frequently attempted to induce the female to copulate. Accompanying such attempts he was seen to exhibit the same peculiar flicking movement of the wings and tail as was seen in connection with the inter-territorial encounters between two males. In an experimental study on sex recognition in birds (Noble and Vogt, 1935:281), the male Yellow-throat was found to attack mounted male specimens and to attempt copulation with female specimens. However, when a black mask was placed on a female specimen, it was attacked, indicating that Yellow-throats recognize sex, at least in part, by color pattern.

The rivalry between two males which were attempting to court the same unmated female in a disputed area between their territories provided an amusing spectacle. The two males, when not fighting, would often chase each other around and about the ever-moving female, flying in a most peculiar manner all the while. Both would fly very slowly and jerkily with a pronounced and continual flopping (up and down motion) of the tail for short distances. The female meanwhile acted as though she were oblivious of all this fuss and attention.

During the courtship period, the males ordinarily sang very little, if at all. Several times, however, a male was observed endeavoring to sing a barely

audible song, but in each case was "sevcrely reprimanded' by the female through the medium of the harsh-sounding warning notcs. After six or seven days the courtship period ended almost as abruptly as it began, with the vigorous renewal of songs by the male.

Nests

Locating a suitable nest site as well as the actual building of the first nest takes place during the courtship period. Knight (1908:561) found that the building of the nest was performed solely by the female. Field observations in the present study, too, indicated that the female was entirely responsible for these activities. The building of two nests was closely watched, one at Arlington, Virginia, in 1940 and one at the Patuxent Research Refuge, Maryland, in 1947. In each case, only the female was observed carrying materials to the nest. During these visits the males were not observed to approach the nests nearer than about 20 feet.

The Maryland nest had been barely started when it was first discovered in the evening of May 21. By the end of the following day the body of this nest was fully formed but the lining had not been inserted; on the evening of May 23, the nest appeared to be completc, indicating a nest-building time of about two days. Surprisingly, the first egg was not laid in this nest until May 29, eight days after the start of the nest. The first egg in the Virginia nest was laid three days after the nest had bcen completed. Conclusions of Knight (1908:561) were considerably at variance with my observations since he reported that this species requires a week to ten days for nest-building.

In total, 23 nests were located in Michigan in 1938. The situations in which the nests were found varied considerably. Most of the ncsts were found on or near the ground (within thrce inches) and were supported on all sides by herbaceous plants, usually sedges and grasses of various species. Two nests were found at the base of bushes, braced on all sides by the up-growing limbs, and several were situated on top of marshy hummocks. Almost all were located in damp situations; two nests were just above water with a depth of a half inch or more. Only two nests were placed higher than three inches above the ground; the rim of thc highest one of these measured 14½ inches from the ground. This nest, built in tall weeds in late July, may have been placed higher because the undergrowth of vegetation within a foot of the ground was scanty. Nests which were placed abovc the ground were apparently supported by being merely wedged in between densc shoots and stems of vegetation as no intertwining nesting material could be found around these supporting structures.

Considerable variation was found in the shape and size of the nests, although most of them appeared to be rathcr bulky compared to the nests of

other warblers. Many were in the form of circular cups while others were found with two sides somewhat compressed. One nest bore a distinct resemblance to the nest of the Oven-bird (*Seiurus aurocapillus*). This nest was on top of a small hummock; it was rather sparsely roofed over with loosely entwined grasses and sedges in such a way as to leave an opening on one side only. Other nests of this type have been reported previously by Audubon (1831:121) and Cook (1893:118). Measurements were made of 12 nests: the outside diameter ranged from 6.8 to 10.8 centimeters (average, 8.5); the outside depth ranged from 6.0 to 12.0 centimeters (average, 8.2). The dried weight of 14 nests collected ranged from 6.7 to 16.8 grams (average, 12.1).

Most of the nests were found, upon dissection, to be composed of three layers or shells, each made up of dry plant remains. The outer shell, which usually comprised most of the bulk and about 70 per cent of the weight, was composed of matted leaves of deciduous trees and shrubs and coarse stems and leaves of many of the larger grasses, sedges, rushes, and cat-tails. The outer shell of any one nest was composed either of a mixture of all or most of these materials or was built predominantly of one type of material. The outer shells of a few nests that were constructed almost entirely of the leaves of narrow-leaved cattail (*Typha angustifolia*) were noticeably smaller and more compact than the others. The middle shell ordinarily comprised about 20 per cent of the weight of the nest and consisted of medium sized leaves and stems of grasses and sedges. One nest was examined in which the middle shell exceeded the outer shell in weight. In this case the outer shell was made up of leaves and coarse stems of weeds, sedges, and grasses while the middle shell was constructed of the matted leaves of deciduous trees and shrubs. The inner shell or lining of most nests comprised about 10 per cent of the weight and consisted of fine grasses and sedges and sometimes a few fine rootlets. Several horse-hairs were also found in the lining of one nest. In a few nests the distinct layering of different types of materials was not evident; instead, there was a gradual diminution in size of materials from the outside to the inside of the nest.

Eggs and Incubation

In the Michigan area, in 1938, the full clutch was determined for 12 nests that had not been parasitized by the Cowbird. Six of these nests contained 4 eggs, 5 contained 5 eggs, and one contained 6 eggs (average, 4.6). The number of eggs laid in first nests seemed to be greater than in succeeding ones. Six of the 12 nests were found in June and of these, one contained 4 eggs, 4 contained 5 eggs, and one contained 6 eggs (average, 5.0). The

other 6 nests were found in July and of these, 5 contained 4 eggs and one contained 5 (average, 4.2).

Records of two nests, one each in Virginia and Maryland, disclosed that after the first egg was laid, one egg was laid on each succeeding day until the full clutch was reached. The time of laying was found to be between 7:00 p.m. and 9:00 a.m. for one egg in the Virginia nest, and between 7:30 p.m. and 8:10 a.m. for one egg in the Maryland nest. The approximate incubation period in both of these nests was about 12 days, or, more specifically, between 11 days, 9½ hours and 12 days, 13½ hours for the Virginia nest and between 11 days, 3 hours and 12 days, 19¾ hours for the Maryland nest. This is in agreement with the observations of Knight (1908:561), Burns (1915:286), and Kendeigh (1945a:159) who also reported the incubation period to be 12 days.

Field observations in the present investigation substantiate the statements by Knight (1908:561) and Chapman (1907:254) that incubation is performed entirely by the female. A total of 17 hours and 50 minutes was spent in a blind recording the incubation schedule of three females in the afternoon. These birds averaged 46, 68, and 70 minutes, respectively, for each setting and 12, 17, and 18 minutes, respectively, for each period spent off the nest (Over-all average of 61 minutes for each setting and 16 minutes for each period off the nest). The longest period that a female spent on the nest at one setting was 84 minutes, and the shortest when undisturbed was 38 minutes. The longest and shortest periods spent off the nest were 26½ and 11 minutes, respectively.

Ordinarily in leaving the nest, when not disturbed, the female hopped to the rim, then to the ground and then by a series of hops made her way through the weeds and sedges for 10 feet or more before flushing. On a few occasions, however, the female flew directly from the nest. Always in approaching the nest she was observed passing through the vegetation close to the ground. Often the male would accompany her to within a few feet of the nest. Upon entering the nest the female almost invariably faced in one direction and then turned and faced in the opposite direction before settling down. While setting on the eggs the female frequently shifted her position and sometimes acted rather restless. Often she would pick at and eat ants or other small insects which were crawling on the rim of the nest or on adjacent vegetation.

Young

The young Yellow-throats normally remain in the nest for eight or nine days after hatching, usually between 196 and 216 hours. During this period they undergo rapid growth and development. The hatching weight is pre-

sumably not much less than the egg weight. Eleven eggs that were weighed were found to range from 1.45 to 1.81 grams (average, 1.66). Several young not more than a few hours old were weighed and the smallest of these weighed 1.80 grams. The weights of five nestlings and certain linear measurements of two nestlings were taken at the end of each day of nest life. The averages of these measurements are shown in Table 1.

Table 1

Growth of Nestling Yellow-throats

	Days of Nest Life							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Weight (in grams)	2.0	3.2	4.8	6.6	8.1	9.4	10.0	9.8
Total length (mm.)	31.5	35.0	42.2	50.2	58.5	63.2	66.5	70.0
Tarsus (mm.)	6.5	8.6	11.4	13.6	16.1	18.5	20.2	21.7
Culmen (mm.)	3.5	4.6	5.6	6.3	6.9	7.3	7.5	7.7
1st primary (mm.)	.4	.8	2.5	4.3	7.6	11.2	15.2	18.0

The data show that these birds actually quintupled in weight in only six days (from the first to the seventh day). The rapid growth is also indicated by the linear measurements. It is interesting to note that there was a slight loss in weight on the eighth day. Possibly this was due to a reduction in frequency of feeding on the eighth day as the nestlings approach nest-leaving.

The behavior and appearance of the nestlings changed almost as rapidly as their size. The development of the juvenal plumage has been described in a previous report (Stewart, 1952). At the end of the first day the nestlings were truly helpless. Their eyes were closed and they sprawled on their bellies. They did open their mouths in response to sound or touch and occasionally they uttered barely audible *seeps*. At this time the legs and toes were light flesh color with lemon-yellow claws, the bill was light tan with a nearly black egg tooth, the edges of the mouth were cream-colored, and the inside of the mouth was bright peach. By the third day the nestlings were able partly to support themselves on their tarsi. The eyes were opened on the fifth day, the claws were becoming flesh-colored, and the young birds were able to crawl a little by using their legs and wings. On the sixth day they could support themselves readily on their tarsi, and on the seventh they could perch on the rim of the nest. By the eighth day the young were calling *chac-chac-chac*—perhaps these are hunger notes. At this time they were apt to leave the nest upon the slightest provocation. This agreed with the findings of Shaver (1918), who observed that the young left the nest on the eighth day.

Both sexes fed the young. Often only one insect would be brought to the nest at a time, especially if it was large, while at other times the bill of the adult would be crammed with small insects. Occasionally, the adults would

experience difficulty in feeding large insects to the young; in these cases the insects would have to be broken up or partly masticated before the young birds could swallow them. Twice a female was observed attempting to feed large katydids (Tettigoniidae) to the young. She was not successful and finally ate them herself. In an intensive study of one nest, Shaver (1918) found that during the first few days of feeding, the male fed the young much more than the female. This was explained by the fact that the duties of the female in brooding kept her close to the nest during this period. Often food was brought to the nest by the male and delivered to the female who, in turn, apportioned it among the young.

After feeding the young, the adult carefully inspected the nest for droppings. The excreta were either eaten by the parent or carried several yards away and then dropped. They were more commonly eaten during the first few days of nest life and more commonly carried away during the last few days. Shaver (1918) found that the act of feeding furnished the stimulus for the evacuation of excreta which usually occurred shortly after the food was swallowed.

The schedule of feeding was studied at three nests. One nest, containing three eggs and one young, not more than a few hours old, was watched for 2 hours and 32 minutes. During this interval the female fed the young bird seven times (one feeding per 22 minutes). Another nest containing four young about two days old was watched for 3 hours and 53 minutes. These young were fed 17 times during this period (one feeding per 14 minutes). Both the male and female actively participated, the male feeding nine times and the female, eight times; usually two young were fed at each feeding. The third nest containing two young which were about six days old was watched on two consecutive days for a total of 2 hours and 23 minutes. A drop nest trap had been placed over this nest and as a consequence the male did not approach close enough to feed the young. The female did not seem to mind the trap and went directly to the nest without hesitation. During this period she fed the young 26 times (one feeding per 5½ minutes). The data from the last two nests would indicate that the rate of feeding increases with the age of the nestlings through the first seven days of nest-life.

After the young have reached the age of two days, the female apparently does little or no brooding during the daylight hours, although it is probable that this activity is greatly influenced by weather conditions. At the nest containing three eggs and one young not more than a few hours old (see above), the female averaged 17 minutes for each period of brooding and 8 minutes for each period spent off of the nest. On several occasions on hot, sunny days, a female was observed standing on the rim of her nest with wings outspread as if she were attempting to shield the young birds from the

sun. Usually while doing this she would hold her bill open and pant as though suffering from the heat. After dark, the female has been observed to brood the young every night except the last (Shaver, 1918).

Adults were observed to take care of the young for at least two weeks after the young leave the nest. There is some observational evidence that the adult male sometimes assumes more responsibility for the care of the young after they have left the nest than does the female. Possibly, this is because the female often begins to prepare for her next nest without much delay and has little time for attending to the first brood. One interesting observation was made of a fully-grown immature bird approaching an adult female while she was caring for nestlings of her second brood. The female ignored the young bird for awhile and then called to it with a few soft low notes and gently pecked it a few times on the head, whereupon the young bird flew away. Stone (1937:838), while observing the actions of an adult male accompanying a brood of stub-tailed fledglings, noted that the adult, while actively moving about, constantly flirted its tail to one side or the other and nervously flapped its wings, so rapidly as almost to escape detection. This behavior is similar to that displayed by males during inter-territorial encounters or when courting a female.

Nesting Success

Of the 12 breeding females definitely identified in the Geddes Marsh area, 10 (83 per cent) were successful in raising young beyond the nestling stage during the summer. Each female seemingly attempted to raise two broods, but apparently few actually attained this goal. Only one of the Geddes Marsh females was known definitely to have raised two broods beyond the nestling stage.

The number of nests built and number of clutches of eggs laid by a female in a season probably depends to a large extent on the degree of success attending each attempt. In the Geddes Marsh area, three females were known to have built at least three nests each, and four females constructed at least two nests each. The shortest interval known to elapse between the destruction of one nest and attention given by the female to a new nest was somewhat less than 10 days. The interval between the start of two consecutive nests, when the first had been successful was determined in one instance and found to be aproximately 28 days. Consecutive nests built within one territory were placed without any apparent relation to each other.

The histories of 19 nests were followed to their conclusion in the Geddes Marsh area. The eggs of 11 (58 per cent) of these nests hatched, and 7 nests (37 per cent) produced fledgling Yellow-throats. In total, the 19 nests pro-

duced an average of only one fledgling Yellow-throat per nest. However, it must be remembered that most female Yellow-throats build several nests (possibly averaging about three) during the season, thus accounting for the maintenance of the population level.

The heavy parasitism by the Cowbird is an important factor in connection with the high mortality rate of the eggs and young. Of 22 nests found in Michigan in 1938 containing eggs or young, 10 (45 per cent) had been parasitized by the Cowbird. In these 10 nests the number of Cowbird eggs or young ranged from one to three (average, 1.8 per nest). In the Geddes Marsh area, nine nests had been parasitized by the Cowbird and of these only one produced a fledgling Yellow-throat. On the other hand, ten nests in the Geddes Marsh area had not been parasitized and of these six produced fledgling Yellow-throats. The average number of fledgling Yellow-throats produced per nest parasitized by the Cowbird was only .1, while the average number produced per non-parasitized nest was 1.9. The average number of Cowbirds fledged in the parasitized nests was .4 per nest.

The causes for the destruction or disappearance of many of the eggs and young were not ascertained. Several of the nest were found greatly disheveled, indicating that some predatory animal may have been responsible. Other nests were found intact and thus furnished no clue as to what the marauders might have been. Two nests had been badly smashed as if some large mammal had stepped on them. Another nest was over-run with a mass of small ants. One nest containing four young gradually became tilted to one side, eventually causing one of the nestlings to fall out.

Summary

Investigations concerning the life history of the Yellow-throat were made in southern Michigan during the spring and summer of 1938. Supplementary information was also obtained at Arlington, Virginia, in 1940 and at the Patuxent Research Refuge, Maryland, in 1947.

Resident males established territories almost immediately upon arrival in spring. In southern Michigan some resident males arrived at least as soon as, if not before, transient males. Most females appeared on their nesting ground about a week later. Adults were engaged in nesting activities from the time of their arrival in spring until the advent of the post-nuptial molt in late summer.

Typical Yellow-throat habitat consists of a mixture of a dense herbaceous vegetation and small woody plants in damp or wet situations.

At Ann Arbor, the Yellow-throat was a common breeding species in its restricted suitable habitat. The population density in one area of suitable habitat was about 69 territorial males per 100 acres. Of 11 territorial males

that were intensively studied, one was polygamous (with two mates), nine were monogamous, and one was probably monogamous (with at least one mate).

The song of the individual Yellow-throat was heard throughout the breeding season except for the courtship period. Two major types of song were the common song given while perched, and an occasional, more elaborate, flight song. Most males sing in spurts, singing at fairly regular intervals for a considerable period and then abruptly ceasing for another period. The vocabulary of both sexes included several types of call notes that appeared either to have special functions or to represent outward expressions of distinct emotional states of the bird.

Resident males were antagonistic toward each other throughout the breeding season. Most remained on well-established territories during this period. Territories of 10 monogamous males ranged in size from .8 to 1.8 acres but the territory of one polygamous male occupied 3.4 acres. The behavior of males during inter-territorial encounters was similar in some respects to their behavior when courting females.

While courting females, the males are very attentive and seldom sing for about one week. During the courtship period the female locates the nesting site and builds the nest without assistance from the male.

Nests, constructed of dried plant materials, were situated on or near the ground and were supported on all sides by stems of herbaceous plants or limbs of shrubs. Many nests were composed of three layers with the coarser materials being used in the outer layer.

The full clutch of eggs in 12 nests ranged from 4 to 6 (average, 4.6). Early clutches seem to be larger than later ones. After the first egg is laid, one is laid on each succeeding day until the clutch is complete. Incubation period is about 12 days. Incubation is only by the female. Records of daytime incubation schedules of three females about half way through incubation indicate that the periods spent on and off the nests average about 61 and 16 minutes, respectively.

Young Yellow-throats usually remain in the nest for eight or nine days. During this period they grow and develop rapidly. Their weight quintuples in six days. Both sexes are active in feeding the young and in removing excreta from the nest. Records of feeding at three nests showed a range of one feeding per 5½ minutes to one feeding per 22 minutes, the rate increasing with age of young. Adults care for the young for at least two weeks after the young leave the nest.

Ten of 12 females that were intensively studied were successful in raising young beyond the nestling stage. Only one of these raised two broods, although three females built at least three nests each. In 19 nests, 11 (58 per

cent) produced nestlings and 7 (37 per cent) produced fledglings. In total, the 19 nests produced an average of one fledgling Yellow-throat per nest. Of 22 nests that were found near Ann Arbor, 10 (45 per cent) had been parasitized by Cowbirds. Nine of the ten parasitized nests produced an average of .1 fledgling Yellow-throat per nest, and ten nests that had not been parasitized produced an average of 1.9 Yellow-throats per nest.

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Patuxent Research Refuge, U. S. Fish and Wildlife Service, Laurel, Maryland, June 20, 1952

GENERAL NOTES

A Michigan record of the Black Rail.—On 12 September, 1951, I collected a Black Rail (*Laterallus jamaicensis pygmaeus*) at Portage Lake, Section 31, Waterloo Township, Jackson County, Michigan. The bird flushed from tall grass and sedge at a distance of about seven feet. The ground surface was dry and about 18 inches above the level of the nearby Portage River. The specimen (Museum of Zoology No. 119,882) was an immature female with the ovary measuring 8 × 3 mm. and the skull incompletely ossified. The bird, weighing 36.33 grams, was very fat. The colors of the soft parts were: feet, dull purplish-black; bill, black; iris, pale ochre-brown. This is the Black Rail referred to in the *Jack-Pine Warbler* (30, 1952:9); it is the first specimen of the Black Rail taken in Michigan.—Robert S. Butsch, *University Museums, University of Michigan, Ann Arbor, October 20, 1952.*

Great Blue Heron feeding on a muskrat.—On August 11, 1952, I observed a Great Blue Heron (*Ardea herodias*) that was standing in a small pothole between the village of Baltic and Portage Lake, in Houghton County, Michigan (section 24, T 54N, R 34W). In its mandibles the heron was holding a full grown muskrat (*Ondatra zibethicus*) by the head. From the soggy appearance of the fur, I judged the muskrat had been dead for some time. The heron dropped and picked up the muskrat several times before leaving it near the edge of the pond and flying away. During this time I was sitting in my car in plain sight of the heron which was obviously disturbed by my presence. Cursory examination of the literature does not reveal any record of a Great Blue Heron feeding or attempting to feed on a muskrat although it has been noted feeding on pocket gophers.—Arthur Ward Peterson, *Game Division, Department of Conservation, Lansing, Michigan, September 17, 1952.*

Unusual behavior of an Osprey.—On October 4, 1952, A. C. Berkowitz and I were attracted by a large whitish bird soaring over a field and occasionally hovering in the manner of the American Rough-legged Hawk, *Buteo lagopus.* We immediately recognized the bird as an Osprey, *Pandion haliaetus.* While we were watching this performance a Marsh Hawk, *Circus cyaneus*, arrived and seemingly tried to drive the Osprey away.

The Osprey flew to a tree in the same field and perched on a bare limb, affording us the opportunity of examining it through a 20 × telescope at a range of 150 yards. After a few minutes in the tree, the bird again took to the air, coursing back and forth, occasionally hovering, and two or three times dropping to the ground or within inches of it. No prey was seized, apparently. The bird finally alighted on the ground and was there when we left.

The field in question is about one-half mile from the Raccoon River and one and one-half miles from the Des Moines Waterworks Impounding Reservoir near Des Moines, Iowa. Ospreys are often observed fishing in the reservoir. Most writers state that the food of Ospreys is exclusively fish, a few mention water snakes and salamanders, and one or two cite instances of poultry being taken, but I am unable to find anything in the literature to indicate that Ospreys have been previously seen hunting in the manner observed by us.—Woodward H. Brown, *4815 Ingersoll Avenue, Des Moines, Iowa, October 9, 1952.*

Wood Pewee builds with green leaves.—In May, 1951, at Nashville, Tennessee, I observed a Wood Pewee (*Contopus virens*) building a nest on a horizontal fork of a hackberry tree at a point about 25 feet from the ground and 12 feet from the trunk. The nest was level with, and about 15 feet away from, a second story window of a house so that details could easily be observed through binoculars.

At 4:30 a.m., May 19, 1951, I began careful observation. The builder, presumably the female since the mate sang at intervals nearby, brought materials at the rate of three or four trips a quarter-hour. She worked from a sitting position inside the partially constructed nest for one-half to one minute at a time. Soon she made a short flight to an elm, returned immediately and deposited a *green* leaf on the outside top rim of the nest. The leaf adhered fairly securely and during subsequent visits to the nest the bird worked her bill and chin over the leaf, shaping it to the contour of the nest. The green color of the fresh leaf was distinct against the gray of the nest. The bird continued to build but did not bring more green leaves. During the latter part of the observation period she shaped fine, branched straws into the inside of the shallow, cup-like structure.

At 6:50 a.m., a Blue Jay (*Cyanocitta cristata*) appeared at the nest, looked it over inside and out, then began to peck and pull the nest apart. The material held together as if caught in an elastic matrix, but the jay pulled until the nest was dislodged from its foundation. The adherent materials, attached at only one point to the limb, hung from it like a bedraggled streamer.

By late afternoon the nest had fallen to the ground. I was surprised to find a chief portion of the body of the nest composed of *green* leaves. All the materials clung together shapelessly but general relationships were recognizable. The lining was incomplete; the outside covering appeared to be started only at the base; the central lamination or body of the nest seemed to be essentially complete. Upon separation six types of materials appeared: (1) fine branched seed plumes of grass; (2) coarser weed straws; (3) small strips of shredded bark and one or two small pieces of hard bark; (4) bits of lichen; (5) green leaves; and (6) web silk. The straws, bark, and lichen could be separated from the web but the green leaves and the silk were inseparable and established a felt-like consistency within the wall of the nest. The seed plumes were probably all from blue grass. They formed the incomplete lining. The few coarser stems outlined the foundation. The lichen was fixed on the outside, largely at the base where the nest was attached to the limb. Most of the green leaves were those of elm. Other green material included two complete leaves of white clover, two grass blades, a grass stem, and one or two leaves—probably hackberry. Green leaves comprised about a third of the material of the uncompleted nest. The fine downy-pubescense of the elm leaves seemed to afford a particularly good surface for the adherence of the spider web.

The only other observation I have made on the inclusion of green leaves in nest material by a Wood Pewee was exactly a year earlier. I saw a pewee carry a green leaf to a 1950 nest located about 20 feet from the 1951 nest. Only one deposition of a green leaf was observed, but detailed observations were not made. The green faded and was covered over as building continued.

Bent (1942. *U. S. Natl. Mus. Bull.*, 179:269) quotes Bendire's description of "a single well-preserved apple leaf" lying "perfectly flat and exactly in the center and bottom" of a well preserved Wood Pewee's nest. No mention of green leaves or other dried leaves is made. Of other flycatchers, Bent (*op. cit.*: 72, 138, 255–256, 262, 305) cites five which use dried leaves as building material.

Among species which commonly use green leaves in their nests are the Mississippi Kite (*Ictinia misisippiensis*), Red-tailed (*Buteo jamaicensis*), Red-shouldered (*Buteo*

lineatus), Swainson's (*Buteo swainsoni*), and Broad-winged (*Buteo platypterus*) hawks, the Purple Martin (*Progne subis*), and the Starling (*Sturnus vulgaris*). The hawks (Bent, 1937. *U. S. Natl. Mus. Bull.*, 167:65, 151, 185–186, 223, 240) variously use green leaves as lining material, around the rim, or in the nest with the young. Purple Martins (Allen and Nice, 1952. *Amer. Midl. Nat.*, 47:622) often line a nest with green leaves and may continue depositing green leaves during egg-laying and incubation. Starlings (Kalmbach and Gabrielson, 1921. *U. S. Dept. Agri. Bull.*, 868:10; Laskey, personal communication) may use green leaves dispersed throughout the nest or as lining, or they may deposit them in a nest cavity before the nest is begun.—Katherine A. Goodpasture, *408 Fairfax Avenue, Nashville, Tennessee, January 13, 1952.*

Notes on some songs of a Pine-woods Sparrow.—In April, 1950, in southwestern Georgia, we recorded on magnetic sound tape the recital of a Pine-woods Sparrow (*Aimophila aestivalis*) who displayed considerable variety in his songs. The bird occupied a portion of a three-acre tung grove which was surrounded mainly by pine forest. He appeared to have several singing stations; one was in a tung tree near the edge of the grove, and there we placed our microphone while we sat by the recorder, some 300 feet away. The bird's activities were as variable as his songs; he did not consistently use the same twig in our tree as a song-perch. Sometimes he sang only three or four times before flitting away; sometimes he sang a dozen or more times. Each song lasted about 2½ seconds, with about 12 seconds' pause between songs. We recorded on several successive mornings, between 6:30 and 8 a.m. for a total of about 15 minutes' singing time, although much of the recording was marred in various ways.

In general structure, the songs usually consisted of a single long note, followed by five to nine notes uttered rapidly—almost a trill, the two parts of the songs being about equal in length. Rarely, the long opening note was omitted entirely. Our bird displayed surprising ability to produce different "song types" or "song patterns" each of which, however, mantained the major characteristics of the "family theme"; that is, every song could be recognized easily as belonging to a Pine-woods Sparrow. Although variations in the structure of the song were noted, his principal changes in the species song pattern were in the pitch of the two parts of the songs. The opening note sometimes was higher in pitch, occasionally of the same pitch, and sometimes of lower pitch than the second part. Sometimes the pitch of one portion of the song would differ but slightly from the pitch of the same portion of a preceding song. Usually the pitch of the opening note remained uniform; more rarely, the pitch of the opening note would change slightly; occasionally, this type of pitch change was displayed also in the second part of the song. The major changes in the structure of the songs usually occurred in the second part of the song, these including variations in the number of notes and their tempo; there was occasionally an apparent slurring or gliding in pitch, giving the impression of double notes.

In the great majority of our recordings, this bird repeated each song pattern twice before changing to another pattern. Occasionally he gave a song pattern only once, then changed to another pattern; more rarely, he gave a song pattern three times before changing to another pattern.

In clarity and sweetness, the recital was similar to that of the Field Sparrow (*Spizella pusilla*); however, the individual Field Sparrow usually confines himself to just one particular variation of his family "song pattern," whereas this Pine-woods Sparrow, in comparison, seemed capable of producing an almost endless variety of patterns.—Jerry and Norma Stillwell, *R.F.D. 2, Fayetteville, Arkansas, August 2, 1952.*

Black Vulture breeding in Pennsylvania.—Black Vultures, *Coragyps atratus*, have been seen occasionally in various parts of Pennsylvania for many years. Warren (1888. "Report on the birds of Pennsylvania," Harrisburg, p. 237) listed the species as a rare straggler in the state. Beck (1924. "A chapter on the ornithology of Lancaster County, Pennsylvania," New York, p. 18) reported sight records in Lancaster County and listed this vulture as a "summer visitant." Townsend (*in* Bent, 1937. *U. S. Natl. Mus. Bull.*, 167:43–44) cited numerous records of the species farther north, and Hope (1949. *Auk*, 66:81–82) reported the first Black Vulture collected in Ontario. There are, however, no published breeding records for Pennsylvania.

Since the fall of 1949, I have observed from time to time as many as 12 Black Vultures among a large flock of Turkey Vultures, *Cathartes aura*, which roost at Big Round Top on the Gettysburg National Military Park, Gettysburg, Adams County, Pennsylvania. Most sightings have been in late fall, winter, and early spring. Few Black Vultures have been seen later than March 25. At approximately that date the vulture population at the Big Round Top roost is noticeably reduced and I assume that the birds, at least some of them, spend their nights at or near their breeding territories. The summer disappearance of the Black Vultures at the roost and the rare observations at scattered points about Adams County, led me to suspect that the species had become a permanent and breeding resident of this area.

Accordingly, I attempted to find a nest of a Black Vulture. In the spring of 1951 the search was unsuccessful. On April 20, 1952, I flushed a Black Vulture from a small cave on a rocky mound approximately six miles south-southwest of Gettysburg. There was a small depression in some dried leaves in the cave but no other evidence of nesting. I returned on April 22 and again flushed the vulture from the cave. This time the depression contained one egg.

Four weeks later the nest was again empty. Fox scats were abundant in the vicinity and the vulture egg may have fallen prey to foxes.

Stewart and Robbins (1947. *Auk*, 64:268) list a nest found near Bowie, Maryland, as "probably near the northern limit of the breeding range of the species." The nest near Gettysburg, Pennsylvania, would extend the known breeding range of the Black Vulture some 60 miles farther north and establishes a first breeding record for the state.—G. E. Grube, *Biology Department, Gettysburg College, Gettysburg, Penn., August 23, 1952.*

An extended incubation period of the Ruffed Grouse.—On June 6, 1952, at the Cusino Experimental Deer Enclosure at Shingleton, Michigan, a Ruffed Grouse (*Bonasa umbellus*) was flushed from a nest containing eleven eggs. The following day a foot-high fence of half-inch poultry screen was placed to enclose an area 20 feet in diameter around the nest in order to detain the chicks after hatching. The nest was inspected daily previous to the supposed hatching period, twice daily during the possible hatching period, and once daily thereafter. On June 23 and June 27, the bird was not observed on the nest, but the eggs were still warm. On July 20, one Ruffed Grouse was flushed from within the enclosure and another was flushed from the nest. On some occasions the hen was flushed from the nest so that the eggs could be examined, but usually the bird was not molested. On August 14, the grouse was not observed on the nest, and the eggs were cold. The eggs remained cold on the two following days. If we assume June 6 as the beginning of incubation (no eggs were laid after that date) and August 14 as the last date of active incubation, they incubated for 70 days. Normal incubation is about 24 days. The eggs were examined and found to be infertile.—Tony J. Peterle, *Cusino Wildlife Experiment Station, Michigan Department of Conservation, Shingleton, Michigan, August 26, 1952.*

EDITORIAL

Dr. Arthur A. Allen will retire from his position as Professor of Ornithology at Cornell University in late August. In 45 years on the Cornell faculty Dr. Allen has worked with more than 10,000 students. His influence on these students, though difficult to measure, constitutes a great contribution to ornithology. Dr. Allen is widely known for his several books, technical papers, bird photographs, and sound recordings. Although retiring from formal teaching, Dr. Allen will continue his other ornithological pursuits.

Dr. Ernest Mayr, Curator of the Whitney-Rothschild Collection, American Museum of Natural History, has been appointed Alexander Agassiz Professor of Zoology in the Museum of Comparative Zoology, Harvard University. Mr. James C. Greenway, Jr., has been appointed Curator of Birds in the Museum, succeeding the late James L. Peters, and Mr. Raymond A. Paynter, Jr., has been appointed Assistant Curator of Birds.

Dr. Ira N. Gabrielson, president of the Wildlife Management Institute and former Director of the U. S. Fish and Wildlife Service, recently became the third recipient of the Aldo Leopold Memorial Award, conservation's highest honor, for his accomplishments in wildlife administration and in prevention of exploitation of our natural resources.

Volume 88, covering the literature of 1951, of the Aves section of the *Zoological Record* was published in April and is now available from the Secretary, Zoological Society of London, Regent's Park, London, N. W. 1 (price 7s. 6d. plus 4d. postage). Lt.-Col. W. P. C. Tenison, compiler of the Aves section, deserves the gratitude of all ornithologists for performing this essential service so capably. Again we urge Wilson Club members to support the Zoological Society through purchase of the Aves section of the *Zoological Record*.

THE WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been recently received. From:

Holly Reed Bennett—8 books, 23 magazines, 32 pamphlets
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Jason A. Walker—2 books
Lawrence H. Walkinshaw—1 book
George J. Wallace—1 book
Merrill Wood—1 reprint

ORNITHOLOGICAL LITERATURE

NATURAL COMMUNITIES. By Lee R. Dice. University of Michigan Press, Ann Arbor, 1952:6½×10 in., xii+547 pp., 52 figs. $5.50.

Ecology has been defined as the science of communities and Dice's new book on natural communities does indeed cover the field of ecology. The author may be credited with rendering a great service. The book is eminently suitable as a text for an ecology class of university level, filling a need that has long existed, and it is an indispensable reference for anyone interested in ecology. The 23 chapters include: community ecology; some important kinds of communities; methods of describing and measuring communities; methods for the estimation of populations; physical factors of habitats that affect communities; effects on communities of fluctuations in the physical conditions of their habitats; food relations within communities; fluctuations in populations; fluctuations in community composition; relations of organisms to their ecosystems; home ranges and territories; effects of social behavior on the community; ecologic relations between species; community equilibrium; effects of communities on their physical habitats; ecologic succession; local and geographic variation within communities; relations between communities; classification of associations and microassociations; larger units of community classification; communities of the past; evolution of communities; philosophy of communities.

An impressive amount of material has been digested, organized and concisely set forth in thoroughly readable and understandable language. Unlike some of his forerunners and contemporaries, the author does not find it necessary to coin new terms in profusion, nor does he use many of the technical ecological terms that have been proposed by previous authors. He has the faculty of presenting ecological concepts simply and clearly in everyday language that should be understandable to the average biology student. Those technical terms that are unavoidable are defined and illustrated with appropriate examples.

Various terms are used with meanings or connotations slightly different from those that have been customarily associated with them in earlier works. One term which is used frequently throughout the book is the "stand." In the past, as the author states, this term has been applied mostly to examples of various kinds of forests, but he uses it here in a broader sense. "A stand may be defined as a local example of an association composed of those individual plants and animals that live together in a particular situation (Braun-Blanquet, Fuller, and Conard, 1932:23)." "Each stand is an actual concrete community which exists at a given time and covers a particular area." It is stated to be the most important unit of ecologic classification, but applies "only to a community of considerable importance that covers an appreciable area. A grove of trees together with its associated plants and animals, for example, is a stand. On the contrary, a single tree or clump of plants is not usually called a stand. A "microstand" is defined as a minor concrete community, such as the assemblage of plants and animals that live in and upon a decaying log. On page 392, in discussing mixed stands, the author mentions both Douglas spruce and Douglas fir. It will not be apparent to readers unfamiliar with the species that these are one and the same.

Symbiosis, used in an especially broad sense, is defined as the living together of individual organisms of dissimilar species. "Most of the plants and animals of a given stand, for example, live in disjunctive symbiosis with one another." Two main types of symbiosis are: conjunctive, involving close bodily contact between the two symbiotic

organisms; and disjunctive, in which the associated organisms are free-living. The term includes both parasitism and mutually beneficial symbiosis. The term commensalism is not mentioned in this discussion of symbiosis, although the word commensal does appear just once, on the final page (320) of this chapter, "Ecologic Relations between Species."

In Chapter 20, "Larger Units of Community Classification," four separate systems are each briefly discussed: (1) Community Type, (2) Life Zone, (3) Biome, and (4) Biotic Province. Quite understandably the author devotes more space to the system of biotic provinces, developed by himself, than to the other three combined. Even so, the treatment is cursory and nothing new is added to the material already presented in the author's "The Biotic Provinces of North America" published in 1943. It seems regrettable that the biotic provinces, potentially useful in study of animal distribution and ecology, have not been further described or classified in the last ten years as the original attempt was admittedly a tentative outline based on incomplete information. Throughout the present book the author refers to geographic areas by the names of their respective biotic provinces, the Hudsonian, Californian, Chihuahuan, etc. A map of the 28 biotic provinces of North America is reproduced from the author's earlier book on this subject. On page 447 it is stated: "The Chihuahuan biotic province in southeastern Arizona, for example, is divided into the Santa Catalina, Chiricahua, Huachuca, and Santa Rita biotic districts (Dice and Blossom, 1937)." However, this statement is not in agreement with the map on page 444 which shows the Chihuahuan entering the United States only in western Texas and southern New Mexico, with its western boundary considerably to the east of the Arizona border; the area in question would fall entirely within the Apachian biotic province.

In comparing the usefulness of the several systems Dice states, "Biomes and biotic provinces are not necessarily to be considered as mutually exclusive and competing systems of ecologic classification, but rather as more or less supplementary to each other." However, he regards life zones as of little value for the classification of communities, and states that the community-type system is of value for description only, not classification.

In the preface, the author states that no attempt is made to supply a complete bibliography of community ecology and this statement is reiterated at the beginning of the "Literature Cited" section. Nevertheless, more than 1100 titles are included, and they cover the field thoroughly. The latest publications included are those of 1949. Relatively recent publications, of the past ten years, make up a susbstantial proportion of the total, reflecting the rapid recent progress in development of ecology. A small proportion of important early works, from the nineteenth century and the early part of the present century, are also included. The works of British and European authors are prominent in the bibliography. Especially noteworthy is the inclusion of a large number of titles by Russian authors, and the content of these papers is often mentioned in the text, providing insight as to the extent and trends of ecological research in Russia.

Of the more than 1100 papers cited, over 200 are concerned primarily with birds, and a somewhat larger number deal primarily with mammals. Although the author has been mainly concerned with mammals and birds in his earlier publications he is not preoccupied with these groups to the extent of neglecting smaller and less conspicuous animals that may be equally important elements of natural communities. Insects and other invertebrates figure prominently among the animals mentioned in discussing various phases of community ecology. Chapter 11 on "Home Ranges and Territories" may be of particular interest to the ornithologist, since much of it is concerned with birds, the most typically territorial animals. Representatives of many other groups are, however,

duly discussed in this connection. The distinction between territories, which are defended, and home ranges, which are not defended, is emphasized, and the many different types of territories are described and illustrated in an excellent short summary of this subject.

On the average there are several citations to the literature on each page of the text, but the author rarely uses direct quotations; he has extracted the essential material from pertinent literature and integrated it into the text in his own wording to attain greater continuity, smoothness, and clarity. At the end of each chapter is a short list of, usually, three to ten "selected references."

The illustrations are not numerous (52 in all). Figure 2, showing "A simple ecologic community composed of a single rabbit sitting under a single blackberry bush," perhaps might have been dispensed with. On the whole the illustrations are well chosen to emphasize or amplify with diagrammatic simplicity some of the more important concepts discussed in the text. Most of the illustrations are reproduced from other publications, but a number are from originals by C. W. Angell, including several pencil sketches of communities in the arid southwestern United States.—Henry S. Fitch.

Stalking Birds with Color Camera. By Arthur A. Allen. Edited by Gilbert Grosvenor. National Geographic Society, Washington, D.C., 1951:7×10 in., 328 pp., 331 unnumbered, color photographs (264 by the author), 87 black and white photographs, 2 wash drawings (W. A. Weber), 3 maps. $7.50.

This beautiful collection of very well reproduced color photographs will stand as an appropriate monument to Dr. Allen's eminence in the field of bird photography. There are today many fine bird photographers, a few of them perhaps as skilled as Dr. Allen, who, however, was taking excellent pictures of birds when most present competitors were in knee-breeches, and before some were born. The author and editor have not hesitated to draw upon the work of others to illustrate the various phases of ornithology and photography touched upon in this book, but the slight degree to which this has been necessary is evidence of Dr. Allen's breadth of experience and the extensiveness of his travels.

It is difficult to single out particular photographs from this impressive array. However, some seem to demand individual mention, among them the Golden-winged Warbler (p. 58), Indigo Bunting (p. 92), Tree Sparrow (p. 110), Marsh Hawk (p. 189), Western Gulls (p. 255), Bald Eagle (p. 180), Duck Hawk (p. 192), and Woodcock (p. 232). Without wishing to revive the senseless controversy of art versus photography, this reviewer thinks that the pictures cited strongly resemble fine paintings, embodying that combined perfection of composition, subjugation and elimination of detail, beauty of tone, and grace of pose which are the objectives of photographer and painter alike, and which are inevitably more difficult for photographer than for painter to arrange and control.

Most of the photographs and text chapters of this book have been published previously in the *National Geographic*. Otherwise the cost would have been prohibitive. The frequent sub-headings of the text and the captions of the many illustrations are couched in somewhat slangy language which may ruffle the feelings of a few scientific ornithologists. It must be borne in mind, however, that the *National Geographic Magazine* has remained successful for many years by the use of these methods, and that Dr. Allen, as well, has succeeded in this way in capturing the interest of thousands of people who are not, and will never be, ornithologists. Aimed at similar audiences, this effort should do equally well.

Being largely a gathering of independent articles, the chatty, readable text covers a diverse quantity of ornithological subjects, including bird photography, use of stroboscopic

light, bird migration, behavior, senses, and bird protection, as well as narratives of some of the author's many trips to Labrador, Alaska, Mexico, and other places. Ardent students of behavior will no doubt regard some of the discussions of this subject as greatly over-simplified, yet the author is to be thanked for a readable indication. to a wide field of lay readers, that animal activity is to be judged by other than human standards.

The book is heartily recommended to all readers, whether lay or scientific, who have a real appreciation of the beauty of birds.—Robert M. Mengel.

CONTROVERSIAL CONSERVATION

A contribution from the Wilson Ornithological Club Conservation Committee

Man always has depended upon the bounties of nature for his sustenance and it is unreasonable to expect him to stop eating—and die himself—rather than take the life of some other animal. Neither can we expect man to freeze rather than destroy a tree for the purpose of making shelter for himself and his family. These facts are self-evident. Formerly, the slaying of deer and the cutting of trees was done by the individual who used these products of nature to satisfy his own wants. Today, we purchase our meat from a butcher shop and secure our lumber from a building supply store, and it is seldom that we harvest directly nature's product. For this reason the conservation of our natural resources may be only of academic consideration to a large part of the American people. Twentieth century Americans may deplore the over-grazing of western grass lands, but insist upon meat in their daily menu.

Theodore Roosevelt is often credited with placing the term "conservation" upon the lips of the American public. For the past half-century the word has been used over and over again until today almost everyone is "for" conservation just as they are "agin" sin. The theological term "sin" has many meanings to different individuals and it appears that the term "conservation" may have as many definitions.

Those of us in the conservation field probably differ as much in our interpretation of the term as does the general public. Most naturalists agree with Thoreau that "Every creature is better alive than dead, men and moose and pine-trees, and he who understands it aright will rather preserve its life than destroy it." It is equally true, however, that most professional naturalists would consider themselves remiss if they did not personally destroy a mortally wounded or sick animal rather than let it die a painful and lingering death. How can a conservationist kill and protect at the same time? Can a hunter and a bird watcher both be called "conservationists"? How can we reconcile the different approaches of the National Park Service, where no life—neither plant nor animal—may be taken and the U. S. Forest Service where the cutting of timber is a standard management practice and the harvesting of the surplus game is considered logical? Again, why does the Fish and Wildlife Service purchase and develop wildlife refuges where waterfowl are encouraged to nest and rear their young without hindrance and, within the same agency, promulgate and enforce regulations for the hunting of ducks and geese? State wildlife agencies devote a majority of their attention to the removal of wild game by sportsmen during the fall and, at the same time, prosecute anyone who kills wild animals at other seasons of the year. All of these agencies consider themselves conservation organizations dedicated to the preservation of our various natural resources. Most individuals would agree that such divergent activities of these organizations actually are dedicated to the conservation of our natural resources only if they have an acceptable and mutually agreeable understanding of

the meaning of conservation. According to the dictionary, conserve means "to maintain in continued being" and conservation, as we use it, includes "a preserving, guarding, or protecting; a keeping in a safe and entire state; preservation." There are those of us who would like to add to these definitions "use without abuse and/or destruction."

The forester holds that his axe is the best tool for the conservation of the forest; we would agree with him if we accept the fact that the cutting of the timber is the only way we can devote the trees to human use and still "maintain them in continued being." True, ecological succession would gradually replace the same species of trees over a long period of time if the old monarchs of the forest were permitted to rot, fall, and decay. The forester bases his conservation activities on the premise that it is better to cut and utilize mature trees rather than to let them be wasted by rotting. He maintains that he is preserving by utilization; that he is conserving and guarding his forest by means of his axe.

Many naturalists think that any form of hunting is destructive and therefore does not fall in the category of conservation by any stretch of the imagination. On the other hand, most state and federal wildlife agencies take the opposite view. They hold that the gun is a tool that will permit the removal and use of surplus game and that they can best guard and preserve our wildlife resources by such judicious utilization. Our federal and state parks, on the other hand, permit neither gun nor axe to be used except under extremely unusual circumstances. Are they both right?

Within the natural sciences, it seems that we must accept the fact that man by his activities has changed the face of this earth and that we must accept him, his desires, his needs and his demands in our conservation activities. Bird protection—especially of our songbirds—should include the complete prohibition of the taking by man of any species which is or will be endangered by such removal. This is the only way to conserve certain species. On the other hand, many of our game birds have been harvested annually without detriment to the species. Would it be true conservation to prohibit the taking of all birds because such regulations are necessary to preserve certain species? Would it be medically sound to remove the appendix of every person—man, woman, and child—because it has been established that appendectomies have saved the lives of scores of persons? The logic is identical and the answer obvious.

Most of our parks today are having great difficulty in "preserving and guarding" their natural resources due to excessive human use of these areas (*cf.* Gunn and Mosby, 1952. *Wilson Bull.*, 64:57–60). State and national parks were established, primarily, so that man could see and enjoy nature; but man, by his excessive numbers, is often destroying the beauty which the park officials are endeavoring to preserve for him. Protection of the deer in many states has resulted in heavy destruction of the fodder vegetation and the starvation of thousands of animals. Both of these situations employ the complete protection of nature from direct utilization by man. In both instances the objective is to conserve the natural resources.

We must be logical and reasonable in our definition and in our practice of conservation. We must establish a more workable understanding between the various factions in the conservation field. There are many types of sin and it is possible that there are many types of conservation. It is possible for us to sin in our fight against evil; it is possible that we may destroy a natural resource in our efforts to conserve it. It has been stated that conservation is a point of view, not an assemblage of facts. Perhaps those of us interested in conservation will have to broaden our point of view to assure that we do not destroy in our over-zealous efforts to conserve; that we do not abuse by use; that we perpetuate while we utilize.—Henry S. Mosby and W. W. H. Gunn.

NEW LIFE MEMBERS

Don Bleitz was born in Los Angeles, California, October 1, 1915. Although he received his academic degree in engineering, his interest in natural history made itself apparent early in his life. Beginning with collecting butterflies, he soon shifted to bird study and especially bird photography. His exceptional photographs have appeared in many national publications. A growing collection of photographs of western birds and field notes led him to conceive the idea of producing a book on the birds of western United States, in which a very large number of his color photographs would be included. He and his wife, who shares his interest in birds, have been engaged in the preparation of the book for two years.

Don designs and manufactures much of his photographic equipment which includes special long-focus lenses and completely radio-operated cameras. In business life he operates a photographic manufacturing firm and pharmaceutical manufacturing businesses.

Tracy I. Storer was born in San Francisco in 1889 and lived in the Bay Region through graduation from the University of California in 1912 and as a staff member of the Museum of Vertebrate Zoology until 1923. While at the Berkeley campus he taught various courses, including ornithology and vertebrate natural history, and was co-author of "The Game Birds of California" and "Animal Life in the Yosemite." Subsequent to 1923 he has been on the Davis campus of the university, and until 1951, was in charge of zoology, teaching a varied program from general zoology to economic vertebrate zoology, and giving special attention to economic relations of birds and mammals. His well known text, "General Zoology," and "Laboratory Manual of General Zoology" grew out of long participation in teaching the beginning course. The study of birds has been a lifelong interest, both professional and avocational.

This number of *The Wilson Bulletin* was published on June 30, 1953.

Suggestions to Authors

Manuscripts intended for publication in *The Wilson Bulletin* should be neatly typewritten, double-spaced, and on one side only of good quality white paper. Tables should be typed on separate sheets. Before preparing these, carefully consider whether the material is best presented in tabular form. Where the value of quantitative data can be enhanced by use of appropriate statistical methods, these should be used. Follow the A. O. U. Check-List (fourth edition) and supplements thereto insofar as scientific names of United States and Canadian birds are concerned unless a satisfactory explanation is offered for doing otherwise. Use species names (binomials) unless specimens have actually been handled and subspecifically identified. Summaries of major papers should be brief but quotable. Where fewer than five papers are cited, the citations may be included in the text. All citations in "General Notes" should be included in the text. Follow carefully the style used in this issue in listing the literature cited. Photographs for illustrations should be sharp, have good contrast, and be on glossy paper. Submit prints unmounted and attach to each a brief but adequate legend. Do not write heavily on the backs of photographs. Diagrams and line drawings should be in black ink and their lettering large enough to permit reduction. The Illustrations Committee will prepare drawings, following authors' directions, at a charge of $1 an hour, the money to go into the color-plate fund. Authors are requested to return proof promptly. Extensive alterations in copy after the type has been set must be charged to the author.

A Word to Members

The Wilson Bulletin is not as large as we want it to be. It will become larger as funds for publication increase. The Club loses money, and the size of the *Bulletin* is cut down accordingly, each time a member fails to pay dues and is put on the 'suspended list.' Postage is used in notifying the publisher of this suspension. More postage is used in notifying the member and urging him to pay his dues. When he does finally pay he must be reinstated on the mailing list and there is a publisher's charge for this service. The *Bulletin* will become larger if members will make a point of paying their dues promptly.

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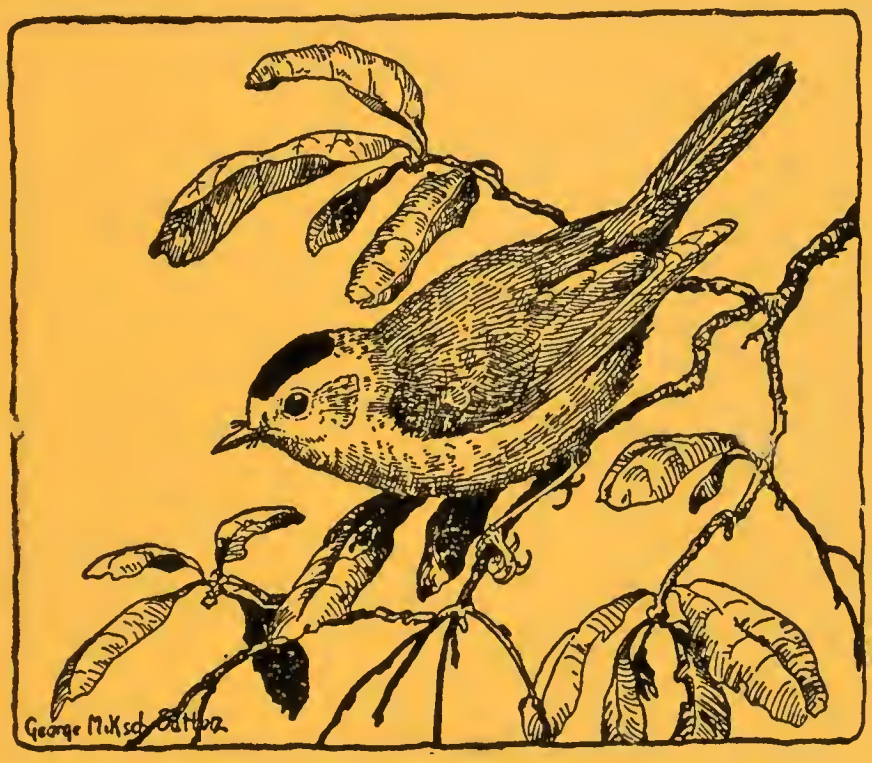

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All articles and communications for publication, books and publications for review should be addressed to the Editor. Exchanges should be addressed to The Wilson Ornithological Club Library, Museum of Zoology, Ann Arbor, Michigan.

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CONTENTS

FIG. 1. Deflective and disruptive patterns in the American Sparrow Hawk (*Falco sparverius*). The features mentioned in text have been emphasized intentionally by the illustrator.

PROTECTIVE COLORATION IN THE AMERICAN SPARROW HAWK

BY WILLIAM M. CLAY

THE adaptive features of the color pattern of the Sparrow Hawk (*Falco sparverius*) are remarkable enough to warrant discussion. Since captive individuals have commonly been available for close and prolonged observation, it is surprising that attention appears not to have been directed at least to the most notable feature, a pair of ocelli or "false eyes" on the back of the head and neck. In study skins, however, these ocelli often are obscured by increased overlap of the feathers in the straightened and somewhat shortened neck. Some well-known paintings show the ocelli and other color-pattern features described below (see Fuertes *in* Eaton, 1914, pl. 52; Brooks *in* Roberts, 1932, pl. 19, and *in* Dawson, 1923:1640).

The Sparrow Hawk plumage illustrates the principles of countershading, disruptive coloration, and deflective or parasematic coloration. Furthermore, there is the possibility, or even likelihood, that some of the markings may be useful in intraspecific or social control, as in sex recognition or in territorial defense.

Countershading (obliterative shading) is so common among birds that it merits but brief mention here. The principle was alluded to by Poulton (1890:37–38) in describing the resemblance between a butterfly (*Apatura iris*) pupa and a leaf, but the concept generally is associated with A. H. Thayer (1896a, 1896b, 1898) by whom it was more fully developed. Thayer's statement of the principle follows: "The newly-discovered law may be stated thus: Animals are painted by nature darkest on those parts which tend to be most lighted by the sky's light, and vice versa" (1896a:124 and 1898: 477). The principle is discussed further by G. H. Thayer (1909:25) and by Cott (1940:35–46). It is an optical or psychological law, that recognition of an object is hindered when the pigmentation of the more brightly illuminated (upper) surface is so intensified in relation to the shaded (lower) surface that the two appear of equal density to an observer. Thus the effect of relief is destroyed and the object appears as a single plane. When the Sparrow Hawk is observed from a moderate distance its lesser markings, such as the streaks of the lower side, are not discernible and the general effect is that described above.

The second principle, that of disruptive coloration, is also common among birds, fishes, insects, and various other animals. It is discussed by G. H. Thayer (*op. cit.*:77) under the terms "secant" and "ruptive," and by Cott (*op. cit.*:47) who used the term "disruptive." This principle, commonly employed in camouflage, is that perception of the true outline or form of an

object is hindered by the presence of conspicuous markings which, although readily visible, bear no likeness to the true shape of the object. In some instances the eye may be concealed by a prominent stripe crossing it. One of the vertical bars on the Sparrow Hawk's head is effective in this way (Fig. 1a), illustrating disruptive coloration in the violent form designated by Cott (*op. cit.*: 51) as "maximum disruptive contrast." This type of concealment of the eye is common among predatory birds and mammals (G. H. Thayer, *op. cit.*: 81).

Deflective or parasematic coloration, the third and most remarkable type displayed by the Sparrow Hawk, was described by Poulton (*op. cit.*:207–208), who used as an example a hair-streak butterfly (*Thecla*) which misrepresents its posture by false eyes and antennae at the posterior end. Cott (*op. cit.*: 372) defined deflective coloration as "characters which misdirect the attack of enemies by misrepresenting the posture of their prey," and as patterns which "produce the impression of a head at the wrong end."

The orientation of the Sparrow Hawk's head is misrepresented by markings which produce the likeness of a face on the rear of the head, or upon each side of the head, according to the position of the observer, while the true face is obscured by the disruptive bars noted above. To the rear the bird presents an owlish "face" consisting of a pair of large "eyes" or ocelli with buffy-rufous irises and black pupils, between which is a slate-colored "beak" (Fig. 1b). In the first winter plumage the feathers comprising the "iris" are more nearly white than in the adult and the "eyes" are even more realistic, a condition which may be related to the greater incompetence during the youthful and inexperienced phase of life.

Fig. 1c shows the "eyes" of each lateral face to consist of one of the false "eyes" described above and the vertical bar which runs through one true eye. The bar, curiously, looks more eye-like from a lateral position than from the front. The "beak" of the lateral face consists of another black vertical bar in the auricular region. This "face" is highly deceptive from a postero-lateral point of observation and therefore to an observer located slightly behind the bird's field of sharp vision (*vide infra*). (Cover the true beak in Allan Brooks' painting in "The Birds of Minnesota," Roberts, *loc. cit.*, or that in Fig. 1c of the present paper, for the maximum deceptive effect.)

The position of the eyes in hawks is more frontal than in most other non-strigiform birds. This lessens the total field of vision but increases the area of binocularity. In accordance with this condition, the retina of hawks has developed a second point of acute vision, a temporal fovea (Walls, 1942: 308–309, Figs. 114 and 115), which serves the binocular or anterior field, while acute vision in the monocular or antero-lateral field is obtained by the central fovea. While binocularity doubtless is advantageous, it has been ob-

tained at the sacrifice of vision in postero-lateral directions. These are clearly the axes along which the deceptive faces are presented.

Mention may be made here of the possible effect of head-bobbing, a performance which the Sparrow Hawk frequently enacts, and which would seem to counteract the effects of concealing coloration. Grinnell (1921) pointed out that stationary objects, unlike those in motion, are more readily located by an actively-moving than by a passive searcher. Calling this mechanism "the principle of rapid peering," he divided birds into two groups according to the extent of their activity when seeking food. Head-bobbing, "teetering," or other movements which alter the location of the eyes, generally help to separate planes and to improve distance judgment, as may be readily tested for both monocular and binocular vision, and it is reasonable to assume that these properties are useful to the Sparrow Hawk. While motions of the body would appear to counteract the general effects of concealing coloration, it should be noted, firstly, that deflective coloration is not essentially cryptic in function, and, secondly, that head-bobbing by the Sparrow Hawk accentuates the conspicuousness of the ocelli and enhances their resemblance to the eyes of an actively peering owl.

The role of deflective coloration in the ecology of the Sparrow Hawk must remain largely speculative until more data are obtained. The presumed function is to "mislead" an observer with respect to the true orientation of the animal. It has been shown repeatedly that birds and many other animals respond to only one or a few attributes or "sign stimuli" in some other individual, with apparent disregard of all other attributes (Tinbergen, 1948). This is indicated in the case reported by Noble (1936) of a male Flicker (*Colaptes auratus*) attacking his own mate after an artificial male-resembling "moustache" of black feathers had been glued to her head, only to accept her again after its removal. We may postulate that the false eyes of the Sparrow Hawk may induce, in some animals, the reaction for which true eyes are the usual stimulus, while the true eyes of this bird, by their concealment, may fail to evoke a response.

It is conceivable that this stimulus-response could be of benefit in capturing food and escaping attack. With respect to the former, it should be noted that the food of the Sparrow Hawk consists partly of animals of poor visual acuity. Myopic grasshoppers and small rodents probably lack the ability and the opportunity to make discriminating observations upon a plunging Sparrow Hawk! However, this sort of deception may possibly be effective in the capture of small birds.

The Sparrow Hawk has not been reported as a major item in the diet of any predator. In fact, the predatory status of this bird so limits its own abundance that for any other animal to depend heavily upon it for food would

be ecologically unsound. However, some hawks and owls do take the Sparrow Hawk at least occasionally. Bent (as cited after each species following) lists the Sparrow Hawk in the food of the Duck Hawk, *Falco peregrinus* (1938:54, 60), Red-shouldered Hawk, *Buteo lineatus* (1937:191), and Screech Owl, *Otus asio* (1938:251). Cooper's (*Accipiter cooperii*) and Sharp-shinned (*A. striatus*) hawks are reported to include "small hawks" in their food (Bent, 1937:118, 133). The Great Horned Owl (*Bubo virginianus*) probably includes Sparrow Hawks in its varied diet. Thus the Sparrow Hawk is subject to predation which, in view of its own limited numbers, may be ecologically significant.

Persecution by non-predaceous birds may also be important to this small falcon. The entire tribe of raptorial birds is subject to such harrassment and, while it may be doubted that the larger hawks and owls are seriously menaced thereby, the small Sparrow Hawk may be more vulnerable. I have watched numerous diving attacks by Robins (*Turdus migratorius*) and Blue Jays (*Cyanocitta cristata*) upon a captive Sparrow Hawk perched on a low post. Not once have I been certain that contact actually occurred, although many times the swooping bird must have missed by less than an inch. Usually the hawk turned toward the attacker and ducked at the approach. It would seem possible that in a surprise approach from the rear the instinctive behavior of the attacker would not allow actual contact with what may appear to be an owl in defensive posture.

The Sparrow Hawk is most vulnerable when it has taken another bird and is having to cope with its struggles, particularly if the victim is a nestling whose parents are aroused to fury. If the victim is large, its struggles may force the hawk to the ground in order to make the kill, which it usually does by biting the occipital region. Perhaps it is significant that in the killing and feeding posture, with bowed head, the ocelli are brought into fullest display.

The evolution of such a complex pattern of coloration by chance alone, without recourse to utility, would appear to be highly improbable. The modern genetic interpretation of evolutionary process favors the assumption that either the color pattern, or some characteristic with which it is linked, confers upon its possessors a greater ability to leave reproducing descendants. Unfortunately, it is not easy to devise experiments to test theories on coloration as an ecological factor. We do know, however, that the average or ecological longevity of animals in the wild state is much less than their potential longevity. Most wild animals die young, from starvation, disease, predation, or other causes, and many that survive leave few or no reproducing offspring. While coloration is not a direct factor in life or death, it may have a bearing upon the possessor's ability to obtain food or to escape enemies, and it may be of service in intraspecific behavior. The very multiplicity of the factors

which affect the abundance of a vertebrate species increases the likelihood that coloration is important. To paraphrase a statement by Tinbergen (1952: 5), the duty of students of coloration is to attempt to explain coloration rather than to assume that it cannot be explained.

Summary

The color pattern of the Sparrow Hawk (*Falco sparverius*) embodies principles of countershading, disruptive coloration resulting in concealment of the eye, and deflective coloration, *i. e.*, presentation of a false "face" in the rear and another in a postero-lateral position. These "misrepresentations" cover the bird's blind area, which is greater in hawks than in most birds, and conceivably are of service in deceiving prey and/or enemies.

Acknowledgment

The writer is grateful to Robert M. Mengel for the drawings accompanying this paper.

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Department of Biology, University of Louisville, Louisville, Kentucky, May 10, 1952

NOTES ON THE NESTING BEHAVIOR OF THE BLACKBURNIAN WARBLER

BY LOUISE DE KIRILINE LAWRENCE

A SUMMARY of data on the nesting behavior of the Blackburnian Warbler (*Dendroica fusca*) obtained from my field notes made during the years 1943 to the end of the breeding season in 1951, is herein presented. The data concern in particular 3 pairs domiciled in the same territory at Pimisi Bay, Ontario, 70°01′ W. long. and 46°16′ N. lat., in 1946. 1948 and 1950. This territory was occupied by the species in all 9 years, but since no banding was undertaken I do not know with certainty how many individuals were involved in maintaining the territorial tradition, or how many consecutive seasons any one bird lived there.

Three nests were found, Nest A in 1946, B in 1948, and C in 1950. At the 3 nests a total of nearly 6 hours was spent watching building and 17 hours and 40 minutes observing incubation activities. At Nest B the care of the young was watched during 10 hours and 48 minutes and, at Nest C, for 40 minutes on hatching day. In addition to these 34 hours of nest-watching, many hours more were spent observing the warblers in the course of my daily field work.

In the last 9 years the first appearance of the Blackburnian Warbler in this locality has ranged from May 5 to May 17, with a mean of May 12 and a median of May 13. In the years 1946 to 1950, the females were first seen on given territories 3, 9, 9, 11, and 23 days later than the males. But since 23 days is unusual, the median of 9 days later instead of the average 11 may be taken as a more nearly representative figure of the time of arrival of the females.

Habitat

Habitat requirements of the species in this area featured chiefly mature evergreens—white pine, *Pinus strobus*, white and black spruce, *Picea glauca* and *mariana*, hemlock, *Tsuga canadensis*, and red pine, *Pinus resinosa*, in that order of importance—with a few deciduous trees, such as aspens, *Populus* spp., and white birch, *Betula papyrifera*, scattered among them. Outside my study area, I found this species in climax stands of conifers with sparse or no undergrowth and with deciduous trees and bushes around only the edges. In none of these habitats were the Blackburnian Warblers established close together. Brooks (1947:293) found this warbler common in the Appalachian Mountains, not only in the coniferous stands, but on the dry chestnut-covered ridges. Kendeigh (1945a:427) found the bird "strictly confined to hemlock trees" on the Helderberg Plateau of New York, "even in woods where the

hemlock occurred singly or in small groups. . . ." Nice (1932:92) recorded a nest found at Pelham, Massachusetts, "among comparatively open, young growth. . . ."

Nest-Building

The building of Nest A began May 25 and continued for 6 days. B was started June 3 and completed in 4 days. Nest C, a second attempt after an earlier failure, was begun June 28 and completed in 3 days. This suggests that more time may be spent building early nests than later ones.

Only the females did the building at all 3 nests. At Nest C, on which I have the most complete notes, the male was very attentive on the first day. He accompanied the female closely, sang and displayed with spread tail and vibrating wings, but I saw no courtship-feeding. Once after the female left, he sat down on the nesting material deposited on the site and remained there when the female returned and stood over him a few seconds. On the second day, he was seen near the nest only once in the forenoon, when he pursued the female and effected coitus, but he failed to appear during the afternoon watch. During an hour in the morning on the third day, he paid no attention to the nest-building, but was heard singing nearby several times. At a nearly completed nest, watched for 82 minutes by Kendeigh (1945b:154) in New York State, the male once alighted close by but was chased by the female.

The energy with which the female worked at Nest C reached a peak before noon on the first day. During this watch of 1½ hours, she made 11 trips with material in the first half hour, 5 in the second, and 7 in the third, or 15.3 trips per hour. In the second half hour she rested for 8 minutes, sitting motionless on the collected nesting materials. There was a marked decline in activity both later in the day and later in the nest-building. During watches on the second day, the female made 12 trips per hour before noon and 4 in the afternoon; on the third day, she made only 3 trips per hour before noon. The data from the other nests are in agreement; at A only 3 trips per hour were made during a watch in the late afternoon on the first day and, at B, the same number per hour were made in the morning of the fourth day. Kendeigh's (1945b) record agrees with these—5.1 trips per hour, presumably before noon, on a day when "construction was nearing completion."

Nest C was built inside an "alcove" of branchlets and leaves on the horizontal branch of a white spruce, 26 feet 2 inches from the ground and 8 feet out from the trunk. Its bottom was not affixed to the branch but rested loosely upon it, half suspended and attached to 4 short and stiff twigs by means of spider silk. The silk was collected on the first day from the trunks of the trees and the branches of the bushes. The outside of the nest was made of fine, dry spruce twigs and two pieces of birch bark. Hovering or perching,

the female broke the twigs from the trees with her bill. For the most part lining was made of dead white pine needles picked, not from the ground, but from those that hung or stuck to the trees, and a few tendrils and fine, dead grasses. The nest appeared rather transparent when seen from below. The outside diameter was 3 inches, inside 1¾ inches; outside depth 1½ inches, inside 1⅛ inches. The other two nests were built in white pines; A, at an estimated height of 40 feet about 10 feet out from the trunk on a horizontal branch; B was tucked into the crotch of 3 small upright branches at a height of about 55 feet. Spider silk, collected on the first day, was also an important item on the list of materials in Nest A. Nest B was watched only on the fourth day of nest-building. Here the female was seen pulling long strands of horsehairs from a supply at my feeding station. Dragging them behind her up to her lofty home, she often had to stop and disengage them by pulling and twisting as twigs and leaves impeded her progress. Kendeigh (1945a:427) mentioned *Usnea* and other lichens in the nesting materials used by this warbler.

Incubation

Owing to the inaccessibility of the nest, I could not obtain data on the beginning of the egg-laying, clutch size, and the exact time when incubation started. In the case of Nest A, H. M. Halliday climbed to the top of the tree 2 days after building ceased and found one egg in it. Three days later the female was incubating. At B, the female began incubating 5 days after the completion of the nest, but at C the interval between nest-completion and the known start of incubation was 7 days. According to Chapman (1940:462), the Blackburnian Warbler normally lays 4 eggs in the clutch.

At all 3 nests the female alone incubated. In Table 1 the data on the incubation rhythm are presented. The long attentive period of 86 minutes at Nest C was caused by my presence and therefore is not representative. In calculating percentage of attentiveness at this nest, however, I felt that the length of this period would be adequately offset by the longer-than-usual time of inattentiveness.

The Blackburnian Warbler's incubation rhythm appears typical for a wood warbler on an open nest. Available data from a Magnolia Warbler, *Dendroica magnolia* (Doris Huestis Speirs, unpublished data), a Chestnut-sided Warbler, *Dendroica pensylvanica* (Lawrence, 1948), a Nashville Warbler, *Vermivora ruficapilla* (Lawrence, *op. cit.*, 207), and 2 forms of Central American redstarts, *Myioborus miniatus hellmayri* and *M. torquatus* (Skutch, 1945:240, 242), the last 3 nesting on the ground or in niches in banks, slopes, or among vegetation, are the basis for Table 2.

The Blackburnian female B showed a decline in the length of her periods off the nest as hatching day drew near, while her periods on remained almost

TABLE 1
INCUBATION OF THREE FEMALE BLACKBURNIAN WARBLERS

		Periods on Nest			*Periods off nest*			
	Day of incubation	Number periods	Average length[1]	Range[1]	Number periods	Average length[1]	Range[1]	Percentage of attentiveness
Nest A	4th	2		26, 35	2		7, 16	
	5th	5	24.6	10–31	6	8.0	5–11	73
Nest B	2nd	5	24.6	21–34	5	6.6	5– 8	
	8th	4	19.3	16–23	5	5.4	4– 9	
	10th	7	18.1	9–22	8	3.9	2– 9	
	12th	5	20.8	18–23	5	1.8	1– 3	83
Nest C	3rd	2		42, 86	3	12.0	10–14	80
Totals for A and B		28	22.0		31	5.5		77

[1] In minutes

TABLE 2
INCUBATION RHYTHM OF SIX SPECIES OF WOOD WARBLERS

	Periods on nest		*Periods off nest*		
	Average length[1]	Median length[1]	Average length[1]	Median length[1]	Percentage of Attentiveness
Blackburnian Warbler	22.0	22.0	5.5	5.0	77
Magnolia Warbler	16.9	16.0	7.4	7.0	70
Chestnut-sided Warbler	34.2	26.5	7.0	7.0	83
Nashville Warbler (tropical)	39.5	41.5	14.4	12.5	72
M. miniatus hellmayri	37.6	—	18.2	—	67.4
M. torquatus	28.9	—	9.8	—	—

[1] In minutes

unehanged. In the Chestnut-sided Warbler whieh I studied (1948), both on and off periods lengthened with the progress of ineubation.

My data are too few for definite conclusions to be drawn as to the influenee of temperature on the rhythm of ineubation. But B's high average attentive periods on the seeond and twelfth days may have been influenced by low temperatures of 50°–60° F prevailing on these days. The data might also suggest that while the periods on the nest of this bird may have been affeeted by the temperature, her periods off were not, but these varied instead aceording to the stage of incubation.

The male exereised some influenee over the length of the female's periods on and off the nest. In my presenee Male A interrupted 2 periods that were

shorter than average, one of only 10 minutes, by giving loud signal songs close to the nest site whereupon the female left and joined him. Male B caused his mate to leave the nest 8 times after incubating for periods, 6 of which were shorter than average. Two of these 6 were of only 9 and 10 minutes duration. At times this male was seen accompanying the female on her return to the nest, obviously delaying her by his mere presence—once for her longest absence, 11 minutes. On the whole, Male B was more attentive to his mate and nest than the other two males watched; on 3 occasions he was seen coming to the nest and feeding the incubating female, once on the fifth day and twice on the tenth day of incubation.

Care of Young

Unfortunately neither of the two broods that hatched were fledged. At Nest C the young disappeared at the age of 2 days. At Nest B the female was taken by a Pigeon Hawk (*Falco columbarius*) when the young were 4 days old. The next day all young were dead, presumably from lack of brooding.

Both nests were watched during hatching day. The young of Nest C hatched on July 19. This nest was watched for 40 minutes, during which time the female did not brood although the morning was rather cool. She alone fed the young 5 times, averaging once every 8 minutes. The male was already molting heavily at this time and I do not know definitely whether or not his absence was connected with his ignorance of the existence of his offspring. In the Chestnut-sided Warbler (Lawrence, 1948:210), the female also performed the feedings alone immediately after her 3 young hatched, at an average rate of once in 21 minutes. In this case the male did not know of the hatching for the entire duration of my watch so far as I could judge.

At Nest B the male was well aware of the existence of his young when I began to watch at 7:55 a.m. on June 24. During the time of observation he fed the young 5 times, while the female fed them only twice, averaging a combined rate of feeding of once in 26 minutes. The female was occupied mainly by brooding 84 per cent of the time in periods on averaging 34.5 minutes and periods off averaging 6.2 minutes. Twice while the female brooded, the male arrived with food. She hopped on the rim, allowing him to feed the young while she watched. The male carried food visibly in the bill and he fed *more than one* young at each visit. Both parents swallowed fecal sacs.

The next day, during 3 hours of observation when presumably all the young had hatched, the female brooded 79 per cent of the time in periods on averaging 14.2 minutes and periods off averaging 3.7 minutes. On this day, the young were fed an average of once in 10 minutes, both parents having increased their rates of feeding and the female her share of feeding as well, bringing it up from 29 to 36 per cent of the total feedings.

Apart from the number of young in the nest, the feeding rate of some small passerines evidently is influenced also by whether one or several young are fed by the parent at each visit, the rate being faster in the first case. For example, in the Chestnut-sided Warbler (Lawrence, 1948:210) and a Black-throated Blue Warbler, *Dendroica caerulescens* (Nice, 1930:339), only one young was fed at each visit. In the first species, the average feeding rate at the age of 3 days was once in 9 minutes and at 4 days once in 5 minutes for an average of one feeding every 7 minutes; in the second species, the rate was once in 7.5 and 6.4 minutes at the same ages, also averaging once every 7 minutes. In a Magnolia Warbler (Nice, 1926:198), more than one young was fed once in 10 visits; here the average rate at the age of 4 days was once in 8 minutes. By comparison, in my Blackburnian Warblers where more than one young were fed at each visit the average feeding rate at the ages of 1, 4, and 5 days (female B was killed on the fourth day) was once in a little over 13 minutes.

Moreover, it is known that birds which bring larger amounts of food at each visit feed their young less often than those which bring smaller helpings (see Nice, 1943:235), a circumstance which may possibly depend on the kind of insects each species generally prefers. Caterpillars, dragonflies, mayflies, for instance, are bulky insects as compared to mosquitoes, gnats, or certain spiders. Because the food carried by the Blackburnian Warblers as they moved about in the tops of 60 to 70 foot pines was plainly visible to me on the ground through 8 × 30 binoculars, the amount of each feeding must be considered as large. Sometimes when the warblers happened to come within closer range I was able to identify the food—once as a green larva and several times as mayflies. Hence, apart from the modifying influence of the events that occurred at this nesting (Nest B), two factors, *i.e.*, the number of young fed at each visit and the size of the meals, provided good reasons for the comparatively slow rate of feeding I found in this warbler.

Female B was killed in the morning in the absence of the male. The first time he came to the nest after it happened he was obviously affected by not finding her near the nest as usual. He hopped around "nervously" with his bill full of food, he glanced in this and that direction, but finally went to the young and fed them. Based on 51 minutes watching before the female was killed, the feeding rate of both parents was once in 17 minutes. After her death, during 129 minutes of observation, the male alone fed the young on an average once in 16 minutes. The next day I watched him feed them 5 times in 68 minutes, or once every 14 minutes. While there appears to be an acceleration in the male's feeding after the female vanished, his mean rate during the fourth and fifth days' watches equals that of the 3-hour watch on the first day, *i.e.*, once every 15 minutes. Keeping in mind the increasing need for food of the young, we should perhaps have found an increased rate of

feeding from the first to the fifth day of nest-life in this male. The lack of this might be accounted for by a change in the number of young in the nest; I had no means of knowing how many hatched or if any disappeared during these days.

In all the time I watched him, Male B showed a clearly defined rhythm in his feeding. In one hour he would feed once or twice, followed by a half hour in which he fed 3, 4, or even 5 times, in rapid succession, after which he repeated the series again. In this way he allowed himself time for preening, resting, and feeding himself between periods of close attendance upon the young. He maintained this rhythm rigidly also after the female was killed.

It seems safe to conclude that my Blackburnian Warbler male was not fitted to raise his brood alone after the loss of the female. Even had the young been able to survive the lack of brooding (which I think was the main reason for their dying), it is questionable whether the male could have kept abreast of their increasing need for food as they grew, although normally he might have increased his rate of feeding and/or the size of his offerings towards the end of the nest-life.

Song

Saunders (1951:194) described the song of this warbler as consisting of two parts—a series of notes in even time and a trill sometimes higher and sometimes lower in pitch than the first notes. He gave examples of 3 different songs.

At Pimisi Bay I recorded 5 different types of song and additionally one courtship-song.

(1) The most common was the long single-note song with rising end-trill (Saunders' No. 3). The length of this song was from 1 to 1½ seconds. Certain males used it almost exclusively, although some sang both this song and that (2) described below. Male B favored this version all through his nesting. After the young died, he began singing again, with particular vigor and intensity in the early morning and into the forenoon, and early in this period often unusually late at night (one record at 8 p.m.). But no new female presented herself and his singing gradually decreased until after July 12, 13 days after the young died, he was heard no longer.

(2) The long double-note song with higher end-trill (Saunders' No. 1) lasted longer than (1), from 1½ to 2 seconds. This also was a song that certain males used almost exclusively. Sometimes, however, I have heard it given by any male as a challenge song when another Blackburnian Warbler invaded his territory and fighting ensued.

(3) Only once I heard songs with double first notes and lower trill (Saunders' No. 2). This song was given by a migrating male passing through the study area.

(4) Half songs were a fourth variety. These songs consisted of the preliminary notes only, without the ending trill, *zree-zree-zree-zree* or *tsevee-tsevee-tsevee-tsevee*, either one used separately on various occasions. These "half-songs" were not heard before the later part of the nestings and perhaps are correlated with the decline of singing.

(5) Male C often sang "half-songs" during his second nesting and he was also heard giving a fifth version—*tse-tse-tse-tse-tsii* with rising inflection at the end. Nice (1939:92) records a similar song but with the last note lower than the rest.

Male C also furnished me with the sole example of a courtship song. At the time I heard it I described it as a short twittering song given at the moment of copulation.

It is noteworthy that in Allegany State Park, New York, Saunders heard the Blackburnian Warbler give songs with double preliminary notes and descending end-trills, and Kendeigh (1947:71), having listened to the birds at Black Sturgeon Lake, north of Lake Superior, remarked that their most common songs were with single preliminary notes and rising end-trill. Nice (1932), in her study of one bird at Pelham, Massachusetts, recorded no song with double first notes but did hear songs with the trills both higher and lower in pitch than the first notes.

From these published observations and mine at Pimisi Bay it may be concluded that the use of the various types of long songs is mainly individual rather than related either to occasion or time in the nesting cycle. In such a case, the preference or ability to sing certain types of song may be a matter of inheritance. This would explain why in one place Blackburnian Warbler songs of one type are more common than the others, while the types of song unusual for that district are heard only from birds passing through in migration.

One call-note was heard. It was used both when scolding and when alarmed, but I could hear no difference of enunciation on the two occasions. Sometimes there appeared to be a slight variation in the note as given by individual birds. The note *chit, chit* (Saunders' *tseek*) is not so sharp as the call-note of the Nashville Warbler, but is otherwise similar.

Dispersal

In the 8 years, 1944-1951, the dates when the Blackburnian Warbler was last seen ranged from August 12 to September 17, the mean being September 2 and the median, September 6. Migration of warblers in general usually begins during the last days of July when the first flocks passing southward may be seen. I have no evidence of any resident Blackburnian Warbler remaining on the nesting territory even as late as this, nor of a third nesting being attempted after two previous failures. The onset of the postnuptial molt

in this region seems to mark the end of the breeding season. Blackburnian Warblers seen during the last three weeks of July are overwhelmingly "molty" in appearance. With the onset of the molt singing ends abruptly and the birds move out of their territories, often pursued by a string of fledglings still begging to be fed.

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Summary

This study was based primarily on observation of 3 pairs of Blackburnian Warblers occupying the same territory in 1946, 1948, and 1950 and, secondarily, on field notes obtained during the years 1943 to 1951.

The spring arrival date for 9 years at Pimisi Bay was May 12, the median May 13. The females of given pairs were seen about 9 days later than the males.

Habitat requirements of the species were mature evergreens, either in climax stands or sparsely intermingled with deciduous growth.

A total of 34 hours was spent watching activities at 3 nests. The building of the nest was completed in an average time of a little over 4 days, but more time was spent on the early nests than on one started later. The female alone built the nest. The male accompanied her, displayed to her, and sometimes effected coitus during the nest-building. There was a notable decrease in building activity toward the end of the day and toward the completion of the nest.

Nests were located in evergreens, most often in white pines, at heights varying from 26 to about 55 feet. A preferred site was on horizontal branches well out from the trunk. The nesting materials consisted mainly of dry twigs, fine grasses, rootlets, and evergreen leaves. Spider silk, collected during the first day of building, was an important item in two nests and was used to attach the nest to the branch.

The female alone incubated. Her average duration of time on the nest was 22.0 minutes, with 5 minutes off for feeding and resting. The mean percentage of attentiveness was 77. The male exercised an influence on the length of the periods off and on the nest by causing the female to leave when she heard him sing loudly or call near by, and by delaying her return by distracting her with his company. One male fed his mate on the nest on 3 occasions during incubation.

On the twelfth day at Nest C and the thirteenth day at Nest B after the female began incubating steadily, young were being fed. At Nest B the male undertook the larger share of the feeding of the young, while the female spent most of her time brooding. The female at this nest was killed by a Pigeon Hawk on the fourth day of nest-life, but the male did not respond effectively to the emergency and the young died the next day, mainly from lack of brooding.

Five types of song as well as one courtship song and one call-note were recorded.

The Blackburnian Warblers left their territories immediately after the nesting cycle was concluded and the postnuptial molt began. This occurred comparatively early, about mid-July. No third nesting was undertaken after two previous unsuccessful attempts. The birds began their southward migration through this region in the end of July. In the past 8 years, the mean date when the Blackburnian Warbler was last seen was September 2, but the median date was September 6.

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ON THE NAME OF THE NORTHERN BALD EAGLE AND THE IDENTITY OF AUDUBON'S GIGANTIC "BIRD OF WASHINGTON"

BY ROBERT M. MENGEL

DURING his extraordinary career, John James Audubon was pardonably confused about the identities of some of the myriad, little-known birds in the wilderness around him. Some of his early misconceptions he cleared up himself; others continued to baffle ornithologists long after his death.

A case in point is furnished by his remarkable "Bird of Washington" (*Falco washingtonii* Audubon, Ornithological Biography, 1, 1831:58–65), long thought to have been an immature Bald Eagle (*Haliaeetus leucocephalus*). Although Audubon came to realize that the dark young and the white-headed, white-tailed adults of the Bald Eagle belonged to the same species, he continued steadfastly to believe in the existence of another sea eagle in eastern North America—a larger, fiercer, still more magnificent creature—the "Bird of Washington." Before discussing the complexities which resulted from this belief, let us consider briefly Audubon's feelings about the matter. He wrote (*op. cit.*, p. 61):

> . . . as it is indisputably the noblest bird of its genus that has yet been discovered in the United States, I trust I shall be allowed to honour it with the name of one yet nobler, who was the saviour of his country, and whose name will ever be dear to it. To those who may be curious to know my reasons, I can only say, that, as the new world gave me birth and liberty, the great man who assured its independence is next to my heart. He had a nobility of mind, and a generosity of soul, such as are seldom possessed. He was brave, so is the eagle; like it, too, he was the terror of his foes; and his fame, extending from pole to pole, resembles the majestic soaring of the mightiest of the feathered tribe. If America has reason to be proud of her Washington, so has she to be proud of her Great Eagle.

It is easily seen that the great naturalist's intense emotions were aroused over and above his normal enthusiasm at what he believed to be a bird new to science. The Washington Eagle was formally presented to science with plate 11 of the elephant folio (1827), in which the bird looks much like an immature Bald Eagle. Its description was completed with the written account that followed (1831), which will be considered further below.

The Bird of Washington, virtually forgotten and long buried in the crypts of synonymy, reappeared on the nomenclatural scene in connection with the large Bald Eagles of the northern part of the North American continent, which had been separated by Townsend (1897) under the name *alascanus* (type locality: Unalaska, Aleutian Islands; type specimen: male, U. S. National Museum No. 151567). Townsend's name stood for the northern sub-

species until Peters (1931:258) replaced it with the older name *washingtoniensis* Audubon (elephant folio), explaining his action by the words (footnote): "Audubon's type of *washingtoniensis* had a wing measurement of 32 inches; 4 inches longer than any Alaskan specimen measured by me if measured the same way."

Bent (1937:333) and the American Ornithologists' Union Check-List (1944:445) shortly followed suit. Soon afterward it became necessary to change the name once again (A. O. U., 1948:439), this time to *washingtonii*, because a number of the elephant folio plates by one engraver (Lizars) bore the name *washingtoniensis*, while others in the same edition (engraved by Havell) were labelled *washingtonii*. Therefore, the use of the name *washingtoni* by Bangs (1898:174) for the Bald Eagles of the northeastern United States fixed the one to be used, according to the "principle of first reviser." The northern Bald Eagle thus became *Haliaeetus leucocephalus washingtonii* (Audubon), with Henderson, Kentucky, where Audubon secured his specimen, as type locality. Audubon's name belonged once more to a bird, if to a less spectacular one than he had originally envisioned.

The logic of Peters' reasoning is obvious, but vulnerable. If Audubon's bird from Henderson was too large for a southern Bald Eagle, too large, in fact, for any known northern bird, it must have been a northern bird. But the question here is, how much too large? The picture evoked by a careful consideration of the original written description is downright unnerving.

I am not the first to appreciate this. Many years ago J. A. Allen (1870) brilliantly reviewed what was then known and thought about Audubon's great eagle, remarking on its incredible size and concluding, doubtfully, that it may have been an extremely large, immature Bald Eagle. He stated in closing that "a 'few grains of allowance' may be safely made for slight inaccuracies on the part of its enthusiastic discoverer." Much later, Friedmann (1950:495) expressed similar doubts, stating that the wingspread (of 10 feet and 2 inches) was too great for any eagle. Carrying this line of thought somewhat further, I found that *all* of the measurements were, as Friedmann put it, "undoubtedly exaggerated," or that Audubon had before him a form of eagle which no longer exists, or that he was in possession of a freak individual. A statistical analysis, the details of which follow, shows that one or another of these conclusions is inevitable.

Table 1 shows the disparity of certain of Audubon's measurements (converted to millimeters) of his type with those of northern birds given by Friedmann (*op. cit.*, p. 489). Audubon said his specimen was a male, but even supposing he mis-sexed the bird, we see his huge eagle to have been much larger than recorded female northern Bald Eagles.

TABLE 1

COMPARISON OF MEASUREMENTS OF MALE AND FEMALE *Haliaeetus leucocephalus alascanus* TOWNSEND* WITH THOSE OF THE TYPE OF *Falco washingtonii* AUDUBON (MALE?)

	washingtonii (1 specimen)	*alascanus* ♂♂ (29 specimens)		*alascanus* ♀♀ (42 specimens)	
		range	*mean*	*range*	*mean*
Wing	812 mm. (32 in.)	570–612	(588.6)	605–685	(640.2)
Tail	381 mm. (15 in.)	290–322	(309.7)	300–365	(339.4)
Tarsus	114.3 mm. (4½ in.)	84.5–106	(99.8)	83–110	(101.9)
Wingspread	10 ft. 2 in.				

* I am indebted for some of the measurements to Dr. Herbert Friedmann.

The results of a statistical analysis of the variability of wing length in a number of *female* eagles are shown in Figure 1. The measurements used were taken from Alaskan specimens and winter-collected birds from the northern United States, and hence were among the largest available. Wing measurement was chosen because of its prevalence in taxonomic work, and because of its fairly low relative variability. Figure 1 also shows the theoretical characteristics of a hypothetical population represented by the type of *washingtonii*. These characteristics were arrived at by making the logically justifiable assumptions that the coefficients of variability in forms presumed to be closely related are roughly similar, and that Audubon's type was an individual near the mean of its population. Using the coefficient of variability for a known population (of Bald Eagles in this case), one can compute the theoretical standard deviation of the unknown population. Details and discussions of this technique have been given recently by Fisher (1952).

If one assumes Audubon's specimen to have been approximately average in size, virtually no overlap is found between the greatest wing length expected in modern [*i.e.*, known] *female* Bald Eagles and the lowest expected wing length in the hypothetical population. For added safety, I have also assumed Audubon's specimen to have been nearly the largest possible example of its population, and placed a second theoretical mean three standard deviations below the first, computing another expected range from the new mean. Since the second mean is smaller, and the standard deviation varies with the mean, it is necessary in this case to compute a new theoretical standard deviation, although this was not mentioned by Fisher. In this second case, as shown by Figure 1, some overlap would occur, but the separability of populations is still more than 97 per cent of recent eagles from 84 per cent of "Audubon eagles," more than enough by most present-day taxonomists' standards for subspecific recognition. The differences are so great that minor variables,

such as the difference between chord and flat measurements, would not significantly affect the results. We are faced by the single hard fact that Audubon's type, which is all that we have to go on, was far too large to be considered a Bald Eagle of either sex or of either present-day race. Had I compared Audubon's "male" bird with male northern Bald Eagles, it would have been impossible to fit the figure into this page using this scale!

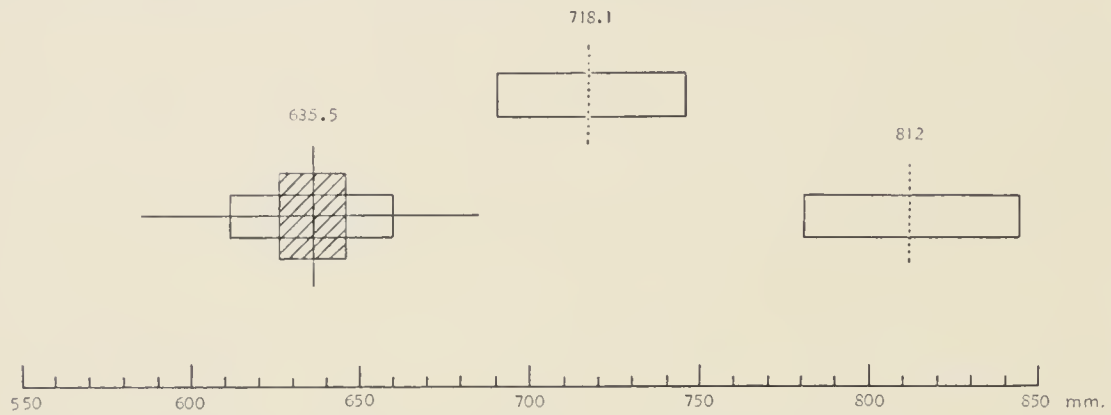

FIG. 1. Variability in wing length of 25 females of *Haliaeetus leucocephalus alascanus*, compared with the theoretical variability in the same measurement of "*Falco Washingtonii.*" Shaded rectangle = mean ± 2 standard errors. Unshaded rectangles = means ± 1 standard deviation. Horizontal line = observed range of 25 females of *alascanus*. Solid vertical line = mean of *alascanus*. Dotted vertical lines = assumed means of *washingtonii*. *Haliaeetus leucocephalus alascanus:* number of specimens (N) = 25; mean (M) = 635.5; standard deviation (σ) = 24.5; standard error of the mean (σm) = 4.9; coefficient of variation (V) = 3.85 (measurements in millimeters). *Falco washingtonii:* (assuming type is average in size) N = 1; M = 812; V = 3.85; σ = 31.3; (assuming type is nearly the largest of population) N = 1; M = 718.1; V = 3.85; σ = 27.7.

Inspection of the other measurements (Table 1) suggests that some or all of them, treated statistically, would also show differences sufficiently great to merit nomenclatural recognition by present standards. I have not gone further, as the argument is carried by one demonstration and, after all, we do not know how (and let me suggest, reluctantly, if) Audubon actually made his measurements.

The assumptions that may now be made are three. Let us consider the least probable, and the most interesting, first. This is the remote possibility, properly derided by many earlier naturalists, that Audubon actually had an eagle of the genus *Haliaeetus*, of the size described, and specifically distinct from *leucocephalus*—a species that became extinct before its existence was otherwise indicated. There is, of course, no evidence from other sources of the presence of such a form in historic times. However, the peculiarity of the tarsal scalation, and the odd conformation of the cere, as shown in Audubon's plate, provide material for speculation of this sort, as neither is at all typical

of the Bald Eagle. The characters of the tarsus have been discussed at some length by Allen (*op. cit.*) and Gilpin (1873), both authors concluding that to blame for the irregularity. The atypical cere does not seem to have been carelessness on the part of Audubon, his engravers, or both, may have been mentioned previously, and was brought to my attention by J. Van Tyne.

It is also thought-provoking to read Audubon's description of the nesting of a pair of the brown Birds of Washington on a cliff at the mouth of Green River, near Henderson (*op. cit.*, pp. 58–60). The possibility, suggested by their choice of the cliff site, that these were in fact Golden Eagles (*Aquila chrysaëtos*) is rendered unlikely by his explicit account of their feeding largely upon fish. The point is that nesting pairs of two immature Bald Eagles probably do not occur at all; they are at any rate so rare that none were known to Bent (1937:322), matings involving even one immature being very unusual. Quite possibly subadult Bald Eagles lack sufficient sexual initiative to bring about successful mating and rearing of a family by two immature birds, although one individual may be capable upon occasion of mating satisfactorily with an adult. Strong evidence against the possible specific validity of Audubon's bird, however, is the fact that no species of *Haliaeetus* other than *leucocephalus* has been discovered in Pleistocene deposits of the United States, and the known fossils are apparently little, if any, larger than large modern Bald Eagles (Howard, 1932:44).

The second possible conclusion is that some genetic or developmental anomaly was responsible for the size of Audubon's bird, assuming it to have been a Bald Eagle. This also seems unlikely, but were it true, the aberration probably could have sprung as readily from one population as from another.

The final possibility, and by far the most probable, is that the measurements are simply unreliable. Whether they were supplied erroneously from memory, resulted from a different system of measurement from that now used, or were accidentally or intentionally falsified does not particularly concern us here. We are clearly not justified in assuming, because Audubon's measurements are too large for *any* Bald Eagle, that the bird must have been a *northern* Bald Eagle. If the measurements are in error, and we have seen the overwhelming probability that they are, there is no way of telling the magnitude of the error or its direction. (Add to this the point that, to keep the discrepancy from being much greater still, we have to assume—with dubious justification—that Audubon mis-sexed his specimen.) No case can be made for the application of the measurements or names based on this specimen to any population of the Bald Eagle.

If Audubon put down the measurements of *washingtonii* from memory, fabricating or exaggerating them to suit his inflamed fancy, the case comes within the meaning of Opinion Number 2 of the International Commission on

Zoological Nomenclature: ". . . we name the objects themselves, not our conception of said objects," and the name is invalid. In any event, the situation is summed up by Canon XLV of the American Ornithologists' Union Code of Nomenclature (1892:53), which states: "Absolute identification is requisite in order to displace a modern current name by an older obscure one." Such identification is lacking.

No specimen certainly identified by Audubon as a Washington Eagle appears to exist. The type of *washingtonii*, presented by Audubon to his friend, Dr. Rankin, was apparently not preserved (Allen, *op. cit.*). The northern Bald Eagle, as currently defined (see Peters, *loc. cit.*) does not breed in Kentucky. Consequently it will prove convenient, as well as necessary, to fall back on Townsend's name. The inimitable Elliott Coues once said, prophetically (Gilpin, 1873:430, footnote), "I wonder how many more times the 'Washington Eagle' must be put down before it will stay down!" Perhaps his question can finally be answered.

Neither *Falco washingtonii* Audubon nor *Falco washingtoniensis* Audubon is a *nomen nudum*, since they are accompanied by a plate and a figure in the first instance and a plate in the second, but neither name belongs in the synonymy of the Bald Eagle. The Washington Eagle should be placed with hypothetical species such as the Blue Mountain Warbler (*Sylvia montana* Wilson) and similarly unidentifiable forms. The subspecies of the Bald Eagle should henceforth stand as:

Haliaeetus leucocephalus leucocephalus (Linnaeus)
Falco leucocephalus Linnaeus
Haliaeetus leucocephalus alascanus Townsend
Haliaeetus leucocephalus alascanus Townsend
Haliaeetus leucocephalus washingtoni Bangs
Haliaeetus leucocephalus washingtoniensis Peters

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University of Michigan Museum of Zoology, Ann Arbor, January 23, 1953

LIFE-HISTORY OF THE PROTHONOTARY WARBLER

BY LAWRENCE H. WALKINSHAW

DURING the years 1937 through 1945, I studied the Prothonotary Warbler (*Protonotaria citrea*) in an area along the Battle Creek River in Convis Township, Calhoun County, Michigan. The area consisted of the winding river and adjoining bottomlands and was nearly two-thirds of a mile (1069 meters) long (about 9460 feet or 2859 meters by river) and approximately 88 acres (35.62 hectares) in area. During the war years fewer trips were made to the area but enough search was made to identify the banded birds.

Much of the information obtained in my first year's study was published in *Bird Banding* (1938. 9:32-46); additional information, on the 1938 season, in *The Jack-Pine Warbler* (1939. 7:64-71); and a comparison of the studies made in Michigan and at Reelfoot Lake, Tennessee, through 1940 was published in *The Wilson Bulletin* (1941. 53:3-21). Since I was unable to visit the Tennessee area after 1940, I was not able to get information on the banded birds which were studied there during 1939 and 1940. This paper deals almost entirely with the Michigan birds. Table 1 gives the first date Prothonotaries were observed at Battle Creek and the date of the first-laid egg, for each year.

Territory

Upon arrival on the Michigan nesting grounds, the male Prothonotary Warbler immediately stakes out his territorial claim. I have never found a territory in other than the immediate vicinity of well-shaded water, either running or in stagnant pools. Of 84 nests found in "natural" locations, 29 were over standing water, 32 along the edge of running water or over it, and the remaining 23 over dry land. The last 23 were from .61 to 137.8 meters from the river bank and usually in easily flooded spots. Nearly all of the nests were shaded most of the day. In one nest, upon which the mid-day sun shone during the nestling period, all of the young died one hot afternoon. There are other requisites besides shade and water for a good nesting site. The sites are usually not very high. Where bird houses were used, I found the birds preferred sites between one and two meters above the water, but would nest in houses whether they were only a few centimeters above the water or three or four meters high. Of the nests located in natural sites, 43 were in various cavities and 41 in woodpecker holes. Downy Woodpecker (*Dendrocopos pubescens*) holes were preferred. Forty-one nests were located from 61 to 152 cm. above the ground or water; 21, between 152 and 304 cm.; 20, between 304 and 450 cm.; and two even higher. The highest nest was 10.4 meters above ground.

I usually found the first male of the year in the early morning. Often there had been no bird in the same place the day before. At first, territories were rather large, taking in great stretches of river. As other males arrived, battles ensued, the new males each finally taking possession of some restricted water frontage and the earliest male trying to retain as much as

Fig. 1. Nesting habitat of Prothonotary Warbler in Calhoun County, Michigan. One pair nested in the dead stub near the blind. Photographed by Lawrence H. Walkinshaw on June 13, 1948.

possible of his original territory. These battles sometimes lasted for two or three days. One male would chase another, back and forth, up and down, through the vegetation, until both were thoroughly tired. Often they stopped to rest but almost as quickly started again—sometimes switching roles of pursuer and pursed. Eventually territorial boundaries were established and regular battles were discontinued. In territories along the river bank, regardless of how irregular the stream, the males battled more for the river bank than for the portion of the territory back in the dry woods. In areas where the river almost encircled land, one male nearly always controlled the encircled land.

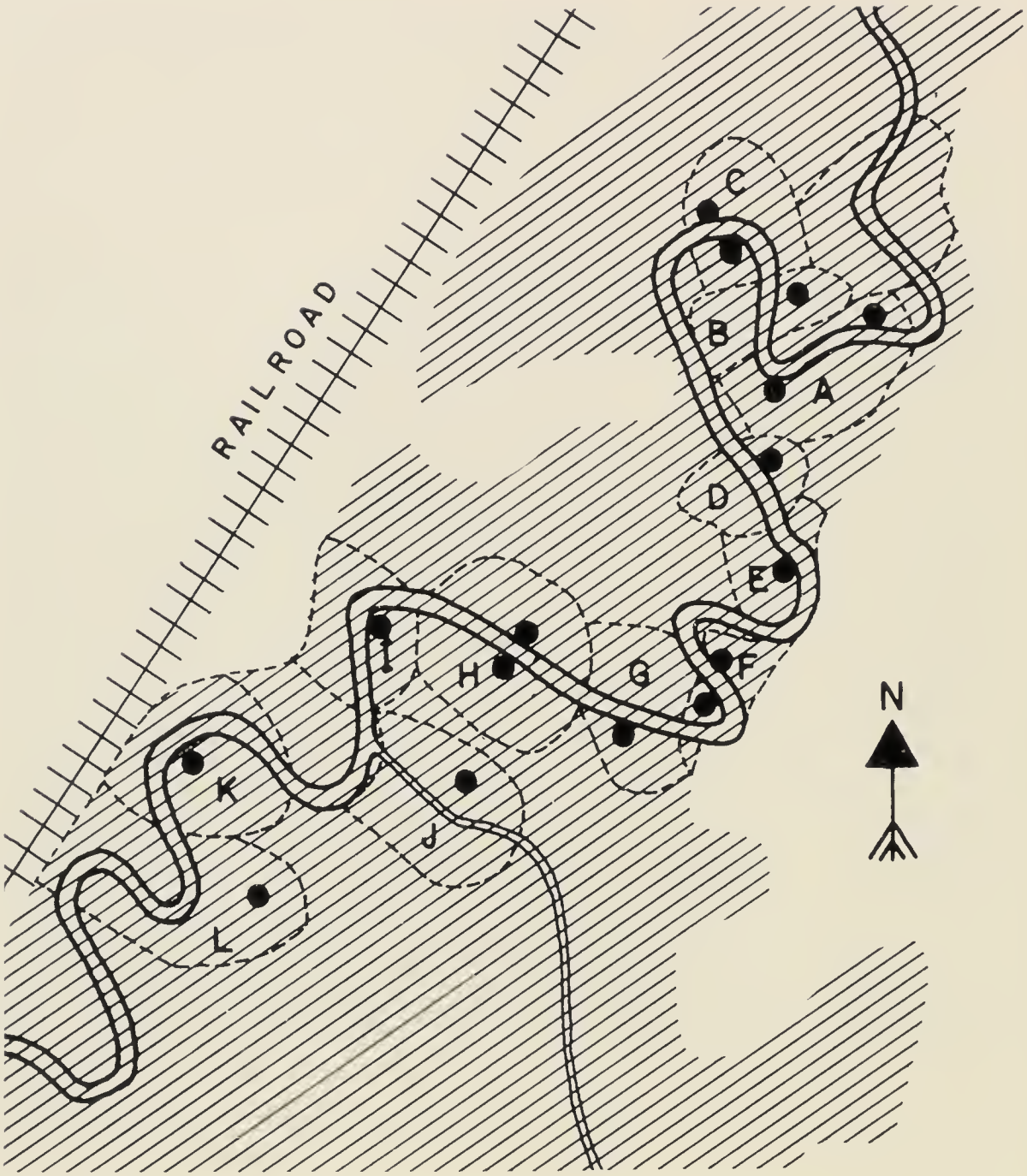


Fig. 2. Nesting territories (enclosed by dotted lines) of the Prothonotary Warbler along the Battle Creek River, Michigan, in 1941. The shaded portion represents bottomland woods; black circles represent nests. Figs. 3-7 reproduce the same area.

The male almost always selected the first nesting site before the female arrived. Often he carried a mass of moss for the base of the new nest into the bottom of the selected cavity. When the female arrived, she completed the nest shortly and a few days usually intervened before egg laying began.

Often a nesting site was selected first and then territory established around it. An example of this occurred in Tennessee at a bird house used during

the summer of 1939 by three different pairs of banded Prothonotaries, all of which reared young. The first pair used the house from April 18 until May 24; the second pair, May 30 to June 24; the third pair, from early July until early August. The first pair disappeared after nesting; the second pair moved about 150 meters to a new site after nesting in the bird house; the nesting site of the third pair prior to their nesting in the bird house was not known.

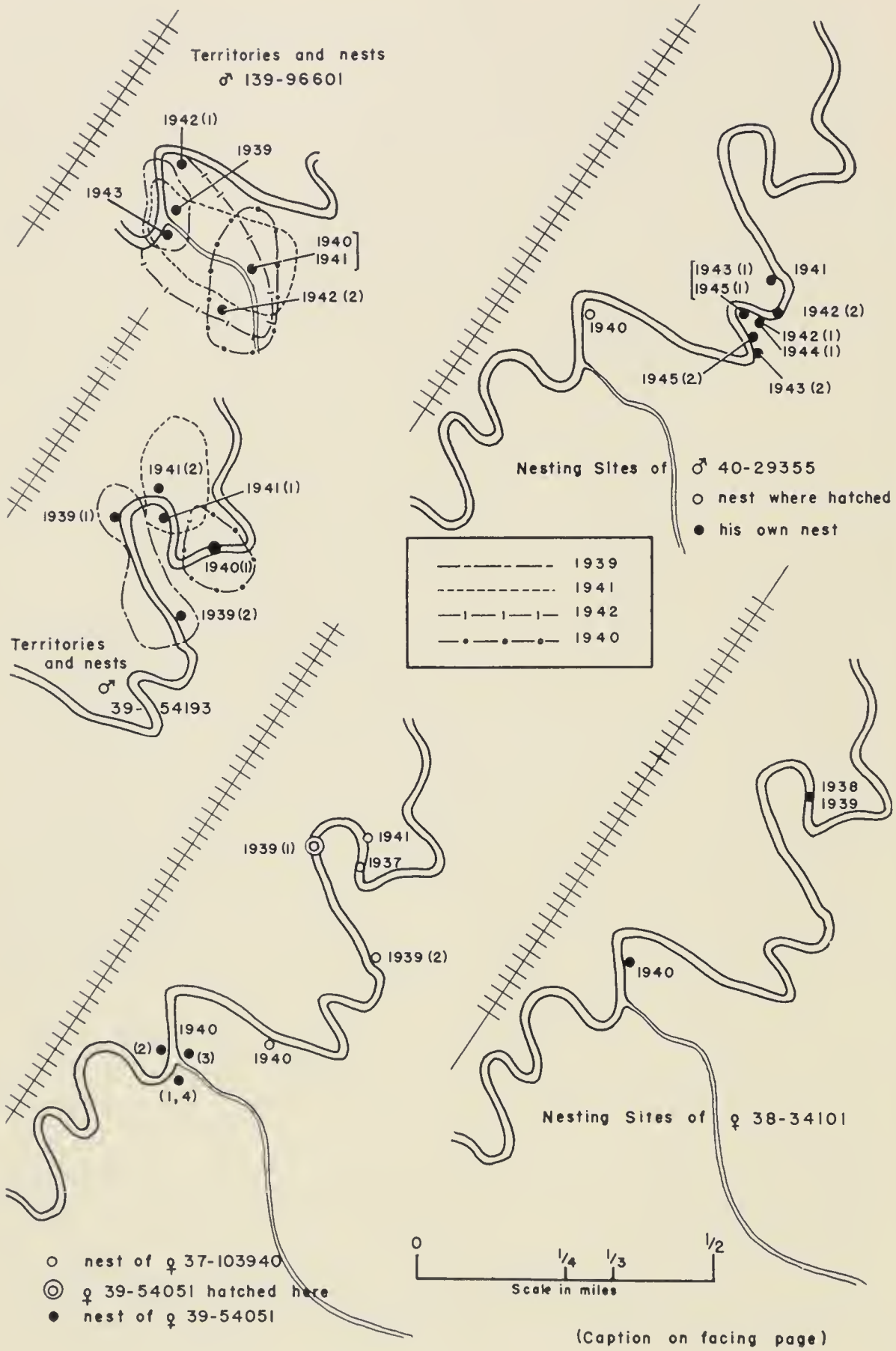
In the Michigan study area the following Prothonotary Warblers nested during the seven summers: 1937, 11 pairs; 1938, 12; 1939, 15; 1940, 19; 1941, 13; 1942, 14; 1943, 14—an average of 14 pairs per year. In 1941 (Fig. 2) the approximate sizes of territories were recorded, averaging for the 13 pairs 3.66 acres (148 ares) per pair with extremes of 1.90 and 6.38 acres (76.8 to 258 ares). Some territories were much larger in total extent, but the entire area was not used at one time. During 1942, male 139-96601 had a territory of 12.41 acres (5.02 hectares) only part of which was used at one time (Fig. 3). Two nests found on this area in 1942 were 1366 feet (412 meters) apart. His 1943 nest, the last one which I found, was only 16 feet (4.9 meters) from the first one found during 1939. His territories during the five summers averaged 9.46 acres (3.82 hectares) in size with extremes of 6.36 and 12.42 acres. The 1940 and 1941 nests were in the same site. Portions of his first year's territory were used each successive year except 1940.

Another male, 40-29355, was banded as a nestling June 16, 1940 (Fig. 4). A nest found during 1941 probably belonged to him. The female was banded, but the male was not captured. It was this male, however, that occupied that territory during the next four summers. He was captured in 1942 and marked with a colored band. His territories were much more concentrated than the territories of no. 139-96601. The entire group covered no more than six acres. His territory size averaged for the four summers 3.16 acres (127.8 ares). The greatest distance between his nests was 491 feet (148.3 meters) during that period.

Male 39-54193 had a different type of territory each year for three years (Fig. 5). The three territories bordered on each other, but barely overlapped. The greatest distance between any of his nests during the three year period was 1226 feet (370 meters).

Male 38-34107 had territories almost equal in size, which overlapped, in 1938 and 1939, but in 1940 he had moved from 990 to 1688 feet (296 to 510 meters) downstream.

Females returned less often than males. If a female's old mate had returned and had a new mate when she arrived, she was forced to mate with a new male. Only one pair remated for the second season, nesting in the same bird



(Caption on facing page)

house in 1938 and 1939. Three other pairs could have remated but did not. The two males returning for five years had different mates each summer. None of their mates was found a second year.

Female 37-103940 was banded in 1937 but in 1938 I did not find her. Every female on the study area was identified but she could have nested a quarter mile or less outside and not have been found. In 1939 she first nested 537 feet (162 meters) from where she nested in 1937. Her second 1939 nest was 934 feet (282.4 meters) from the first 1939 nest. In 1940, she nested 1371 feet (417 meters) downstream and in 1941, 2423 feet (732 meters) upstream from the 1940 nest, but only 211 feet (64 meters) from her 1937 nest (Fig. 6).

General Life History

The early dates of egg-laying and hatching and the time that the young left the nest were given in *The Wilson Bulletin* (1941, 53:6-11). An interesting correlation was found between the average weight of the eggs and the average number of eggs in a set. If one was greater during a year, the other was less, so that the total weight of each set averaged almost the same each year (Tables 2 and 3). I have studied the records of nests in Michigan where the incubation period was known, but find that air temperature apparently had no effect on the length of this period. All incubation periods (*i.e.*, the period between the laying of the last egg and its hatching) were from 12 days to slightly under 14 days. The highest mean temperature during one of these incubation periods at Battle Creek was 71.8°F., May 26 to June 8, 1939. The same incubation period was found for two nests when the mean temperature was the lowest recorded, 61.1°F., May 27 to June 9, 1938. The two shortest incubation periods, 12 days each, occurred when the mean temperatures were 67.0° and 66.5°F., respectively. Thus, at 17 recorded nests, 1937 through 1941, no correlation was found between incubation period and air temperature.

Notes taken at a nest found along the Battle Creek River on June 6, 1948 (see Fig. 1) record the typical home life of the Prothonotary Warbler. The nest contained at least five eggs. It was over the river in a Downy Woodpecker hole in a dead maple about two meters above the water level. The tree was about 34.5 centimeters thick. The territory of the male extended upstream about 50 meters and about the same downstream. He often penetrated inland about the same distance, on either side of the river, but the

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Figs. 3–7 (opposite page). Nesting of Prothonotary Warbler along Battle Creek River, Michigan. Fig. 3, upper left; Fig. 4, upper right; Fig. 5, middle left; Fig. 6, lower left; Fig. 7, lower right. Symbols in the box are the key to identification of nesting territories.

TABLE 1

BREEDING SEASON OF PROTHONOTARY WARBLER IN MICHIGAN †

Year	Record of first male	First April or May day with 70° temperature	Date of first egg	Temperature 4–5 days prior laying of first egg (day in par.) Date	High	Low	Termination of last nesting	Number of days between first laid egg and termination of last nesting Actual	Possible
1937	May 11*	May 2	May 22	(17)	67°	43°	July 14	53	69
1938	April 27	April 12	May 8	(3)	90°	64°	July 7	60	80
1939	April 26	April 23	May 18	(13)	67°	39°	July 6	49	69
1940	May 6	April 28	May 22	(18)	67°	36°	July 14	53	73
1941	April 29	April 10	May 15	(10)	64°	34°	July 12	58	69
1942	April 29	April 14	May 10	(5)	61°	34°	July 6	57	—
1943	May **	April 24	May 25	(21)	69°	47°	July 1+	37+	—
1944	May 14	April 23	May 20	(15)	87°	55°	.....	—	—
1945	May 6	April 9	May 19	(14)	61°	38°	July 10	52	59
1946	May 1	April 14							
1947	May 11								
1948	May 9		May 23	(18)	69°	46°	July 8	46	—
Mean	May 4	April 19	May 18		70°	43°	July 8	53	69

† Temperatures used under headings 3 and 5 are those recorded at the Battle Creek Weather Station. Under the last heading are two figures: the first shows the number of days between the laying of the first egg and the termination of the last nesting; the second, the possible number of days if the last nest had not been destroyed.

* Recorded by Mr. and Mrs. N. T. Peterson.

** First Prothonotary not back by May 5 after which I was not able to visit area until May 25.

majority of his time was spent on the river banks or in the trees above the river. When I found the nest both male and female Prothonotary Warblers were scolding a female Cowbird (*Molothrus ater*) that was in the nest area and both were trying to drive her away. When the Cowbird left, the male Prothonotary began to sing. About 85 per cent of his song perches were in the shade and about 15 per cent in the open. Some were over the river, some over land, and only one was more than 50 meters from the nest. Song perches at heights in meters listed were used in the following order: 1.83, 1.22, 3.35, 6.7, 7.5, 8.4, 9.1, 10.6, 9.6, .9, 3.6, 4.5, 5.4, 6.7, and 8.4.

When the female left the nest she usually uttered a rapid, sharp chipping. Often the male was silent while she was away from the nest, but started singing when she returned. While she was away he often stayed within five meters of the nest and at times was observed looking into the nest cavity. Often when she returned to the nest, she chipped considerably and he answered with a sharp *zip-zip*. One noon the song sequence of the male was timed. He sang the regular *tweet-tweet-tweet-tweet-tweet* song. The number of *tweets* was listed in each song for some time as: 12, 9, 11, 11, 10, 10, 10, 10,

TABLE 2

SIZE OF PROTHONOTARY WARBLER EGGS

Year	Number of eggs	Average length in mm.	Average width in mm.	Average weight in gm.
1937	78	18.47	14.55	2.07
1938	40	18.68	14.8	2.11
1939	31	18.33	14.88	2.07
1940	47	18.68	14.75	2.12
1941	31	17.74	14.67	1.99
1942	7	18.04	14.35	——
1943	17	17.51	14.48	2.00
1944	18	17.31	14.26	2.00
1945	28	18.01	14.32	2.03
Mean	297 total	18.26	14.62	2.06

TABLE 3

NUMBER AND WEIGHT OF PROTHONOTARY WARBLER EGGS

Year	Number of sets	Average number of eggs per set	Average weight of set in grams
1937	16	5.06	10.4742
1938	18	4.94	10.4234
1939	13	5.07	10.4949
1940	15	4.93	10.4516
1941	13	5.15	10.2485
1942	5	5.20	——
1943	6	5.33	10.6600
1944	3*	6.00	12.0000
1945	5**	4.80	9.7444
Mean	94 total	5.07	10.4531

* Early sets only. ** All late sets.

8, 8, 10, 10, 10, 10, 10, 9, 9, 9, 8, 10, 7, 9, 8, 10, 9, 10, 11, 10, 11, 9. There followed a whisper song, and then a song of 8 *tweets*. During a period of seven minutes he sang per minute, 3, 2, 1, 3, 3, 4, and 1 times. During early morning hours males often gave 7 or 8 songs per minute.

The female, on leaving the nest, flew some distance directly away; as a rule, 135 to 150 meters downstream, but less often upstream, and occasionally inland. Sometimes after feeding she preened for a few minutes. The male at times fed her on the nest as she incubated, but most of her feeding was done away from the nest. Between 9:45 a.m. and 4:00 p.m. on June 6, 1948, she spent 303 minutes on the nest and 73 minutes away (Table 4).

In 1948 the following species of birds were nesting or singing on the 88-acre river area where this pair of Prothonotary Warblers nested. Numbers of pairs as given varied little for the entire period of study, 1937–1945: Wood Duck (*Aix sponsa*), 1 pair; Red-shouldered Hawk (*Buteo lineatus*), 1; Yellow-billed Cuckoo (*Coccyzus americanus*), 1;

Table 4

Attentiveness of Female Prothonotary Warbler
During Incubation, June 6, 1948

Female on nest	Time in minutes	Female off nest	Time in minutes
9:45 a.m.–10:51 a.m.	66	10:51 a.m.–11:10 a.m.	19
11:10 a.m.–12:02 p.m.	52	12:02 p.m.–12:17 p.m.	15
12:17 p.m.– 1:15 p.m.	58	1:15 p.m.– 1:29 p.m.	14
1:29 p.m.– 2:17 p.m.	48	2:17 p.m.– 2:24 p.m.	7
2:24 p.m.– 3:04 p.m.	40	3:04 p.m.– 3:11 p.m.	7
3:11 p.m.– 3:50 p.m.	39	3:50 p.m.– 4:00 p.m.	11
Total time	303 minutes		73 minutes
Per cent	80.58		19.41

Barred Owl (*Strix varia*), 1; Ruby-throated Hummingbird (*Archilochus colubris*), 1; Belted Kingfisher (*Megaceryle alcyon*), 1; Red-bellied Woodpecker (*Centurus carolinus*), 1; Hairy Woodpecker (*Dendrocopos villosus*), 1; Downy Woodpecker (*Dendrocopos pubescens*), 1; Crested Flycatcher (*Myiarchus crinitus*), 2; Eastern Phoebe (*Sayornis phoebe*), 1; Acadian Flycatcher (*Empidonax virescens*), 1; Wood Pewee (*Contopus virens*), 2; Rough-winged Swallow (*Stelgidopteryx ruficollis*), 1; Black-capped Chickadee (*Parus atricapillus*), 2; Tufted Titmouse (*Parus bicolor*), 2; White-breasted Nuthatch (*Sitta carolinensis*), 1; Brown Creeper (*Certhia familiaris*), 1; House Wren (*Troglodytes aëdon*), 8 (4 nests found); Catbird (*Dumetella carolinensis*), 1; Robin (*Turdus migratorius*), 2; Wood Thrush (*Hylocichla mustelina*), 1; Veery (*Hylocichla fuscescens*), 1; Blue-gray Gnatcatcher (*Polioptila caerulea*), 1; Starling (*Sturnus vulgaris*), 4; Yellow-throated Vireo (*Vireo flavifrons*), 3; Red-eyed Vireo (*Vireo olivaceus*), 1; Black and White Warbler (*Mniotilta varia*), 1; Prothonotary Warbler (*Protonotaria citrea*), 12 (6 nests found): Golden-winged Warbler (*Vermivora chrysoptera*), 2 (one nest found); Blue-winged Warbler (*Vermivora pinus*), 1; Cerulean Warbler (*Dendroica cerulea*), 3; Louisiana Water-thrush (*Seiurus motacilla*), 4 (one nest found); American Redstart (*Setophaga ruticilla*), 15 (3 nests found); Cowbird (*Molothrus ater*), 4; Scarlet Tanager (*Piranga olivacea*), 1; Cardinal (*Richmondena cardinalis*), 5; Goldfinch (*Spinus tristis*), 3; Field Sparrow (*Spizella pusilla*), 2 (nesting along high bank bordering river); Song Sparrow (*Melospiza melodia*), 8–making a total of 40 species and 105 pairs (210 individuals) on the area of 88 acres–a density of 119 pairs per 100 acres.

The nearest Prothonotary Warblers to the pair studied intensively on June 6, 1948 were 370 meters upstream, but on June 13 another pair moved in about 90 meters upstream and during late May a pair nested 135 meters downstream.

The male vehemently scolded Bronzed Grackles (*Quiscalus quiscula*) which fed in the area but he paid little attention to Red-wings (*Agelaius phoeniceus*) until they were about nine meters from the nest nor was he much excited by other birds that came into the immediate area. Species which came within a meter or two of the nest and were immediately chased were: Black-capped Chickadee, House Wren, Catbird, Robin, Golden-winged Warbler, Mourning Warbler (*Oporornis philadelphia*), Louisiana Water-thrush,

Redstart, Cowbird, Rose-breasted Grosbeak (*Pheucticus ludovicianus*), and Cardinal. The male chased them by darting quickly in their direction. Once a fox squirrel (*Sciurus niger*) was driven away by the male Prothonotary and a male House Wren that nested nearby.

On June 8, 1948, I was back at this nest site again at 4:20 a.m. The male began singing at 4:37 a.m. The morning was cool, the temperature about 53°F., and the sky overcast. The male carried food to the nest for the first time at 4:52 and had made 17 trips to the nest with food by 7:15 a.m. Twelve of them were between 4:52 and 5:29 a.m. After that he sang more and he spent some time scolding and chasing a grackle even when it was 30 meters from the nest. The male was quiet as he approached, but sang immediately after feeding the young. The female made three trips with food. She left the nest for the first time at 5:32 a.m. During four periods she was away from the nest 13, 9, 9, and 8 minutes and brooded the newly hatched young during periods of 23, 18, and 15 minutes. She chipped as she left the nest and chipped considerably more when she neared it on her return. Both birds flew some distance from the nest in search of food.

The following notes were made June 13, 1948, between 12:45 and 3:00 p.m. while I was watching from a blind two meters from the nest: The young were not brooded by the female. Both birds were feeding the young. The male fed them 10 times with an average of 10.4 minutes (2-28) between feedings; the female fed them 9 times with an average of 9.9 minutes (1-25) between feedings. The longest period between feedings was 16 minutes. The male removed excreta six times; the female, twice. The male did considerable singing and sang most often when the nearest neighboring Prothonotary Warbler sang. The young of this pair died during the afternoon because of the excessive heat of the sun beating on their exposed nest site. They were apparently five days old.

In my studies of the Prothonotary Warbler from 1936 through 1948, I followed 178 nestings of which 50 (28.09 per cent) were successful (at least one young raised). Out of 645 eggs, 262 (40.62 per cent) hatched and 191 (29.61 per cent) young left their respective nests. I banded 138 nestlings of which only two have been found in subsequent years. One, a female, nested in the area for one summer; the other, a male, was found the second year after banding and for three additional years.

Returns and Longevity

In 11 years, 1937-1947, 58 adult female and 17 adult male Prothonotary Warblers were banded. These birds were at least one year old when banded and some were probably older. The known age of two nestling returns would be 1.5 years for the female and 5.5 years for the male. Table 5 gives the

TABLE 5

PROTHONOTARY WARBLER RETURNS

	Males	Per cent return	Females	Per cent return	Both sexes	Per cent return
Number banded	18		59		77	
First year return	9	50	12	20.3	21	27.3
Per cent disappeared first year	50		79.7		72.7	
Second year return	4	22.2	6	10.2	10	13.0
Per cent of original number disappearing second year	27.78		10.2		14.3	
Third year return	2	11.1	1	1.7	3	3.9
Per cent of original number disappearing third year	11.1		8.5		9.1	
Fourth year return	2	11.1	1	1.7	3	3.9
Per cent of original number disappearing fourth year	0.0		0.0		0.0	
Fifth year return	0	0.0	0	0.0	0	0.0
Per cent of original number disappearing fifth year	11.1		1.7		3.9	

returns of the adult birds. The two nestlings are entered in this table as one year old. Females did not return to their territories of past seasons nearly so often as males so that the computed survival of males is probably much more accurate and representative. Females often were found some distance from their previous years' nest sites. Banding returns of 18 males known to have lived a total of 35 years indicated that they survived an average of 1.94 years. Since no birds were found dead and none disappeared, except by moving, during the breeding season, I assume that all males died between breeding seasons and probably lived an average of about one-half year additional to the 1.94 years, or 2.44 years. This would be a minimum figure for these adult birds because the ages at which they were banded is not known, except for one bird. Banding returns of 59 females indicate an average age of 1.36 years but again, the females are less prone to return to the previous nesting areas.

HISTORIES OF PAIRS

♂ 38–70502 × ♀ 38–34101 (Fig. 7)

1938 Nest 1

Nest completed May 7; six eggs laid May 8–13; two Cowbird eggs laid May 12; eggs destroyed by some predator May 18; four eggs May 12 weighed 8.7 gm. Female weighed 16.0 grams May 15.

1938 Nest 2

Nest revamped in same site as above nest; five eggs laid May 23–27; one Cowbird egg laid May 25, the same day Prothonotary egg number 1 was found with a bill hole in it. This egg and egg number 2 disappeared May 27; eggs 3 and 4 hatched June 8, egg 5 on June 9; three young left nest June 18 when I touched the house. One landed in river where it swam 50–60 feet (15.1–18.1 meters) to shore; both parents fed young June 26. Eggs measured 18.5 × 14, 19 × 15.5, 19 × 15.5, 19 × 15.5 and 19 × 15.5 mm. Three eggs weighed 6.4 gm. on May 28.

1939 Nest 1

This pair remated the second year. The male first observed May 9; female building nest May 14 in the site of her two 1938 nests; six eggs laid May 21–26; predator destroyed eggs May 27. Birds not seen during remainder of summer. Eggs measured 18 × 15, 18.5 × 15, 18 × 15, 18 × 15, 18.5 × 15.5 and 18.5 × 15.5 mm., and weighed 13.2 gm. on May 26.

Unbanded male × ♀38–34101

1940 Nest 1

Nest with five young about two days old found June 12 in rotted portion of a live ash tree along river bank; five young, including male 40–29355, left nest June 21. Eggs probably laid May 24–28.

The following history pertains to 40–29355 (Fig. 4), son of female 38–34101. During the summer of 1941 he was not positively identified but a pair of Prothonotaries used the same territory that he used during the following four summers. The female was banded 41–73211 and her nest with five eggs was found June 15, but these eggs were destroyed by some predator July 3 or earlier. The nest was in a maple stub on the river bank and 18 feet (5.44 meters) above the water.

♂40–29355 × ♀41–73373

1942 Nest 1

Found with four eggs June 11; June 25, four young; July 3, young and adults gone. Nest in maple stub which had fallen into river and extended about four feet (1.23 meters) above normal water level.

♂40–29355 × ♀41–73269

1943 Nest 1

Nest with two eggs found May 27 in bird house; May 30, nest torn to pieces and eggs gone. House Wren had replaced nest with sticks.

1943 Nest 2

Nest with two young about two days old and three unhatched eggs found June 24; July 1, two young left nest as I photographed them during mid-afternoon when hot sun beat on their stub, a small white ash on river bank. Nest five feet (1.53 meters) above water. Young flew 10 to 18 feet when they left the nest.

♂ 40–29355 × ♀ 140–32248

1944 Nest 1

Female building nest May 14 in nest box; six eggs laid May 20–25; six young hatched about June 8–9; six young left nest about June 17, all banded.

♂ 40–29355 × ♀ 40–29350

1945 Nest 1

Male returned May 6. Nest found in bird house (same house in which this male nested early during 1943, but a different one than that in which he nested during 1944), May 24, containing five eggs and three Cowbird eggs (the box top was ajar as was sometimes found in the spring); eggs probably laid May 18–22; four young Prothonotaries hatched June 4–5; one young Cowbird hatched. Young banded June 14 and left nest June 15.

1945 Nest 2

On June 28 found nest with two eggs in another bird house farther downstream. On July 12, nest was empty and parents could not be found.

Male 40–29355 had a different mate each year and none had been banded previously. These mates laid 32 eggs of which 16 hatched (50.0 per cent) and 12 young (37.5 per cent) left the nest. His mother was known to lay 22 eggs in three summers. Of these eggs, 8 hatched and 8 young (36.4 per cent) left the nest.

♂ 139–96601 × ♀ 39–54195 (Fig. 3)

1939 Nest 1

Nest with five eggs found June 9 (eggs probably laid June 1–5); four eggs hatched June 16 or 17 and four young left the nest June 27 or 28. Nest two and one half feet (76.8 cm.) above ground in rotted top of small dead maple (4 inches in diameter).

♂ 139–96601 × ♀ 40–29312

1940 Nest 1

Nest found July 3 with two newly hatched young and one infertile egg. Eggs probably laid June 16–18. Young left about July 12. Nest two feet (61 cm.) above ground in rotted end of maple stub blown over in bottomland.

♂ 139–96601 × ♀ 41–73204

1941 Nest 1

Nest with five eggs found June 5 in same site as 1940 nest. Still contained five eggs June 15. When I arrived at 2 p.m. June 19 both parents were scolding a pilot black snake (*Elaphe obsoleta*) that was wrapped around the stub and had its head inside the nest. When killed it was found to have swallowed all five young which were about two days old.

♂ 139–96601 × ♀ 40–29310

1942 Nest 1

Found May 15 with one egg and four Cowbird eggs in a semi-open bird house on river bank. Nest destroyed by some predator before June 8.

1942 Nest 2

Found June 21 with five newly-hatched young. One still had pieces of egg shells around it. Four left nest about June 30. Nest eight feet (2.45 meters) above ground in natural hole in six-inch (15.3 cm.) maple.

♂ 139–96601 × Unbanded ♀

1943 Nest 1

Nest found June 17 in natural opening in small maple 18 feet (5.44 meters) above ground. Seven eggs found in nest. Although in good location it was torn to pieces by some predator June 20.

Male 139–96601 had a different mate in each summer for five years. These mates laid 26 eggs of which 16 (61.5 per cent) hatched and 10 young (38.5 per cent) left the nests. Five of the young were eaten by a pilot black snake; another disappeared from its nest.

A female, 37–103940 was banded during 1937. During the four summers I observed her, I was able to capture but one of her mates. During 1938 she did not nest on the study area.

♀ 37–103940 (Fig. 6)

1937 Nest 1

Four eggs laid June 16–19 measured 18 × 14.5, 18.5 × 15, 19 × 16, and 17.5 × 14.75 mm. and weighed 7.5 gm. She weighed 13.6 gm. June 18. Her nest was flooded June 26.

1939 Nest 1

Five eggs laid May 22–26; three measured 17.5 × 13.5, 17.5 ×14, and 18 × 14 mm., and weighed 6.1 gm. Two eggs disappeared, but three hatched and three young left nest June 18–19. Female weighed 16.7 gm. on May 24.

1939 Nest 2

Four eggs laid June 27–30 measured 18 × 14, 18 × 14.5, 18 × 15, and 18 × 15 mm. and weighed 7.2 gm. Destroyed by predator July 6.

1940 Nest 1

Four eggs laid May 25–28 measured 18 × 14.5, 17.5 × 13.5, 18 × 14, and 17.5 × 14 mm. and weighed 7.2 gm. Predator devoured eggs June 2. Female weighed 16.0 gm. May 27.

1941 Nest 1

Nest found June 1 with four young and two infertile eggs. The two eggs measured 17 × 13 and 18 × 14.5 mm. The six eggs were probably laid May 14–19; four young left nest June 10.

1941 Nest 2

Five eggs laid June 14–18 measured 18 × 14.8, 18 × 15, 18.2 × 14.5, 18.5 × 15, and 18.5 × 15 mm., and weighed 10.6 gm. Nest destroyed by predator July 3.

During the five years that she lived on or near the area I found six nests of female 37–103940 containing 28 eggs of which 7 hatched and 7 young left the nests (25.0 per cent). Her eggs averaged 17.94 × 14.45 mm. in measurements and 1.93 gm. in weight. During 1940 her daughter nested about one quarter mile downstream from her. Her daughter, 39–54051, during the summer of 1940, laid 11 eggs which averaged 17.8 × 14.8 mm. in measurements and 2.1 gm. in weight.

Unbanded male × ♀ 39–54051 (daughter of 37–103940) (Fig. 6)

1940 Nest 1

Three eggs laid in bird house on river bank May 29–31. Nest 1436 feet (434 meters) from nest site in which 39–54051 was hatched June 7 or 8, 1939. Her eggs in this nest all measured 18 × 14.5 mm., and weighed a total of 6.1 gm. Some predator took the eggs between June 8 and 11.

1940 Nest 2

Found June 16 in rotted portion of maple stub directly across river from nest 1. Three eggs in nest measured 16.8 × 15, 17.8 × 15, and 18 × 15 mm. There were also two Cowbird eggs, but all were destroyed by some predator, June 19.

1940 Nest 3

Three eggs laid June 23–25 measuring 18 × 15, 18 × 15, and 18.8 × 15 mm., disappeared June 26. Nest two feet (61 cm.) above ground in small maple stub 22 feet (7.1 m.) from nest 1.

1940 Nest 4

Found July 2 with two eggs measuring 18 × 15 and 17 × 14.8 mm., which had disappeared July 3. A House Wren had replaced nest with sticks. Nest in same bird house as nest 1.

Weights and Measurements

Newly hatched Prothonotary Warblers range in weight from 1.1 to 1.9 gm., averaging for 16 individuals 1.84 gm. When one week old they usually weighed more than 12 gm., but gained little more by the time they left the nest at ten or eleven days. Wings measured about 6 mm. at hatching and increased to 51 mm. at 11 days; tarsi from 5 to 19 mm.; exposed culmens from 3 to 9.5 mm.

Sixty-one adult females fom Michigan averaged 17.4 gm. (13.6–20.0) in weight; their wings averaged 68.9; exposed culmens, 13.77; tarsi, 18.44 mm. Of 18 males, the average weight was 14.95 (13.6–15.8) gm.; wings, 73.8 mm.; exposed culmens, 14.4; tarsi, 19.6. Wings were measured, unflattened, with a straight-edge ruler from the bend to the tip of the longest primary.

Summary

A nesting study of the Prothonotary Warbler (*Protonotaria citrea*) was made in Calhoun County, Michigan from 1937 to 1948. The study was made in a plot two-thirds of a mile long (1069 meters) and about 88 acres (35.62 hectares) in area, along the Battle Creek River.

Of 84 nests, 29 were over standing water, 32 over running water or its edge, and 23 over dry land. The latter were from .61 to 137.8 meters from the river bank. Of the 84 nests, 43 were in natural openings and 41 in woodpecker holes, usually those formerly used by the Downy Woodpecker. Forty-one nests were from 61 to 152 cm. above ground or water; 21 from 152 to 304, and 20 from 304 to 450: two nests were still higher, the highest being 10.4 meters above ground.

Males usually selected the first nest site and often carried moss into the opening before the arrival of the female. Battles over territory often lasted several days. A nest site was often selected and territory established around it.

In Michigan, an average of 14 pairs nested on the 88 acres from 1937 through 1943. In 1941, the average size of territory was 3.66 acres (148 ares) with extremes 1.9 and 6.38 acres (76.8 and 258 ares). Smallest were three territories each of about 1.9 acres.

Two males were studied in detail through five summers of nestings. One, 139–96601, had two nests 412 meters apart during 1942, but in the five summers occupied an area of about 9.46 acres (3.82 hectares). The other male, 40–29355, banded as a nestling, returned to use an area of about six acres during four summers, the average size per summer being about 3.16 acres (127.8 ares). A third male had a different territory for each of three summers while yet another had two that overlapped in different years, then a different one the third year. Females returned less often. One female lived at least five years, but was found during only four. She apparently had a new mate each summer as did the two males for which I have five-year records. The greatest distance between her nests of 1937, 1939, 1940, and 1941 was 2423 feet (732 meters).

During 10 summers the average date of arrival of the first male was May 4 (April 26–May 14): the average date of the first laid egg, May 18 (May 8–25); and the termination of the last nesting, July 8 (July 6–14). The average measurement of 297 eggs was 18.26 ×14.62 mm., and the average weight, 2.06 gm. The average number of eggs in 94 sets was 5.07 (3–7) and the average set weight, 10.45 gm. First sets of eggs are larger, as demonstrated earlier (Walkinshaw, 1941. *Wilson Bull.*, 53:10).

The female does the incubating, but at times is fed by the male. Usually she leaves the nest to receive food. During 376 minutes at a nest in 1948, the female incubated 303 minutes (80.6 per cent) of the time, in periods of from 39 to 66 minutes duration. Inattentive periods (19.4 per cent) varied from 7 to 19 minutes. The male usually sang less than 50 meters from the nest; 85 per cent of his perches were in the shade and were from 1.22 to 10.6 meters above the ground or water. Rates of singing in the early morning are 7 to 8 songs per minute; during mid-day, 1 to 4. The number of syllables varied from 7 to 12. In 1948, a total nesting census was made. Forty species of birds and 105 pairs nested on the 88 acres–a density of 119 pairs per 100 acres.

Male Prothonotary Warblers have been observed to chase all birds that came within a few feet of their nests. Near one nest Bronzed Grackles were scolded much more than other birds, and squirrels also were chased away.

On June 8, 1948, a male Prothonotary began to sing at 4:37 a.m. The female left the nest for the first time at 5:32 a.m. and the male made 17 trips with food to the newly hatched young while the female made three between 4:52 and 7:15 a.m. The female left the nest for four periods averaging 9.7 minutes (8–13) and remained on the nest an average of 18.6 minutes (15–23). On June 13, between 12:45 and 3:00 p.m., the female did not brood the young; the male fed ten times with an average of 10.4 minutes (2–28) between feedings; the female fed nine times and averaged 9.9 minutes between feedings (1–25).

Of 178 Michigan nests, 50 (28.1 per cent) were successful in that at least one young left the nest. Of 645 eggs, 262 (40.6 per cent) hatched and 191 (29.6 per cent) young left the nest. Two of 138 banded nestlings returned the next year. One returned one year; the other, five. In 11 years, 1937–1947, 58 adult females were banded. Based on returns, the average age of these birds was at least 1.86 years. Males were more faithful in returning to past years' territories. Eighteen were banded of which nine returned the first year, five the second, two the third, and two the fifth.

One pair of Prothonotaries nested twice in the same bird house in 1938 and once in 1939. The female mated with a new male during 1940. In three summers she was known to produce eight young from 22 eggs. One of these, a male, apparently had a different mate each year for five summers. His mates laid at least 32 eggs of which 16 hatched and 12 left their nests. Another male was observed for five summers and had a new mate each year. His mates were found to lay 26 eggs, hatching 16, and 10 young left the nest. A pilot black snake devoured five of their young.

During four summers I observed 21 eggs of one female which averaged 17.94 × 14.45 mm. in size and 1.93 gm. in weight. One summer her daughter, when one year old, laid 11 eggs averaging 17.8 × 14.8 mm. and 2.1 gm.

Newly hatched Prothonotaries range in weight from 1.1 to 1.9 gm. (average, 1.84 gm.). When they left the nest at 10 or 11 days of age they weighed over 12 gm. Sixty-one females averaged 17.44 gm. (13.6 to 20.0) in weight; 18 males averaged 14.9 (13.6 to 15.8) gm. Wings of the females averaged 68.9 mm.; exposed culmens, 13.8 mm.; tarsi, 18.4 mm. In the males, wings averaged 73.8; culmens, 14.4; and tarsi, 19.6 mm.

1703 Wolverine Tower, Battle Creek, Michigan, January 19, 1952

WOOD WARBLERS WINTERING IN CUBA

BY STEPHEN W. EATON

LITTLE is known concerning the winter behavior of the various species of North American wood warblers (Parulidae) which retire south of the United States in the fall. Are they sedentary or do they wander over broad geographic areas? What degree of sociality among individuals and species is present? Because of the abundance of warblers in Cuba during the winter this island is an ideal place to study these questions.

From December 23, 1948 to January 3, 1949 I was on the island of Cuba with Ernest P. Edwards and George E. Grube. We stayed at the Harvard University Tropical Station which is approximately ten kilometers northeast of Cienfuegos. Habitats typical of this locality were well described by Barbour (1922:16–17).

Much of the land in this area has been cleared of its native vegetation to make way for sugar cane and pasture. The areas still forested are located on limestone outcrops, along fresh and brackish water streams, and along fence rows. Because of the abundance of termites, fences are of live trees, principally *Bursura* sp. and *Gliricidia* sp. The winter fruits of these trees and their insect fauna attract many birds.

My primary objective was to study the winter habits of the Ovenbird (*Seiurus aurocapillus*), Northern Water-thrush (*Seiurus noveboracensis*), and Louisiana Water-thrush (*Seiurus motacilla*). Three areas of habitat typical for these birds were chosen for study. The Ovenbird was found in upland woods; the Northern Water-thrush in and adjacent to mangroves; and the Louisiana Water-thrush along wooded fresh-water streams. Notes were taken on all parulids as well as on other species. For the most part the wood warblers present in the region were species which also winter in extreme southern Florida and throughout the Greater and Lesser Antilles.

Individual and Specific Sociality

The warblers were found (1) singly, (2) in flocks of one species, or (3) in flocks of several species. Species tending to be solitary (category 1) were the Louisiana Water-thrush, Ovenbird, Northern Water-thrush, Swainson's Warbler (*Limnothlypis swainsonii*), and Cape May Warbler (*Dendroica tigrina*). The Ovenbird and Northern Water-thrush were sometimes seen near mixed flocks of other species but were usually encountered as single individuals. All of these are primarily terrestrial or semiaquatic feeders except the Cape May Warbler which was usually seen feeding singly about bromeliads or trees in flower. In the second category was the Palm Warbler (*Dendroica palmarum*). Flocks numbering up to ten individuals, usually feeding in open fields, were seen on several occasions. However, they were also found in other

Table 1

Mixed Flocks of Warblers in Cuba

	Mangroves		Upland Woods						Wooded Stream Border					
	Flock Number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Black and White Warbler		1	1		1	1	2	1	1			1		
2. Parula Warbler	5	3	1	1	1	1		3			1	1		
3. Black-throated Blue Warbler					1	1	1		1	1	1	1	1	1
4. Prairie Warbler		1				1		1			1			1
5. Redstart	4	3	2		2	3	3	4		1	1	1	1	1
6. Tody	1	1	1	1	1									
7. Loggerhead Flycatcher		1				1	1							
8. Greater Antillean Pewee			2	1	1	3	2							
9. Cuban Vireo							2							
10. Yellow-throated Vireo						1	1							
11. Palm Warbler			1						1	1	1	1		
12. Ovenbird	1			1	1	2	2	1						
13. Northern Water-thrush	2	1												
Total individuals per flock	13	11	8	4	8	14	14	10						

Species 1 through 5 are considered "nucleus species" and 6 through 13 "circumference species." Circumference species in the wooded stream border were not recorded in my field notes.

types of habitat and were sometimes seen singly. They were seldom found in mixed species flocks. The Yellow-throat (*Geothlypis trichas*) was often seen in loose aggregations but never in relatively compact flocks as was the Palm Warbler which fed in open fields and at the borders of fields. Flocks of several species (category 3) usually included the Black and White Warbler (*Mniotilta varia*), Parula Warbler (*Parula americana*), Black-throated Blue Warbler (*Dendroica caerulescens*), Prairie Warbler (*Dendroica discolor*), and the Redstart (*Setophaga ruticilla*). These aggregations were encountered in all three study areas (see Table 1). The mixed species flocks of winter birds, familiar in the northern United States, variously composed of chickadees, nuthatches, woodpeckers, kinglets, and brown creepers, seemed to be paralleled here by these wintering warblers. The groups moved gradually through the woods, each species of the flock feeding in its own fashion within fairly consistent altitudinal limits. Black and White Warblers searched for food hidden in the tree trunks; Parula, Yellow-throated, and Prairie Warblers hunted the tops and central areas of the trees; Black-throated Blue Warblers fed mainly close to the ground; and Redstarts fluttered from ground to tree-top after flying insects. Indigenous species sometimes associated with these flocks, particularly in the upland woods, were the Cuban Tody (*Todus multicolor*), Loggerhead Flycatcher (*Tolmarchus caudifasciatus*), Greater Antillean Pewee (*Contopus caribaeus*), and the Cuban Vireo (*Vireo gundlachii*).

On three occasions I heard excited chipping from some or all of the species in these flocks which seemed to indicate they were in close communication with one another. Two of these incidents occurred after I shot a member of such a group. A third seemed to start spontaneously, all members of the mixed group beginning to chip excitedly. The cause of the excitement was never discovered. I looked hard for a Cuban Pygmy Owl (*Glaucidium siju*), known to occur locally, or some other predator but never succeeded in locating one.

Territoriality

Most of the solitary warblers seemed to remain within rather well circumscribed areas. An Ovenbird, assumed to be the same individual, could always be found in an open greenhouse within the confines of the Tropical Station. However, none of the warblers studied, except the Louisiana Water-thrush showed obvious territorial tendencies. This species appeared to be established in distinct feeding areas along fresh water streams. Ten individuals occurred over a distance of about one kilometer along a stream. On three occasions I visited this area and each time Louisiana Water-thrushes were seen in the same locations along the stream. As I walked up the stream one bird would flush from the bank and fly upstream approximately 100 meters in two or three short flights. Then the bird would fly around me downstream or engage

in a fight with another Water-thrush. These fights, of which three were seen, were brief encounters involving a flashing of wings and short aerial chases. Before and during these engagements chipping was loud and frequent and was followed by a "sputtering" sound from one or both of the birds. This behavior pattern suggested somewhat the defense of territory by the male on the breeding grounds (Eaton, 1949). The last day I visited this area I was able to collect five of these birds all of which proved to be males.

Miscellaneous Observations

The Black and White Warbler was the only species of warbler heard singing and was heard only twice during intraspecific fighting. It was interesting to note the presence of vertebrate bones in warbler stomachs. Bones of small amphibians were found in stomachs of the Louisiana Water-thrush and bones of small lizards in stomachs of Swainson's Warbler, Worm-eating Warbler (*Helmitheros vermivorus*), and Ovenbird.

Discussion

The solitary species were more sedentary and restricted in their choice of feeding areas than the species in mixed flocks. The Ovenbird fed on the ground but hopped up into the tree canopy to seek shelter. The Northern Water-thrush fed on the ground and along edges of pools but when disturbed flew into the dense tangles of mangroves. These essentially solitary individuals became loosely associated with mixed flocks only when seeking cover. Louisiana Water-thrushes were never seen with mixed species flocks. They seldom left the stream border. These three species range in weight from 15 to 21 grams in contrast to members of mixed flocks which range from 7 to 11 grams. The Cape May Warbler, the last of the normally solitary warblers here considered, was usually seen near flowers, which at this season were not generally distributed. This fact may explain why the Cape May seldom wanders with mixed flocks.

The Palm Warbler was considered by Todd (1940:534) to be sparrow-like in its haunts and habits, particularly in the fall. Trautman (1940:365) said (Ohio): "The bird habitually flocked by itself in a brushy thicket of less than an acre in extent. . . ." Palmer (1949:483) said it was gregarious and social in the fall and often accompanied other warblers as well as juncos. This gregariousness seemed to be maintained into the winter in Cuba—a unique habit for a member of this family. This inclination of the species to feed in open areas may well account for the single species flock. A parallel may be drawn here to pure flocks of juncos, Tree Sparrows (*Spizella arborea*), and blackbirds which feed in open areas during the non-breeding season. Allee (1938) mentions examples from other groups: including the grouping of foreigners

in a strange city, the schooling of fish in a clean aquarium, and the flocking tendency of mammals on the grassy plains of the temperate zones.

Chapin (1932:220–224) wrote of mixed flocks in the Belgian Congo and spoke of their presence there at all seasons. Winterbottom (1949:258) suggested that species of woodland bird parties of Northern Rhodesia fall into two categories: "nucleus" species, always found in parties; and "circumference" species which formed mixed parties by attaching themselves to groups of nucleus species. Davis (1946:tables II and III) classified birds, in mixed flocks in Brazilian forest, as regular or accidental in respect to their membership in the flocks. The mixed flocks of warblers I saw in wooded habitat in Cuba seemed to suggest similar associations. Nucleus species appeared to be the Black and White Warbler, Parula Warbler, Prairie Warbler, Black-throated Blue Warbler, and Redstart. Redstarts and Parula Warblers were represented in flocks by from two to five individuals—other nucleus species usually by one individual. Circumference species included the Ovenbird, Northern Water-thrush (in mangroves), Cuban Tody, Loggerhead Flycatcher, Greater Antillean Pewee, Cuban Vireo, and Yellow-throated Vireo (*Vireo flavifrons*). It must be remembered that my data merely suggest these categories and further work should be done before further generalizations are made.

The sedentary habits of wintering warblers have been previously observed. Wetmore (1943:318) wrote of a Redstart which fed in a very restricted area near his camp in Veracruz. The Louisiana Water-thrushes which I observed in Cuba had feeding territories which averaged 100 meters in length—approximately one quarter the length of the average breeding territory (Eaton, 1949). Another species which frequents the borders of streams shows a similar type of feeding territory. Bent (1948:109), writing of the Dipper (*Cinclus mexicanus*), said that even though the territories are shorter in winter, they seem to be fairly well maintained.

Summary

North American warblers wintering in Cuba are either solitary or occur in flocks of one or several species. Large ground-feeding species and species which habitually feed near flowering plants usually occur as solitary individuals. Species feeding in open fields tend to occur in pure flocks. Mixed aggregations usually consist of small species which feed within canopies of heavily wooded areas. Perhaps these flocks have some survival value. They appear to be counterparts of Winterbottom's "nucleus" and "circumference" species.

The solitary warblers seemed to be sedentary but the only species seen actively defending a feeding area was the Louisiana Water-thrush.

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WINTER DISTRIBUTION OF ROBINS EAST OF THE ROCKY MOUNTAINS[1]

BY J. MURRAY SPEIRS[2]

Distribution during December, January, and February

MUCH has been written dealing with the distribution of American Robins (*Turdus migratorius*) during the winter months, mostly from the point of view of specific occurrences at given localities. Robins have been recorded wintering from St. Johns, Newfoundland, in the northeast, to Winnipeg, Manitoba, in the northwest, and south into Mexico.

Cooke (1884) gave a very good account of Robin distribution during one winter. He stated: "During the larger part of the month of January the bulk of the Robins, and probably even ninety-five to ninety-seven per cent, were south of the parallel of 37°. This is south of the usual limit, the northern boundary for ordinary winters being 39°."

The A.O.U. Check-List (1931:255–256), apparently following Cooke in regard to the northern boundary, states that the Robin "Winters from central Kansas, Ohio Valley, and eastern Massachusetts (irregular farther north) to the Gulf coast and southern Florida, and to Nuevo Leon, Mexico."

Several authors have shown that Robins occur quite regularly in many localities north of the Cooke-A.O.U. boundary, from Nova Scotia in the east to northern Minnesota in the west (Lewis, 1919; Roberts, 1932:112–113).

The most northerly winter records of Robins I have found in the literature and from correspondence include Winnipeg, Manitoba (Cartwright); Fort Frances, Ontario (Robertson); Port Arthur, Ontario (Allin); Ottawa, Ontario (Eifrig); Point des Monts, Quebec (Comeau); and St. Johns, Newfoundland (Hawley). Robins winter regularly in small numbers as far north as the lower Great Lakes, and large numbers have occasionally been reported in winter from Duluth, Minnesota, and from Cleveland, Ohio.

Brooks (1934) published a map showing for each state and province (1) the number of Christmas bird censuses which had been made during the previous 34 years, (2) the number of censuses on which Robins were seen, and (3) the number of individual Robins seen. This map shows that, in the 34-year period, some Robins had been reported from every state east of the Rocky Mountains (except Vermont) and from the provinces of Ontario and Quebec.

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

[2] I wish to thank Mr. Frederick C. Lincoln, who kindly gave access to the banding records of Robins in the files of the Fish and Wildlife Service; Dr. S. Charles Kendeigh and Dr. Josselyn Van Tyne for their constructive suggestions and careful reading of the manuscript; and Doris H. Speirs for her encouragement and ready assistance at all times.

Map 1 (left). Winter range of Robins as indicated by banding recoveries (but see also Map 2). The crosshatched area includes localities from which banded Robins have been recovered in December, January, and February. The heavy lines indicate the average positions of the 40°F, 50°F. and 60°F isotherms for January (Kincer, 1928). The December and February isotherms are slightly farther north.

Map 2 (right). Relative density of Robin populations in late December. The degree of shading indicates the density of Robin populations in late December, as indicated by Christmas censuses taken in 1938, 1939, and 1940. No Robins were reported on censuses taken north of the upper line; less than 10 Robins per census party were observed in the most lightly shaded area between the two upper lines; between 10 and 100 Robins per census party were reported in the next most heavily shaded area; over a hundred Robins per census party were reported in the area indicated by cross hatching; the darkest areas indicate regions where over a thousand Robins per census party were reported.

On September 13 and 14, 1940, Doris H. Speirs and the writer were given access to the Robin banding records in the files of the U. S. Biological Survey (now U. S. Fish and Wildlife Service) at Washington. We listed all records for Robins recovered at localities more than 50 miles distant from the station where they were originally banded, for all states and provinces east of the Rocky Mountains. Maps similar to Maps 4, 5, and 6 have been prepared for each of these states and provinces, showing corresponding points of banding and recovery.

Map 1 shows the 348 localities where 405 banded Robins were recovered during the months of December, January, and February. One locality is not shown (a Robin was recovered in December at Pachuca, Hidalgo, Mexico—about 800 miles south of San Antonio, Texas). Most of the winter recoveries have been in the Gulf States and the Atlantic Coast States from Florida to North Carolina. Actually 79 per cent of the recoveries have been from the Gulf States and 99 per cent have been south of 37° N. latitude.

Map 2 summarizes the Robin population data from the 1938, 1939, and 1940 "Christmas censuses" published in *Bird-Lore* and the *Canadian Field-Naturalist*. A comparison of Maps 1 and 2 will show that the area in which banded Robins were recovered in winter corresponds fairly closely with the area in which densities of more than one hundred Robins per census party were reported.

Maps 1 and 2 indicate that the area of greatest abundance in winter lies between the latitudes of 30° and 35° N. latitude, with extensions northward into eastern North Carolina and central Tennessee, and southward into the peninsula of Florida and into the wooded regions in southeastern Texas. It will be seen that this excludes the southern tip of Florida, southern Texas, northern Mexico, and from the Ohio Valley to eastern Massachusetts, all of which are included in the winter range as defined in the A.O.U. Check-List. From Map 2 it will be seen that there is a population of Robins north of the region of greatest abundance until at least as late as the Christmas season.

Relationship between Winter Distribution and Temperature

Allard (1928:390) remarks: "It is said [by Cooke, 1904:384–385] that the Robin's migratory movements are determined by a temperature of 35° Fahrenheit yet something makes him quietly forget this so-called determining point in the south throughout the winter." Eifrig (1922:92) wrote that during the mild winter of 1920–21 "there were more Meadowlarks and Robins remaining all winter a few miles south [of Chicago] than usual, but nothing striking." Forbush (1923) wrote: "Robins . . . survived temperatures of 40 below zero" in New England during the winter of 1922–23. Jones (1923) said, "the mild winter . . . made it possible for many birds [including Robins] to spend the winter [1921–22, 1922–23] well north of their usual range." Roads (1930) noted that the Robins were "unusually common" during the open winter of 1928–29 at Hillsboro, Ohio.

Allard's criticism of Cooke's 35° "determining point" is an indirect criticism of Cooke's use of "arrival" dates to represent the time of migration of the species. Cooke was dealing with the earliest birds noted in spring and the latest noted in autumn, whereas Allard was referring to the bulk of the Robin population. Several of the authors quoted above imply that appreciable numbers of Robins occur in the northern states only during unusually mild, or open, winters, whereas Forbush showed that some Robins can survive very low temperatures.

From Map 1 it will be seen that the majority of the winter recoveries of banded Robins have been made in the region lying between the average positions of the 40° F and the 60° F January isotherms. Actually, only about

6 per cent of the winter recoveries occurred in regions north or south of these isotherms.

The 40° F isotherm for January corresponds well with the northern boundary of the region in which less than 15 days per winter have continuously freezing temperatures. In this region it is to be expected that, generally, Robins would be able to find unfrozen ground and a supply of animal food. Temperature, however, is not the only factor important in determining the winter distribution of Robins, as is indicated by the comparative scarcity of Robins in western and southern Texas, much of which lies between the 40° F and 60° F isotherms in January.

Winter Distribution and Ecological Relationships

An abundant literature has dealt with the kinds of berries eaten by Robins at different localities in winter, with the importance of fresh water as well as food, with the types of roost cover (mostly low, dense growth), and to some extent with the general habitat type in particular localities. For details see Black (1932); Corrington (1922); Fargo (1926, 1928); Forbush (1925, 1929: 408); Ganier (1924); Gardner (1933); Hicks (1934); A. H. Howell (1932); Hunt (1921); Larson (1928:110); Lewis (1919); May (1924); McIlhenny (1936, 1940); Miller (1922); Nuttall (1832:338) and Stone (1937:768–773). Cooke (1884:106) stressed the importance of food as a factor in the winter distribution, while Howell (1940, MS) pointed out that insects as well as wild fruits were important as Robin food, particularly in the late winter.

The region in which Robins are most abundant in winter (as shown in Maps 1 and 2) corresponds very closely with the oak-pine and the pine associes of the deciduous forest biome. Even the outlying recoveries shown in Map 1 occurred in wooded areas. The lack of recoveries from the mesquite areas of southern Texas, from the prairies of western Texas, and from the coastal grasslands of Texas and southern Florida indicates that forested areas as well as favorable temperatures are winter habitat requirements.

Observers in the Southern States have found Robin roosts in such evergreens as camphor trees, junipers, bay, gallberry, small pines, cane, cedar, and magnolias. The tendency of Robins to winter in the pine and oak-pine associes, rather than the surrounding regions, may be due to the abundance of good roosting cover in these associes as much as to the greater prevalence and variety of food, though the latter has hitherto been stressed in the literature.

Latitudinal Relationship of Winter and Breeding Distributions

Cooke (1904:374) wrote: "Probably no individual robin is a continuous resident in any section; but the robin that nests, let us say, in southern Mis-

Map 3 (upper left). Winter recoveries of Robins banded in Saskatchewan (11 birds banded between March 29 and July 23) and in Massachusetts (12 birds banded between April 22 and October 21).

Map 4 (upper right). Place of banding of 58 Robins (banded during the summer season) recovered in Texas in winter.

Map 5 (lower left). Place of banding of 116 Robins (banded during the summer season) recovered in Louisiana in winter.

Map 6 (lower right). Place of banding of 60 Robins (banded during the summer season) recovered in Florida in winter.

souri, will spend the winter near the Gulf, while his hardy Canada-bred cousin will be the winter tenant of the abandoned summer home of the southern bird." This concept of a hardy population of Robins from the north coming

south in autumn and displacing the summer residents which then go still farther south to winter has been widely accepted (Forbush, 1929: 408, and Lincoln, 1939:69).

The following analysis of banding data does not support this view. Of 273 Robins banded north of 40° N., the average latitude of winter recovery was 32.0° N. For the 51 of these Robins banded north of 45° N., the average latitude of winter recovery was 31.9° N. For the 17 banded north of 48° N., the average latitude of winter recovery was 32.1° N.

For 46 Robins banded at stations south of 40° N., the average latitude of winter recovery was 32.2° N. For the six of these banded south of 37° N., the average latitude of winter recovery was 33.0° N. These data show a tendency for Robins from all latitudes of their breeding range to winter in about the same average latitude (32° N.). The only tendency to deviate from this, shown by the above analysis, is for the Robins breeding in the most southerly latitudes to winter slightly farther north than those breeding in the north. However, the data for the south are too scanty to more than suggest this tendency at present. The following additional cases may be cited as evidence against Cooke's displacement theory.

An immature Robin, banded at Nashville, Tennessee (36.1° N) by Amelia R. Laskey on June 11, 1936, was found dead at Mt. Juliet, Tennessee (about 15 miles east of Nashville), the following February 14, 1937. Laskey (1947) also reported on a pair of color-banded Robins which nested in her garden at Nashville in July, 1945, and wintered there from December 27, 1945, to March 24, 1946, when the male was killed by a dog.

One Robin was banded at Auburn, Alabama (32.6° N.) on March 6, 1931, and recovered in winter *farther north* than this, at Guntersville, Alabama (34.4° N.) on February 1, 1934. Incidentally, so far as I am aware, this is the farthest south that a Robin has been banded and later recovered more than 50 miles from the banding station.

Longitudinal Relationships of Winter and Breeding Distributions

Several writers have analysed the winter recoveries of Robins banded in particular localities or states: *e.g.*, Beals and Nichols (1940); Brooks (1931: 27); Commons (1938:231); Howell (1940, MS); and Lincoln (1939:134–135). Howell (1940, MS) pointed out the tendency for most of the Robins from Illinois and Iowa to winter directly south of these states, whereas the Massachusetts population wintered mainly in the Atlantic coast states and the Saskatchewan population, mainly in the Gulf coast states. The analyses have generally shown a wide spread in the winter recoveries of Robins which had been banded in relatively small areas, though the majority of the recoveries have been from almost directly south. Exceptions are far eastern birds forced

westward by the Atlantic and far western birds deflected eastward by the prairie. These findings have been corroborated and extended by my study.

Map 3 shows that the bulk of the Saskatchewan Robins winter considerably farther west than the bulk of the Massachusetts Robins, although there is a large overlap in the longitudes of the recoveries from the two regions.

Maps 4, 5, and 6 show that most of the Robins wintering in Texas come from the west, that most of the Robins wintering in Florida come from the east, and that most of the Robins wintering in Louisiana come from the central part of the country. No Robins from the far east have been recovered in Texas, and no Robins from the far west have been recovered in Florida, but Robins from the central area have wintered to some extent in both: and Robins from both far east and far west have wintered in the central south (Louisiana).

Summary and Conclusions

Analyses of the winter recoveries of banded Robins and of Christmas bird counts indicate that the area in which Robins are most abundant in winter lies between the latitudes 30° N. and 35° N., and extends northward into eastern North Carolina and central Tennessee; southward it includes the peninsula of Florida (north of the everglades) and the wooded regions of southeastern Texas. This winter range differs from that given in the A.O.U. Check-List (1931) in excluding, in the south, the southern tip of Florida, southern Texas, and northern Mexico and, in the north, the Ohio Valley to eastern Massachusetts. The status of the Robin north of this area of greatest abundance is indicated.

Banding evidence indicates that 94 per cent of the Robin population winters between the 40° F. and the 60° F. isotherms. Robins are most abundant in winter in the pine and oak-pine associes of the deciduous forest biome. They decrease in abundance in non-forested or poorly forested areas westward.

Most northern Robins winter in the same latitudes as Robins raised in the south. Robins breeding in the east tend to winter farther east than Robins breeding in the west, but some overlapping occurs.

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EFFECT OF WEATHER ON SPRING BIRD MIGRATION IN NORTHERN ALABAMA

BY THOMAS A. IMHOF

IN VIEW of current interest in trans-Gulf migration, I herewith present the results of a four-year study (1947–1950) of the correlation of spring bird movement with weather at Birmingham, Alabama. In a large area of the Gulf States of Texas, Louisiana, Mississippi, Alabama, and Florida, true transient birds are notably scarce in spring (Lowery, 1946; Williams, 1950a and 1950b; and others). This study covers all night-migrating land birds that winter south of the Rio Grande and that breed east of the Mississippi but not within five miles of the place where I made observations. These 28 species are listed in Tables 1 and 2 and will be referred to in this paper as true transients.

True transients are generally recorded on the Gulf Coast only in weather associated with the passage of a cold front (Burleigh, 1944:9–10; Lowery, 1945:95–96; and others). However, at Birmingham, 220 miles inland, conditions are different. It is my hope that the differences as brought out by this study will increase our understanding of spring migration in the Gulf area.

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Methods

Within the periods March 1 to June 1 inclusive, in the four years of the study, I was afield on 130 days, averaging 32.5 days per spring period (93 days). Trips afield varied from one-half hour to 10 hours and averaged 2.15 hours. All daylight hours were included with most coverage between 6 and 9 a.m. Habitat coverage was approximately as follows: oak-pine woodland (65% hardwoods, 35% pine), 80%; lake shore, 8%; suburban residential areas developed from oak-pine woodland, 5%; farmland, including fallow fields mostly in broomsedge and aster, 3%; cattail marsh, 3%; and open short-grass airport, 1%. Numbers of species and individuals of true transients observed were recorded and correlated with weather data from the Birmingham station (U. S. Dept. Commerce, Weather Bureau, W.R.P.C., Chattanooga, Tenn., 1947-1950).

Detailed graphs were made showing a norm line based on more than 55 years of weather observations with adverse weather charted below this line and favorable weather above. Elements considered were wind direction and velocity, sky cover, precipitation, and departure from the normal temperature. These detailed graphs for March, April, and May, 1947 to 1950, are the bases for Tables 1, 2, and 3. Five weather factors were considered: *cold front, adverse* (north) *wind, south wind, rain alone* (*i.e.,* in absence of a front), and *clear, warm* weather. The frequency of occurrence of each factor is shown in Table 3, Column 1, covering the period when true transients were recorded (see footnote to Table 3).

A rather even sample of weather adverse due to one or another of the causes listed was obtained, as shown in Table 3, Column 2. Anyone afield at Birmingham notices that true transients are scarce in clear, warm weather. This is a characteristic of the Gulf Coast hiatus (Williams, 1950b:182)—hence I was seldom afield in such weather. However, I obtained sufficient data to show that the number of true transients seen per day under such conditions is considerably lower than during adverse conditions (see Table 3, Column 7).

In other words it should be understood that adverse weather, as here used, means weather adverse to migration of birds (*i.e.,* favorable for observation of grounded migrants), while favorable weather (*clear, warm* and to a lesser extent, *south wind*), being good for migration of true transients, is unfavorable for observation and results in few such birds being seen.

Weather Principles

The U. S. Weather Bureau, on the reverse side of its daily weather map for Monday of each week, states:

> The boundary between two different air masses is called a front. Important changes in weather and temperature often occur with the passage of a front . . . The boundary of relatively cold air of polar origin advancing into an area occupied by warmer air, often of tropical origin, is called a cold front. The boundary of relatively warm air advancing into an area occupied by colder air is called a warm front. A boundary between two air masses, which shows little tendency at the time of observation to advance into either the warm or the cold areas, is called a stationary front. Air mass boundaries are known as surface fronts when they intersect the ground, and as upper air fronts when they do not.

Winds in the northern hemisphere rotate clockwise around a high pressure area and counterclockwise around a low pressure area. The typical cold front has a low pressure area at its eastern or northern end. Hence winds in the warm sector are southwesterly, passing counterclockwise around the eastern end of the low and usually producing a warm front. On the western side of the low, this counterclockwise rotation produces a NW wind which pushes

Table 1

Weather at Birmingham in Spring in Relation to Migrants Breeding North of Alabama

*Species**	*Winter Range†*	*Main Flyway†*	*No. of migrants seen with each weather factor. (Column A, no. of records; Column B, no. of individuals.)*											
			Cold Front		Adverse Wind		South Wind		Rain Alone		Clear Warm		Total	
			A	B	A	B	A	B	A	B	A	B	A	B
Chestnut-s. Warbler	CA	M,A	4	4	3	15	1	2	3	16	1	1	12	38
Bobolink	SA	A	2	247	4	30	1	2	3	3			10	282
Bay-br. Warbler	SA	A	3	8	3	23	2	12	2	3			10	46
Black-poll Warbler	SA	A	2	17	2	5	2	11	3	33			9	66
Blackburnian Warbler	SA	A	2	2			2	5	4	5	1	1	9	13
Olive-b. Thrush	CA&SA	M,A	2	8			3	5	3	9			8	22
Rose-br. Grosbeak	CA&SA	M,A	2	3	1	1	2	10	2	3			7	17
Veery	SA	M,A	1	2	1	1	2	7	2	6	1	1	7	17
Tennessee Warbler	CA&SA	M	2	3	1	4	1	1	2	9			6	17
Magnolia Warbler	WI&CA	M,A	2	5	2	6			2	3			6	14
Gray-cheeked Thrush	SA	M,A	1	3	1	2	1	1	1	2			4	8
Golden-w. Warbler	CA	M	1	1			3	5					4	6
Cape May Warbler	WI	A	1	1			1	1	2	3			4	5
Black-billed Cuckoo	SA	A					1	1	1	2			2	3
Philadelphia Vireo	CA	M,A	1	1									1	1
Least Flycatcher	CA	A			1	1							1	1
16 species			26	305	19	88	22	63	30	97	3	3	100	556

* Spring records of others: Olive-sided Flycatcher (*Nuttallornis borealis*), SA; Nashville Warbler (*Vermivora ruficapilla*), CA; Black-throated Blue Warbler (*Dendroica caerulescens*), WI, A; Northern Water-thrush (*Seiurus novaboracensis*), WI, A; Connecticut Warbler (*Oporornis agilis*), SA; Mourning Warbler (*Oporornis philadelphia*), CA& SA, M; Wilson's Warbler (*Wilsonia pusilla*), CA; and Canada Warbler (*Wilsonia canadensis*), SA.

† Peterson, 1947

the cold air southeastward and invades the warm sector (U. S. Dept. Agrieulture Yearbook, 1941). This explains the wind shift from SW to NW when the

Table 2

Weather at Birmingham in Spring in Relation to Migrants Breeding In Alabama but not near the Site of Observation

Species*	Winter Range†	Main Flyway†	No. of migrants seen with each weather factor. (Column A, no. of records; Column B, no. of individuals.)											
			Cold Front		Adverse Wind		South Wind		Rain Alone		Clear Warm		Total	
			A	B	A	B	A	B	A	B	A	B	A	B
Black and White Warbler	US	M,A	9	27	3	7	5	13	8	16	1	4	26	67
Cerulean Warbler	SA	M	7	15	2	2	4	25	4	7			17	49
Ovenbird	US	A	5	10	3	13	3	11	6	7			17	41
Scarlet Tanager	SA	M,A	3	11	4	6	4	26	4	23	1	1	16	67
Am. Redstart	WI, CA, SA	M,A	3	6	3	9	4	5	3	4	1	1	13	24
Black-thr. Gr. Warbler	CA	M,A	3	6	3	3	3	3	2	3			11	15
Eastern Kingbird	CA&SA	M,A	3	28	1	14	3	10			1	4	8	56
Worm-eating Warbler	WI&CA	M,A	2	4			2	5	2	3			6	12
Blue-winged Warbler	CA	M,A	1	1	1	1	1	1	1	1			4	4
Parula Warbler	US	M,A	1	1	1	1	2	2					4	4
Yellow-thr. Warbler	WI	A	1	2	1	3	1	1					3	6
La. Water-Thrush	CA&WI	A	1	1	1	1							2	2
12 species			39	112	23	60	32	102	30	64	3	9	127	347

* Spring records of others: Warbling Vireo (*Vireo gilvus*), CA, breeds rarely in nw Ala.; and Baltimore Oriole (*Icterus galbula*), CA&SA, breeds or bred rarely in n. Ala.

† Peterson, 1947.

typical cold front approaches from the northwest (see Figs. 1 and 2). This invasion of cold air generally blocks migrating birds in spring.

Correlation of Migration with Weather

Cold Front.—Because nearly all lows and highs pass north of Birmingham, winds there shift clockwise (veer) completely around the compass, producing a typical weather cycle lasting usually from two to ten days. Starting with a SW wind, we find that this brings in the warm, moist, light air from the Gulf of Mexico, resulting in cloudy weather and rain. Then comes the *cold*

front behind which is a wedge of heavy, cold, dry air which forces the lighter Gulf air mass to rise and to precipitate its moisture. The wind shifts immediately to NW, skies eventually clear, and it becomes cold. The attendant low pressure area moves eastward or northeastward and, as the cold air mass behind the front invades the warm sector, migrating birds encounter cloudiness, rain, then clearing, with a head wind and lower temperatures.

Occluded and stationary fronts were considered cold fronts when the wind shifted to northwesterly, although, due to their nature, they were much milder in action.

Typical of 16 observations of migration following a *cold front* is that of May 2, 1949. On May 1, the wind averaged SSE, almost 13 m.p.h., the temperature averaged 5° F. above normal, and precipitation was 1.44 in. May 2 was rainy and heavily overcast, clearing about 4 p.m. with gusty winds. The weather bureau recorded an average wind of 8 m.p.h. from the NNW, temperature 1° F. below normal, precipitation, .08 in. The precipitation followed by a sudden shift to strong northwesterly winds and the drop in temperature are characteristic *cold front* phenomena.

On May 2, during 9 hours in the field, I saw 98 species, 18 of which are considered here as true transients. The latter were: Eastern Kingbird (*Tyrannus tyrannus*), 25; Olive-backed Thrush (*Hylocichla ustulata*), 7; Gray-cheeked Thrush (*H. minima*), 3; Veery (*H. fuscescens*), 2; Black and White Warbler (*Mniotilta varia*), 3; Golden-winged Warbler (*Vermivora chrysoptera*), 1; Black-throated Green Warbler (*Dendroica virens*), 3; Cerulean Warbler (*D. cerulea*), 1; Blackburnian Warbler (*D. fusca*), 1; Chestnut-sided Warbler (*D. pensylvanica*), 1; Bay-breasted Warbler (*D. castanea*), 3; Black-polled Warbler (*D. striata*), 16; Ovenbird (*Seiurus aurocapillus*), 2; Louisiana Water-thrush (*S. motacilla*), 1; American Redstart (*Setophaga ruticilla*), 2; Bobolink (*Dolichonyx oryzivorus*), 240; Scarlet Tanager (*Piranga olivacea*), 6; and Rose-breasted Grosbeak (*Pheucticus ludovicianus*), 1.

Other migrants observed the same day included the Common Loon (*Gavia immer*), Black-crowned Night Heron (*Nycticorax nycticorax*), three species of ducks, Osprey (*Pandion haliaetus*), Barn Swallow (*Hirundo rustica*), three species of transient wrens, and large flocks of many resident species, including Blue Grosbeak (*Guiraca caerulea*), 22. Since these species are resident part of the year at Birmingham, they cannot be considered as true transients for the purpose of this paper although many individuals may be.

Adverse Wind.—The northerly winds, or *adverse winds*, which follow a cold front usually last two or three days and the weather is clear and cool. This weather is characteristic of the eastern side of a high (see Fig. 2). Birds are generally grounded by strong head winds, but when the winds lessen they

probably move on. Lowery (1945:97–98) and Weston (1947:152) say that migrants usually leave the Gulf coast the day after passage of a cold front. Possibly many true transients seen at Birmingham during periods of adverse winds were grounded in Gulf coast areas by a cold front.

On May 10, 1947, I observed a concentration of true transients held up by unfavorable winds, typical of 11 such instances noted. On May 9, the wind had averaged NE, 12.5 m.p.h., temperature was 9° F. below normal. Ten Bobolinks were the only true transients seen. On May 10, the wind was still NE but with negligible velocity and the temperature was 10° F. below normal. However, 11 species of true transients were seen, as follows: Black and White Warbler, 3; Tennessee Warbler (*Vermivora peregrina*), 4; Magnolia Warbler (*Dendroica magnolia*), 2; Black-throated Green Warbler, 1; Chestnut-sided Warbler, 4; Bay-breasted Warbler, 8; Black-poll Warbler, 4; Ovenbird, 4; American Redstart, 3; Bobolink, 14; and Scarlet Tanager, 3.

South Wind.—While northerly winds prevail, there is a gradual shift from NW to NE or NNE under the influence of a high pressure cell moving eastward. When this cell—at the station or north of it—passes east of the observer, the wind shifts from NE to SE or SSE. This is the *south wind* typical of the western side of a high (see Fig. 3). In spring, noticeable warm fronts are seldom recorded at Birmingham because the cold, dry air masses are greatly modified by the proximity of the Gulf of Mexico.

True transients are observed at Birmingham on the day of a wind shift to southerly as described above. This is the resumption of migration which Bagg *et al.* (1950:13) say occurs when a region becomes part of the warm sector of a low pressure area or the western side of a high. During the balance of the period of southerly winds, the arrival of most of the local summer residents is recorded and daytime migrants such as hawks and swallows are observed. Although few true transients are seen by day on the ground (see *clear, warm*), observations of birds passing before the moon show that heavy migration is taking place.

Of 16 such days in four years with a shift to *south wind*, April 19, 1947, is typical. On the two preceding days, winds were northerly and the average temperatures 10° F. and 8° F. below normal, respectively. On April 19, the wind shifted to south, the temperature was normal and there was no precipitation. The following true transients were seen: Olive-backed Thrush, 2; Black and White Warbler, 1; Worm-eating Warbler (*Helmitheros vermivorus*), 1; Golden-winged Warbler, 2; Cerulean Warbler, 10; Blackburnian Warbler, 2; Ovenbird, 1; and American Redstart, 2.

Rain Alone.—Frequently, true transients were seen during rain not associated with the passage of a cold front or other adverse weather. Apparently

the *rain alone* was sufficient to ground these birds. Typical of 17 such observations was that of April 21, 1949.

On April 20, the wind was ESE, 9 m.p.h., and, although April 20 was the second day of southerly winds, the temperature was 7° F. below normal. On April 21, the wind was still ESE and averaging 12 m.p.h., the temperature was 3° F. below normal, and .2 inches of rain fell. I saw the following true transients during this rain: Worm-eating Warbler, 2; Cape May Warbler (*Dendroica tigrina*), 1 (unusual this far west but the wind had been easterly for three days); Black-poll Warbler, 16; Ovenbird, 1; and Scarlet Tanager, 8.

Clear, Warm.—This is the most favorable weather for spring migration, with moderate tail winds (southerly), good visibility, and generally good flying conditions. Usually, *clear, warm* weather occurs in April the day after a high passes to the east. Examples are April 23, 1947 (Veery, 1; Eastern Kingbird, 4); April 7, 1948 (Black and White Warbler, 4); and April 26, 1949 (Scarlet Tanager, 1). Early in spring, however, rainy weather preceding the next cold front usually arrives the day after a southerly wind resumes.

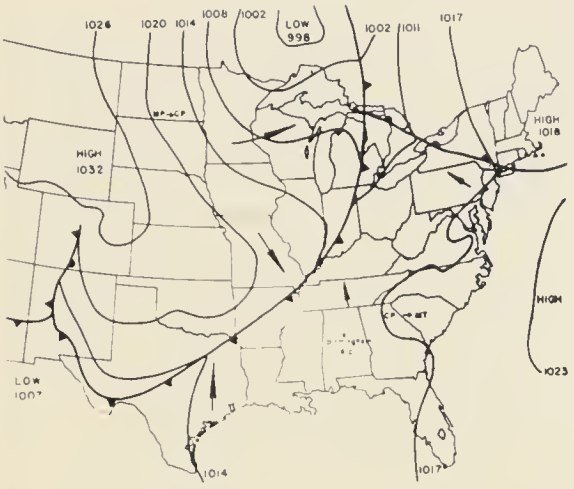
In May, this *clear, warm* weather usually persists a week or longer. Records of true transients are: May 16, 1947, the 6th day of a 10-day period of southerly winds, Blackburnian Warbler, 1; May 10, 1950, the 9th day of a similar 13-day period, Chestnut-sided Warbler, 1.

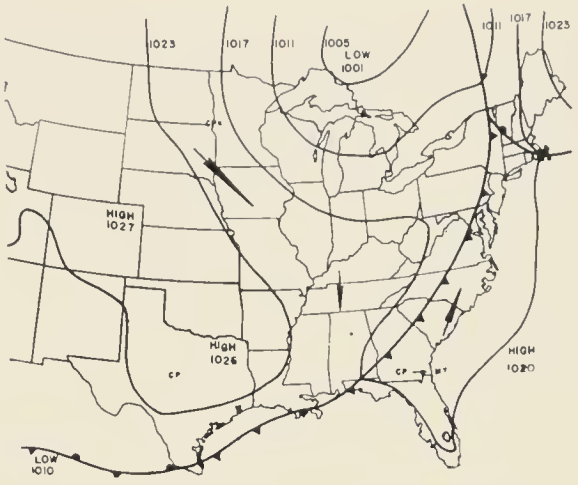
A Typical Weather Cycle

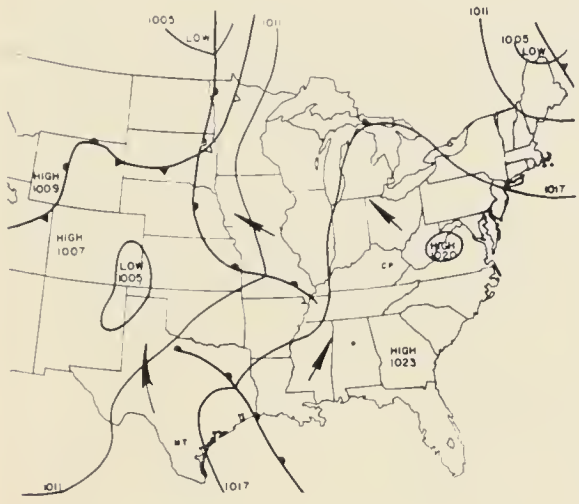
In order to show more fully the relationships of these weather components to migration, a complete weather cycle, from April 16 to 22, 1950 is analyzed below. (Figs. 1, 2, and 3 are weather maps for parts of this cycle.) During the 372 days of the study in four years, 65 such cycles were recorded.

On April 16, 1950, Birmingham experienced its fifth straight day of *cold, clear* weather after passage of a cold front on April 11, with the cold air coming from the eastern side of a high pressure area in mid-continent. Late on April 17 this high passed to the east of Birmingham, the wind veered to S, the temperature was only 2° F. below normal, and .03 in. of rain fell.

On the 18th, 74 species of birds were observed in 5.5 hours spent almost entirely in woodland and around a small lake. The wind was SSE, temperature normal, and .68 in. of rain fell. One Parula Warbler (*Parula americana*) and one Ovenbird were the only true transients seen. Also seen were five species of ducks (including 163 Lesser Scaup, *Aythya affinis*), Osprey, Sora (*Porzana carolina*), Wilson's Snipe (*Capella gallinago*), Spotted Sandpiper (*Actitis macularia*), Solitary Sandpiper (*Tringa solitaria*), Winter Wren (*Troglodytes troglodytes*), Long-billed Marsh Wren (*Telmatodytes palustris*), and Blue-headed Vireo (*Vireo solitarius*). As usual, a good portion of the migrants seen are species that winter locally or on the Gulf Coast, and rarely breed in Alabama.







FIGS. 1 and 2 (upper left and right). Weather maps for 1:30 a.m., April 19, 1950, and 1:30 a.m., April 20, 1950. Cold front approaches Birmingham from the northwest. Air mass behind it is a mixture of Maritime Polar (MP on maps) and Continental Polar (CP on maps) air as indicated over the Dakotas. The southeastern states are covered by a Continental Polar air mass which has been mixed with Maritime Tropical (MT on maps) air from the Gulf. Arrows indicate wind flow and a condition favorable for migration from the Texas coast to the warm front over New York. This cold front passed Birmingham at 1:30 p.m. April 19 and 12 hours later had reached a position as shown in Fig. 2, bringing unfavorable conditions for migration to all the eastern states except a narrow strip along the Atlantic coast. See text for details of weather and birds observed at Birmingham on April 18 and 19.

FIG. 3 (lower left). Weather map for 1:30 a.m., April 22, 1950. Conditions favorable for resumption of migration. The high centered over Wyoming on April 19 (see Fig. 1), while moving south to Texas, has poured cold air into the southeastern states and blocked spring migration with its northerly winds. At 1:30 p.m. on April 21 this high was over Alabama and Fig. 3 shows it in Georgia. Now east of Birmingham, its clockwise rotation brings southerly winds on its western side and migration is resumed there. Both warm fronts (over Texas and Missouri) are disintegrating as is also the Minnesota cold front with hollow 'teeth.' See text for weather details and birds observed at Birmingham on April 22.

Another *cold front* arrived on the 19th; the temperature was 2° F. above normal but went to 9° F. below normal the next day and the wind veered to NW after a trace of rain. In 2¾ hours afield on the 19th, I saw seven species of true transients: Philadelphia Vireo (*Vireo philadelphicus*), Black and White Warbler, 3; Worm-eating Warbler, 3; Tennessee Warbler, 1; Cerulean Warbler, 6; and Ovenbird, 5. Other migrants included in a total of 66 species observed were uncommon winter residents: Palm Warbler (*Dendroica palm-*

Table 3

Relative Influence of Weather Factors on Migrants in Spring at Birmingham, Alabama*

Column number	1	2	3	4	5	6	7
Weather factors	No. of Occurrences	No. of days afield during phenomena	No. of days on which migrants were seen	% of days afield (Column 2)	No. of migrants seen	% of all migrants seen	Migrants per day (Column 5/ Column 3)
Cold Front	48	25	16	64.0	417	46.2	26.2
Adverse Wind	67	26	11	42.3	148	16.5	13.5
South Wind	47	22	16	72.7	165	18.3	10.3
Rain Alone (not on frontal days)	72	25	17	68.0	161	17.8	9.5
Clear Warm	43	10	5	50.0	12	1.2	2.4
Total	277	108	65	60.0	903	100.0	(mean) 14.0

* The first migrants for the year were seen in 1947 on Mar. 29; 1948, Mar. 30; 1949, Mar. 19; and 1950, Mar. 28. Above figures are from those early dates until June 1. Peaks of migration for true transients; 1947, Apr. 14–May 10; 1948, Apr. 25–May 14; 1949, Apr. 11–May 12; 1950, Apr. 8–May 1.

arum), House Wren (*Troglodytes aëdon*), Pine Siskin (*Spinus pinus*), and White-crowned Sparrow (*Zonotrichia leucophrys*); early-arriving summer residents: Yellow-breasted Chat (*Icteria virens*), Blue Grosbeak, Indigo Bunting (*Passerina cyanea*), and Dickeissel (*Spiza americana*); and one transient: Upland Sandpiper (*Bartramia longicauda*).

April 20 and 21 were days of *adverse winds*; the *south wind* resumed on April 22 with a shift from NE to SW, a trace of rain, and a sharp rise in temperature. On the 22nd I saw four species of true transients: Golden-winged Warbler, 1; Parula Warbler, 1; Cerulean Warbler, 5; and Ovenbird, 3. Migrant Chuck-will's-widows (*Caprimulgus carolinensis*) and Blue-headed Vireos were also seen.

Discussion and Conclusions

Correlation of Migration with Weather.—Almost half the individuals (46.2%) of all true transients were recorded on days when the wind shifted to strong northwesterly, that is, days when a *cold front* grounded migrating birds. An average of 26.2 (individual) true transients were seen on each such day afield (12 per hour). The effect of other weather factors is as shown in Table 3, column 7. Although I spent only 10 of 108 *clear, warm* days afield and saw only 1.2 per cent of all true transient individuals in such weather, the average of 2.4 birds per trip in *clear, warm* weather as compared to 14 true transient individuals per trip for all types of weather seems significant.

Urgency of Spring Migration.—In spring, apparently, the individual migrating bird takes advantage of favorable weather to advance as far as possible. Frequently, especially after a period of strong southerly winds,

some birds, notably warblers, are found far north of their usual range. For instance, in the New York City region up to 1941 there were 42 spring records for the Prothonotary Warbler (*Protonotaria citrea*) and 15 spring records for the Yellow-throated Warbler (*Dendroica dominica*) (Cruickshank, 1942:372, 394). Neither of these birds normally breeds at New York. In late March, 1950, no less than 14 Hooded Warblers (*Wilsonia citrina*) reached Wisconsin, Illinois, Ohio, and Ontario during a period of strong southerly winds (Robbins, 1950:232). In a similar period in April, 1947, the Blue-gray Gnatcatcher (*Polioptila caerulea*), White-eyed Vireo (*Vireo griseus*), Worm-eating Warbler, Hooded Warbler, Summer Tanager (*Piranga rubra*), and Harris's Sparrow (*Zonotrichia querula*) reached Toronto, Ontario (Gunn and Crocker, 1951:142). In my study, also, migrants seemed to move northward whenever weather permitted.

Migration by Day.—Urgency of migration is such that on occasion some true transients migrate by day. Lowery (1945:95) and Williams (1945:108) state that the arrival of a cold front in daylight will precipitate these migrants. A typical example at Birmingham is that of April 25, 1947. At 1 p.m. the wind was SW, the temperature 78° F., and rain was commencing. At 2 p.m. it was 79° F., and at 3 p.m. with a wind shift to NW, the temperature had dropped to 65° F. At 4 p.m. the rain stopped and the weather began to clear. At 4:30 p.m. I saw the following on a wet field: Little Blue Heron (*Florida caerulea*), 2; Solitary Sandpiper, 2; Lesser Yellow-legs (*Totanus flavipes*), 1; and Bobolink, 1.

Winter Range.—During the four-year study, I recorded 28 species of true transients. Some records of all but the Black-billed Cuckoo (*Coccyzus erythropthalmus*), Least Flycatcher (*Empidonax minimus*), and Blue-winged Warbler (*Vermivora pinus*) are mentioned above. Of these 28 species, 9 winter in South America, 5 in South and Central America (American Redstart also in the West Indies), and 14 in Central America and the West Indies (3 of the last, the Black and White Warbler, Parula Warbler and Ovenbird, also winter in southern United States, especially in Florida). Of the individuals recorded, 61% winter in South America, and 23.9% in Central America and the West Indies. However, by number of records there were 37% of South American-wintering species, and 44.5% of those that winter in Central America and the West Indies. In short, I saw more South American-wintering individuals, but saw Central American and West Indian winterers more frequently. The difference, percentage-wise as in Table 4, indicates a relatively even mixture of the two categories.

Equality of Adverse Weather Types.—The distribution of records of true transients observed during the various types of adverse weather is remarkably uniform. Of the 28 species, 26 were seen immediately after *cold fronts*,

Table 4

Frequency of Spring Migrants at Birmingham, Alabama, in Relation to their Origins and Destinations*

Origin	Destination						Totals by origin			
	North of Alabama			*Alabama*						
	Records	*Individuals*	*Percent*	*Records*	*Individuals*	*Percent*	*Records*	*Percent*	*Individuals*	*Percent*
S. America (9 species, of 28)	51	435	79.0	33	116	21.0	84	37.0	551	61.0
Cent. Amer., W. Indies, southern U. S. (14 species, of 28)	28	65	30.0	73	151	70.0	101	44.5	216	23.9
S. Amer., Cent. Amer., W. Indies, southern U. S. (5 species, of 28)	21	56	41.2	21	80	58.8	42	18.5	136	15.1
Totals (by destination)	100	556		127	347		227	100.0	903	100.0

* Long range migrants, wintering in South America and breeding north of Alabama, comprise 48.2% (435/903) of all true transients seen. Short range migrants, wintering in Central America, West Indies, and southern U. S. and breeding—at least in part—in Alabama, comprise 16.7% (151/903). Medium range migrants comprise the remaining 35.1%.

21 during periods of *adverse winds*, 24 immediately after resumption of *south winds*, 21 on days of *rain alone* (that is, rain not associated with frontal wind shifts), and only 6 in (favorable) *clear, warm* weather (shown in detail in Tables 1 and 2).

Flyways.—The coastal hiatus is described by Williams (1950b:176–179) as a triangle with a base along the Gulf Coast from about Houston to about Tallahassee, and the apex near where Alabama, Mississippi, and Tennessee meet. Of 227 records of true transients (one record being one day's observation of a species), 133 (58.6%) are of species using both the Mississippi and Atlantic Flyways; 67 (29.5%) are Atlantic Flyway birds, and only 27 (11.9%) are Mississippi Flyway users. These data (shown by species in Tables 1 and 2) suggest that Birmingham lies near the apex of this triangle and closer to its eastern (Atlantic Flyway) side. This agrees with Williams' map (1950b:178) except that perhaps the eastern leg should be at least 50 miles further east.

Summary

A study was made for 1947–1950 at Birmingham, Alabama of 227 spring records of 28 species of land birds that winter south of the Rio Grande and breed east of the Mississippi River. Daily weather at Birmingham was labelled *cold front, adverse* (north) *wind, south wind, rain alone,* and *clear,*

warm, and the numbers and kinds of transient birds recorded on each day afield were tabulated and studied. These true transients (*i.e.*, night migrating land birds wintering south of the Rio Grande and breeding east of the Mississippi, but not locally) were found in all types of weather but especially after a *cold front* (46.2%) and seldom in *clear, warm* weather (1.2%).

Most of the individuals seen (58.6%) were of species that use both the Atlantic and Mississippi Flyways. Birds that winter in Central America and the West Indies were seen more often (44.5% of the records), but South American winterers were more numerous (61.0% of the individuals).

Birmingham probably lies within the triangular hiatus of Williams (1950b: 178) on the eastern side near the apex.

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307 38th Street, Fairfield, Alabama, April 16, 1952

GENERAL NOTES

Fresh-water mollusks fed to young Tree Swallows.—While studying nesting Tree Swallows (*Iridoprocne bicolor*) at the University of Michigan Biological Station in the summer of 1952, I found evidence that the adult birds were feeding their young on fresh-water snails and clams.

A number of snail shells and one clam shell were found among the fecal sacs which accumulated in the nests during the last few days before the young left the nest. Each snail shell showed signs of chemical action on the surface and was filled almost to the tip of the spire with fecal matter.

To test the assumption that snail shells would be recovered in this form after passing through the digestive tract of a swallow, a young Purple Martin (*Progne subis*)—the only species then available—was fed eight snail shells of the size of those found in the Tree Swallow nests. Within 16 hours four of these snails had passed through the digestive tract of the Purple Martin to be deposited separately from the fecal sacs. They were nearly identical in appearance to the shells found in the Tree Swallow nests.

Seven of the 26 Tree Swallow nests studied at the Station contained these shell remains. The shells were identified by Dr. Frank E. Eggleton, of the University of Michigan, as *Physa sayi*, *P. gyrina*, *Helisoma antrosa percarinatum*, and *Sphaerium* sp. These species were all abundant within a half mile of the nesting boxes, inhabiting shallow water areas and occasionally emerging on the vegetation or wet sandy beaches. The swallows may have picked up the mollusks from the beach, from vegetation, or from the surface of quiet water.

Dr. A. L. Nelson, Director of the Patuxent Research Refuge at Laurel, Maryland, has kindly notified me that there are a few unpublished records of unidentified mollusks eaten by several species of swallows.—Mary-Elizabeth Whelan, *University of Michigan Biological Station and Muskegon (Michigan) Public Schools, September 30, 1952.*

Identification of songbird nests by reclaimed eggshell fragments.—During the course of a study started in October, 1952, aimed at an evaluation of use of habitat improvement plantings by wildlife, songbird nests were collected and brought into the laboratory for identification. Here they were keyed with the aid of Richard Headstrom's recent guide (1949. "Birds' Nests. A Field Guide." Ives Washburn, Inc., New York). Many of the nests were from previous season's nesting attempts. Measurements and positive identification were hampered by damage in collecting and from the middens of white-footed mice (*Peromyscus leucopus*). It was, therefore, necessary to find bits of eggshells, either to confirm identification made from the key or, in some instances, to determine which of two or three species with similar nests had built the one in question.

The bottom parts or often the entire nest were put into a 6 inch diameter battery jar (2 gallon capacity) half full of water. The water and nest material were thoroughly mixed for approximately 30 seconds with a small electric mixer. As soon as the contents settled, the floating debris was skimmed off and the muddy water carefully poured away. Repeated washing and decanting floated away all objects of lesser density than the eggshells which were then easily reclaimed from the bottom of the jar. Almost all pieces of shell found were large enough to show any speckled pattern present and shell colors were easily distinguished without magnification.—Joseph C. Rieffenberger, *Forestry Section, Illinois Natural History Survey, February 5, 1953.*

Barrow's Golden-eye using Crow nests in British Columbia.— There appears to be no mention in the literature of Barrow's Golden-eye (*Bucephala islandica*) nesting in old Crow (*Corvus brachyrhynchos*) nests. This note records two such nests. Munro (1939. *Trans. Royal Can. Inst.*, 22 (Pt. 2) :259–327) recorded six nests of Barrow's Golden-eye found in British Columbia, five of them in holes in trees and one in a marmot burrow. He also noted nests found on the ground in other parts of the world, but did not mention utilization of stick nests.

During the summer of 1948, I was employed by the University of British Columbia and the British Columbia Game Commission to participate in a waterfowl population survey on Anahim Lake, B. C., and vicinity (Lat. 52° 30′ N., Long. 125° 20′ W.), an area about 90 miles from salt water at Bella Coola, but in the dry lee of the Coast Mountains.

On June 6, with J. S. Tener, I was working on Abuntlet Lake, the first lake downstream from Anahim Lake on the Dean River. There were two small islands in this shallow lake, each less than 200 feet long and about 50 feet wide. One was low and covered with dense alder and willow growth while the other rose higher from the water, was forested with trembling aspen and Engelmann spruce, and fringed with alder and willow at its shores. Both islands had a dense understory of an unidentified *Ribes*.

The waterfowl nests located on these islands were: seven Mallard (*Anas platyrhynchos*), three Barrow's Golden-eye, one Pintail (*Anas acuta*), and one Canada Goose (*Branta canadensis*). One occupied Crow nest was found. Two of the three Golden-eye nests were in old Crow nests and the third was in a hole twelve feet up in a large aspen stub. Of the two in Crow nests, one was fifteen feet above the water in a willow (*Salix* sp.), the other seven feet over the water in an alder (*Alnus sinuata*). They contained six and eight eggs respectively. The photograph is of the former nest. Both clutches were unchanged on June 24, and both had fully hatched by June 28.

Such nesting sites may be commonly used in western British Columbia, for C. F. McLeod, in 1950, noted that similar nesting sites were used near Stum Lake (Lat. 52° 20′ N., Long. 123° 00′ W.).

It should be noted that if nesting sites limited the size of golden-eye populations about these lakes, then the Crow could have augmented waterfowl production through providing suitable sites. This is an interesting possibility for a species popularly regarded as detrimental to breeding populations of waterfowl.—R. Y. Edwards, *British Columbia Forest Service, Victoria, B. C., September 2, 1952.*

Warblers, hummingbird, and sapsucker feeding on sap of yellow birch.—From September 3 to 6, 1952, I observed a Ruby-throated Hummingbird (*Archilochus colubris*), two Black-throated Blue Warblers (*Dendroica caerulescens*), a Cape May Warbler (*Dendroica tigrina*), and Yellow-bellied Sapsuckers (*Sphyrapicus varius*) as they came to feed on the sap of a yellow birch (*Betula lenta*) in Tamworth, New Hampshire. The tree had been drilled by sapsuckers in previous years and was partly dead. The Cape May Warbler was first noticed on September 4, when it clung to the bark and dipped its bill repeatedly in holes which a hummingbird had been visiting. Soon after, a male Black-throated Blue Warbler lit in the same place. It fed for 30 seconds, rested a bit on a twig, then fed for another 30 seconds before flying away. Both species of warbler fed in much the same fashion and seemingly were afraid of wasps which came to the feeding area in small numbers. The Cape May Warbler paid 5 visits in 75 minutes. On September 6, it was observed again feeding off and on for 6 minutes at the sapsucker holes. Black-throated Blue Warblers visited the tree eight times during periods of observation; two of the visits were by females. The longest single period at the tree for the sapsucker was 35 minutes and for the hummingbird, 15 minutes. It would seem unlikely that these visitors were after insects as a continuous supply would have been required and I saw none on close inspection. It also seemed improbable that the warblers were after water since there was a small brook nearby.

Observations of hummingbirds and warblers feeding at sapsucker-drilled trees have been previously recorded (Bent, A. C., *U. S. Natl. Mus. Bull.*, 174:136, 150). For these birds, the sap may serve as a substitute for nectar. This approach to nectar-feeding by warblers is of interest in view of Beecher's recent statement (1951. *Wilson Bull.*, 63:274–287) that the warblers (Parulidae) are, in fact, closely related and probably ancestral to certain honey creepers ("tribe Coerebini") which are confirmed nectar-feeders.—Lawrence Kilham, *8302 Garfield Street, Bethesda, Maryland, October 11, 1952.*

Siskin and goldfinch feeding at sapsucker tree.—On December 28, 1952, I watched a male Yellow-bellied Sapsucker (*Sphyrapicus varius*) that was visiting his borings 30 feet up in the trunk of a 50-foot sweet gum (*Liquidambar styraciflua*) growing in a swampy portion of the Ocmulgee National Monument, Macon, Georgia.

A Common Goldfinch (*Spinus tristis*) and several Pine Siskins (*Spinus pinus*) were gathering food from the dried fruit capsules hanging in the same tree. When the sapsucker left the trunk a siskin replaced him at the borings and began to pick lightly at them. Evidently the bird was taking sap because it hesitated a while between "picks"—apparently waiting for more sap to flow. The same siskin made three trips to these holes before being chased away by the returning sapsucker. Again the woodpecker left and was replaced this time by the goldfinch which behaved in a manner similar to that of the siskin.—H. Lewis Batts, Jr., *Kalamazoo College, Kalamazoo, Michigan, January 9, 1953.*

An apparently hybrid golden-eye.—An adult male golden-eye collected at Petitcodiac, New Brunswick, by H. C. White, on April 14, 1951, now specimen No. 78916 in the Royal Ontario Museum of Zoology and Palaeontology, is apparently of hybrid origin. In the following remarks characters described and compared are presented approximately in the order of their importance for specific identification of adult males of Common (*Bucephala clangula*) and Barrow's (*Bucephala islandica*) golden-eyes in full breeding plumage. The trachea of the specimen was not preserved.

Facial spot: Nearer round in shape (as in *B. clangula*) than crescentic but slightly longer dorso-ventrally.

Scapulars: Black and white feathers with bicolored tips, the black portion of the outer web, though narrow, is extended into a pointed process as in *B. islandica.* The general pattern effect of the area tends to be streaked, rather than spotted, as in *B. clangula* and the extent of the white scapular pattern is more like that form, less restricted than in *B. islandica.*

Head gloss: Major effect is peculiar, being reddish purple, unlike the bluish purple gloss of *B. islandica* and also unlike the green gloss of *B. clangula.*

Shape of bill: Dorsal view shows no pronounced taper toward the tip and thus is well within range of variation of *B. clangula.* Lateral view, not relatively as deep at base as in *B. islandica*; within range of variation of *B. clangula.* Nail rather broad at the tip and more fully and abruptly arched distally than is usual for *B. clangula*, thus tending toward *B. islandica.*

Color pattern of wing: Relative amount of black and white is intermediate between *B. clangula* and *B. islandica.* The black area involving the lesser wing coverts is more extensive than in *B. clangula* but less so than in *B. islandica.* The black basal portion of the greater coverts is largely veiled by the white middle coverts but a narrow and broken bar is exposed, though it is not nearly as broad and conspicuous as in *B. islandica.*

Flank: More heavily margined with black than in *B. clangula* but not as broadly so as in *B. islandica.*

Sides of breast, forward of folded wing: This area is essentially white as in *B. clangula* but a few feathers are black-tipped, suggesting the wholly black pattern of *B. islandica.*

Frontal bone: A small lump is tactually evident in the prepared specimen indicating a tendency toward the bulged frontals of *B. islandica.*

Nape feathers: Tend somewhat toward the elongate "mane" of *B. islandica.*

Nostrils: Nostrils nearer to *B. clangula*, not as large and wide dorso-ventrally as in *B. islandica.*

In conclusion it should be stated that all comparisons with the Common Golden-eye have been made with North American specimens, *B. c. americana.* Specimens of *B. islandica* from its eastern and western ranges have been used indiscriminately. To the best of my knowledge, the particular specimen here discussed is the first recorded case of a supposed hybrid between the Common and Barrow's Golden-eye (see Cockrum, 1952. *Wilson Bull.*, 64:140–159).—L. L. Snyder, *Royal Ontario Museum of Zoology and Palaeontology, Toronto, Ontario, October 27, 1952.*

Another American Rough-legged Hawk in Florida.—On March 25, 1950, at St. Marks National Wildlife Refuge in Wakulla County, northern Florida (on the Gulf of Mexico), we observed an American Rough-legged Hawk (*Buteo lagopus*) perched in a dead tree in a marsh. We watched the bird for about twenty minutes; it was in typical light plumage with white base of tail and black wrist patch.

The A.O.U. Check-List (1931:69) gives American Rough-legged Hawk as ranging south in winter to "southern California, southern New Mexico, Texas, Louisiana, and North Carolina." However, Sprunt (1940. *Auk*, 57:564–565) mentions a number of sight records from Florida; and there is a record from Thomasville, Georgia (about 50 miles north-northeast of St. Marks) of a Rough-legged Hawk shot in February, 1925 (Stoddard, 1928. *Auk*, 45:211).—Richard A. Herbert and Kathleen Green Skelton, *Linnaean Society of New York, November 11, 1952.*

Bird notes from the Grand Prairie of Arkansas.—Since the publication of Baerg's "Birds of Arkansas" (1951. *Univ. of Arkansas, Agric. Exp. Sta. Bull.* 258, Revised), we have had opportunity to clarify the status of a number of species about which little was known in east-central Arkansas, and to add a few species to the State list. From a considerable mass of observations the following have been selected.

These records are entirely from Arkansas, Lonoke, and Prairie counties, the section of Arkansas commonly known as "the Grand Prairie," and from the lowlands of the Arkansas and White Rivers and the Bayou Meto, which adjoin Arkansas County on three sides. Observations by the senior author have been nearly daily since May, 1950, while those of the junior author have been intermittent but total almost 24 months since the spring of 1948. Several short notes on specific subjects have already been published. Where specimens were taken these have been sent to the U. S. National Museum.

Colymbus grisegena. Holboell's Grebe. One was seen on a flooded area near Humnoke, Lonoke County, October 21, 1951.

Podilymbus podiceps. Pied-billed Grebe. On October 12, 1952, we found a Pied-billed Grebe incubating four eggs near Lonoke. Incubation continued through October 21. The last week of October brought freezing weather and the nest was deserted.

Guara alba. White Ibis. Baerg listed one record by Van Huizen in Arkansas County, September 10, 1950. Van Huizen again saw White Ibises in 1951, and on September 15, 1952, Neff saw an immature White Ibis flying along a rice field canal 4 miles east of Stuttgart.

Dendrocygna bicolor. Fulvous Tree Duck. First recorded in Arkansas near Lonoke by Marshall, Coffey, and Block (Baerg) on September 20, 1950; a flock of eight was reported to us from the same area in September, 1952, and a male was taken there on September 17.

Ictinia misisippiensis. Mississippi Kite. Along the lower reaches of the Bayou Meto, the Arkansas River from the mouth of Bayou Meto downstream, and probably along the lower White River, this kite is a fairly common breeding bird. During May and June kites are often seen catching dragonflies just a few feet over the water in the rice fields adjoining the bottomland forests.

Since we discovered this species south of Gillett in the summer of 1950 we have seen it on numerous occasions. During the summer of 1952 fourteen pairs were under observation; most of the nests are high up in the tall bottomland cottonwoods. Earliest spring date was May 5, 1951, while the latest autumn date was at Nady, Arkansas County, September 13, 1952, recorded by Anna G. Meanley.

Buteo lineatus texanus. Texas Red-shouldered Hawk. A female taken near Hazen

on December 10, 1951, with cinnamon rufous breast, and conspicuous dark shaft lines in the breast feathers, was identified by Meanley at the U. S. National Museum as of this race, not previously reported in Arkansas.

Rallus limicola. Virginia Rail. Baerg listed only two sight records. An adult male was taken in a rice field near Hazen, Prairie County, on November 15, 1952.

Porzana carolina. Sora. This species is an abundant migrant through the eastern Arkansas rice country, especially in autumn. A dead male, frozen into the ice along a roadside ditch on February 3, 1951, proved at least occasional wintering, and three seen in a rice field on July 12, 1951, indicate possible breeding.

Coturnicops noveboracensis. Yellow Rail. The third State record is based on a bird flushed from a rice stubble field south of Stuttgart on October 9, 1952.

Gallinula chloropus. Florida Gallinule. Although this species was already known to breed in the Lonoke area, a nest with six eggs was noted on a fish farm near Lonoke on September 9, 1952 and four downy young not over one week old were seen on a neighboring farm on September 17, 1952.

Pluvialis dominica dominica. American Golden Plover. Although known as a common spring migrant through Arkansas, its occurrence as a common autumn migrant in the Grand Prairie area is apparently unrecorded. Small flocks were seen each day through November, 1951, and single birds were seen near Stuttgart as late as December 1 and 3 of that year. Specimens were collected on November 16, 1950, and November 2, 1951.

Columbigallina passerina. Ground Dove. A single bird was flushed from a farm road five miles southwest of Stuttgart on September 15, 1952, but managed to escape. This appears to be the first record for Arkansas.

Crotophaga sulcirostris. Groove-billed Ani. A new State record was established when a male was collected about seven miles southeast of Stuttgart on September 21, 1952. The bird was discovered perched in a dead tree about 20 feet high in a brushy field border. Its stomach was full of grasshoppers.

Limnothlypis swainsonii. Swainson's Warbler. We have been able to locate Arkansas records from only three localities in earlier literature. Along the lower White and Arkansas River bottomland forests adjoining Arkansas County the species is fairly abundant in May and June. Five singing males were heard in a canebrake east of Tichenor on May 9, 1951. Four singing males were heard in timbered areas near Nady during May and June, 1952. A male was collected on June 12, 1952.

Spiza americana. Dickcissel. One of the most common breeding passerines in the area, the Dickcissel is apparently unrecorded as a winter resident. During the winters of 1950–51 and 1951–52 we found single Dickcissels associating with the flocks of English Sparrows (*Passer domesticus*) about the farmyard of a majority of the farms visited. They fed with the sparrows in the barnlots, on straw stacks, and in open sheds. Dates ranged from mid-January to April.

Zonotrichia querula. Harris's Sparrow. In east-central Arkansas this species appears to be rare. C. M. Owen (now deceased) banded one at DeWitt some 18 years ago. We banded one near Stuttgart on November 27, 1950, and collected an immature male near Nady on November 3, 1952.—Brooke Meanley and Johnson A. Neff, *U. S. Fish & Wildlife Service, Stuttgart, Arkansas, and Denver, Colorado, December 8, 1952.*

Groove-billed Ani in Oklahoma.—On October 7, 1952, a Groove-billed Ani (*Crotophaga sulcirostris*) was shot by Lewis T. Pickett at Duncan Lake, about 11 miles northeast of Duncan, Stephens County, Oklahoma. On October 11, Mr. Pickett gave me the ani which, fortunately, he had not discarded. Dr. George M. Sutton, of the University of Oklahoma at Norman, made a fine study skin of the bird in spite of the fact that it was in an advanced state of deterioration. The skin is now in the University of Oklahoma museum.

The ani was a male with testes, though not large, readily perceptible even though the specimen was decomposing. Its stomach held six large grasshoppers of the genus *Melanopus* (five of one species, one of another). These were identified with the assistance of Dr. Cluff Hopla of the University of Oklahoma Department of Zoology. The bird weighed 90.6 grams. It was not emaciated but neither was it fat. The bird's plumage, on the whole, was in fine condition, but some of the larger wing and tail feathers were of a brownish cast and less glossy than the others—indication of a protracted late summer and fall molt.

The bird was sitting on a stem among the cattails surrounding the minnow ponds below Duncan Lake when Mr. Pickett first observed it. It was alone although there was a flock of Red-wings (*Agelaius phoeniceus*) in the cattails at the other end of the pond about 200 feet away.

The principal native vegetation around Duncan Lake is postoak-blackjack oak with associated mixed grasses—not particularly suggestive of the ani's native tropical and subtropical home. The summer and fall of 1952 were the driest and hottest for the lower Plains states since Weather Bureau records have been kept (1900). The unusually dry weather may have been the principal reason for the northward movement of the ani.

Mr. Raymond G. Keck, of Drummond, Garfield County, Oklahoma, wrote the Oklahoma Game and Fish Department concerning a Groove-billed Ani he saw in the trees in his yard on September 25, 26, and 27, 1952. He said the bird was tame and could be approached so closely that the grooves on the bill could be seen. He photographed the ani with his box camera. The picture, though not clear enough for reproduction here, is still good enough for positive identification of the ani.

There are several previous instances of the Groove-billed Ani occurring outside its normal range. Two instances are worthy of note here: W. S. Long (1940. *Trans. Kansas Acad. Sci.*, 43:444) mentions a specimen taken on November 1, 1904 in Lyon County, Kansas. Thomas S. Roberts (1932. "The birds of Minnesota. Vol. 1," pp. 594-595) lists a specimen taken in Goodhue County, Minnesota on October 12, 1913.

The Groove-billed Anis reported here are the first records of the species in Oklahoma.—Glenn E. Jones, *Oklahoma Game and Fish Department, Capitol Building, Oklahoma City, Oklahoma, November 24, 1952.*

Groove-billed Ani in Great Plains in 1952.—This note reports and summarizes the records of the Groove-billed Ani (*Crotophaga sulcirostris*) in Kansas and other plains states in the remarkable northward movement of this species in the autumn of 1952.

This species was first reported outside its normal range on September 21, 1952, when a male was collected seven miles southeast of Stuttgart, Arkansas (Meanley and Neff, 1953. *Wilson Bull.*, 65:201). From September 25 to 27, an ani was present at Drummond, Garfield County, Oklahoma, and a male was collected at Duncan Lake, Stephens County, Oklahoma, on October 7 (Jones, 1953. *Wilson Bull.*, 65:202). One Groove-billed Ani was seen in the vicinity of Elgin, Antelope County, Nebraska, from

late September to October 4. Unfortunately, this bird was not obtained (Baumgarten and Rapp, 1953. *Nebraska Bird Rev.*, 21:2-3).

Finally, an immature male ani was shot six and three-fourths miles northeast of Blue Rapids, Marshall County, Kansas, on October 28. The specimen was brought by Elizabeth G. McLeod to Ted Andrews, of Kansas State Teachers College at Emporia. Andrews presented the specimen to the University of Kansas, where I prepared it as a study skin. The bird weighed 67.5 grams, had some fat, and had testes approximately 3 mm. long. It was in fresh plumage with sheaths still attached to the bases of the remiges and rectrices. The ani was immature, as judged from the incompletely ossified skull.

Speculation as to the cause of this movement of at least five (and probably many more) anis from their normal range seems futile. The invasion, if it may be called that, spanned at least five weeks in time and took at least one bird 1100 miles north of the species' nearest usual haunts in southern Texas.

Groove-billed Anis were previously reported in this portion of the Great Plains only from Kansas, where a specimen was taken in Lyon County on November 1, 1904.—Harrison B. Tordoff, *Museum of Natural History, University of Kansas, Lawrence, March 30, 1953.*

The voice of the Grand Potoo.—The identification of birds of the night by means of their voices sounding in the darkness of virgin forests is one of the most difficult tasks of the ornithologist travelling in tropical countries. Besides the owls and the true nighthawks which lead in the nocturnal concert, there are in the New World the strange potoos (Nyctibiidae). Little has been published on their call notes. Everybody who listens for the first time to the cry of *Nyctibius griseus*, a common and widely distributed species, is in doubt whether these unusual sounds can be attributed to a bird at all. The song consists of a falling-off series of full, melodious notes that sound human. It has already been described several times (see, for instance, Sutton, 1950. *Bird-Banding*, 21:154–155) and it is generally assumed that the voices of other potoos are similar. However, this statement is misleading, at least regarding the Grand Potoo (*Nyctibius grandis*).

The voice of this species sounds like a very harsh, deep, and long *kwak* or *kaw* or *graw-ar*. The calls are uttered always separately. At pairing time the loud quacking is repeated at intervals of 10 or 20 seconds, but there is never a connection between the single notes, as in *Nyctibius griseus*. Sometimes the voice of the Grand Potoo is more like that of *Nyctibius griseus*, as many individuals of the latter species make harsh sounds, but *griseus* is always distinguishable by its uninterrupted falling-off pattern.

I find in the literature only two references which clearly deal with the voice of *Nyctibius grandis*. To Goeldi (1900. *Bol. Museu Paraense*, 3:211) the call of the Grand Potoo sounded "like the mewing of a big cat," while he reproduced the song of *Nyctibius griseus* as *pu-hu-hu*, if slowly spoken in a high voice. Haverschmidt (1948. *Auk*, 65:32) remarked that he heard strange notes of *Nyctibius grandis* sounding like *oorrroo* or *oorrr*.

It may be added that both species, when fighting, utter cries in a croaking manner different from the song described above.

These observations on the Grand Potoo were made in the state of Mato Grosso, Xingú region, Central Brazil.—Helmut Sick, *Fundaçao Brasil Central, Avenida Nilo Peçanha 23, Rio de Janeiro, D. F., Brazil, March 12, 1953.*

Incubation and nesting behavior of the Chuck-will's-widow.— In view of the few published accounts of courtship, nesting behavior, and incubation in American goatsuckers other than the Nighthawk (*Chordeiles minor*), the following facts concerning the Chuck-will's-widow (*Caprimulgus carolinensis*) taken from the notebook of J. Southgate Y. Hoyt may be of interest. During the period from August 27, 1942, until January, 1944, while he was in the Medical Corps of the U.S. Army in Charleston, we lived in a small cottage on the edge of Summerville, South Carolina. The cottage was part of a property known as the Tea Garden, and next to our yard, between it and the azalea- and camellia-bordered walks of the Tea Garden estate proper, was an overgrown field containing a few large pines and with the ground fairly well carpeted with needles.

The Chuck-will's-widow was calling in the vicinity the week we moved in, and we heard it until September 6. The next spring we listened for its return and on March 19, 1943, we heard the first call of the Chuck-will's-widow at approximately 7:00 p.m. (E.S.T.). The bird called about ten times and was not heard calling the rest of the night.

During the next month, on warmer evenings, the bird began calling shortly after 7:00 p.m. The calling started at the same time each evening, but its duration increased from several minutes to some hours. At the time of the full moon (which was on April 20 in 1943), the bird was joined by another and they called all through the night until daybreak. As the moon began to wane, the calling seemed confined to an hour in the evening and about an hour at dawn. Occasionally a few calls were given during the night, but the activity never compared to that of the period of the full moon. By May, calling was confined to the morning and evening periods and seemed to come from the same direction every night.

At this time we began a careful checking of the position of the birds each evening, listening for any unusual calls. On May 4, we flushed one of the birds from the ground and heard another a short distance from it. On May 5, as we investigated, "we heard a bird call to the right of the path and very close to us. We waited and soon saw a bird fly from the ground to a tree. Almost at once another bird flew to the ground at the spot where the first had flown up. The first bird doubled back and joined the second on the ground. At this time we heard some fluttering and a slight vocal *chuck*ing. Soon both birds flew off and we left" (field notes). We investigated the spot but found nothing.

To the best of my recollection, we did not notice the strange clapping sound nor the increase in the speed of the calls which was noted and recorded by P. P. Kellogg in Florida and published on the record of "Florida Bird Songs" (Cornell University Press), nor does Southgate's notebook mention any such sound.

On the evening of May 6: "Returning to this same area, we approached the spot carefully and flushed the bird from the ground. Going to the exact spot, we found one egg on the pine needles. The egg was typical in color and seemed large for a bird of this size." Checking the spot again on the 7th, we found that another egg had been added during the previous 24 hours.

During the next two weeks, we checked the bird cautiously, and Southgate noted that: "Always when I approach her during the day, she seems to be sleeping and is not hard to approach." On May 23: "I returned to the nesting site and found that all was well and the bird sitting tight on the eggs, not flushing till I was within a few feet of her. I set up the blind some ten feet away and got in, only to find that she

was very timid at the sight of it. I cut some bushes and placed them over and in front of the blind and returned to my post inside. This time she returned very quickly, approaching the eggs from the back. She flew to a spot some four feet from the eggs and sat there motionless with her eyes shut for about five minutes. Then she slowly waddled onto the eggs with an awkward shuffle and, spreading her breast feathers, she gave a slight hitch that raised her body over them. She then tucked the eggs well under her with her bill and finally settled down with ease and closed her eyes again. During this performance, I was taking motion pictures of her and she seemed not to mind the click of the camera." When she left the nest, she gave two small leaps on the ground, then jumped into the air and flew to a nearby limb, uttering a slight chuckle.

On May 26, Arthur A. Allen of Cornell University arrived for a short visit with us, and "we immediately investigated the nest. One egg had hatched and the young was squatting by the other egg. This makes an incubation period of 20 days for this bird." The second egg hatched on the 27th, which seemed to prove that incubation started with the laying of the first egg.

On the 28th, we found both young under a bush about ten feet from the nest site. Quoting again from the notebook: "They jump with both feet, and look like little toads or frogs, jumping on the pine-needle floor of the woods." On the 30th, we located them about 25 feet from the nest. "The parent was brooding them, and flushed when we approached very close."

The final note is on June 17, a few days after we returned from a furlough: "Several birds were flying around our yard this evening and giving the *chuck*ing note as they passed near us. On the fence not far from the house we could hear some strange hissing and chucking noises that sounded very much like young birds calling for food. The singing of the birds has been very much less than in the past and has been heard only in early evening and early morning."

The birds were heard calling off and on throughout the summer until September 13, when we presumed they left the area.—Sally F. Hoyt (Mrs. Southgate Y. Hoyt), *"Aviana," Etna, New York, March 5, 1953.*

Red Phalarope in Utah.—In September 1951, botulism workers at Bear River Refuge picked up a partially-paralyzed Red Phalarope (*Phalaropus fulicarius*). This appears to be the second record of the occurrence of the species in Utah, the first having been reported by C. Lynn Hayward (1937. *Wilson Bull.*, 49:304) from southern Utah.

An interesting feature of the paralysis exhibited by this individual was that the skeletal musculature of the neck remained largely unaffected. The bird's muscles of locomotion were so weakened that it could neither stand nor move its wings, but when stimulated it carried out the characteristic side-to-side "pecking" movements associated with phalaropes. The sickened bird was hospitalized, but it failed to respond and soon died.

Dr. John W. Aldrich has had a skin prepared from the badly battered remains, and (personal communication) confirms the identification. The skin is now deposited in the Fish and Wildlife Service collection in the U. S. National Museum.

The assistance of Dr. Clarence Cottam in supplying information on the previous occurrence is gratefully acknowledged.—George W. Sciple, *U. S. Fish and Wildlife Service, Wildlife Research Laboratory, Denver, Colorado, March 13, 1952.*

Further evidence of the homing ability of the Cowbird.—Several reports have been published describing homing ability in the Cowbird (*Molothrus ater*). These reports are reviewed, and added to, by Harold B. Wood (1952. *Wilson Bull.*, 64:46).

At my station in Addison Township, Oakland County, Michigan, I banded a female Cowbird (No. 49–140409) on May 4, 1951. This bird returned on April 10, 1952, and subsequently repeated on April 12, 15, and 22. On April 22 I put her in a small canary cage, placed it on the floor of my car, and took her to a point 15 miles *south* of the station and released her at about 4 p.m. On April 28 she re-entered the same trap (a government sparrow trap). I then took her, in the same container, 22 miles *south* of the station on a different road and released her at 3 p.m. On April 29 she re-entered the same trap between 9:00 and 10:30 a.m., thus completing the 22-mile flight in from 18 to 19½ hours.

I then intended to transport the bird to a point north of the station but did not because the fore part of the bird's head was scalped at some time during the last flight. I released her at the station and she did not again enter a trap during the 1952 season.

I had presumed that the bird would not live long with what appeared to be such a serious injury. I was, therefore, considerably surprised on April 18, 1953, to find her in a Glenhaven drop-door trap situated on a steep bank near a creek. There were soft small feathers covering the fore part of her head, but across the rear of the occiput there was a ⅛-inch scar upon which no feathers grew. The nape feathers being normal, the bird had a peculiar flat-headed appearance which made it possible for me to recognize her in the field.

I held her over-night and on April 19 took her, in the cage previously mentioned, to a point 5 miles *east* of the station to the border of a small lake. The weather was stormy, snow squalls alternating with clear weather. I released her at the edge of the lake, facing east. Just at that time it began to snow again. The bird rose somewhat higher than the trees bordering the lake, seemed to hover in almost one spot, flew a short distance to the north, then to the south, then to the west (away from the lake) and into a tree. I did not see her again that day. On April 23 she returned to a sparrow trap in a field about 60 rods from the house. If she flew directly from the place where she was liberated, this was the first trap she would have come to. She was then taken in the same cage, this time completely covered with a white cotton cloth, to a point 17 miles *north* of the station. She was held over-night and photographed. At 7:45 a.m., April 24, she was released facing south. She exhibited no special behavior but flew directly to a tree. My traps were closed April 24 until late in the evening. At 9 a.m., April 25, she was in a drop-door pedestal trap at the edge of a marsh. I released her there.

On April 29 she entered a sparrow trap. Again in a covered cage, she was taken 21 miles *west* of the station and released at 5:30 p.m. She exhibited no special behavior, but flew into the nearest tree. At 9 a.m., April 30, she was back in a drop-door trap in a field 500 feet from my house. I released her there. When I had completed my work and returned to the house at 10:30 a.m. she was in a pedestal trap near the house and was released there. On May 1, 3, 15, 23, and 28 and on June 1 and 4, she repeated in various traps. Several times I saw her on perches and flying about over approximately 10 acres; the last such observation was on June 18. She made 13 entries into four types of traps in 1953. On the occasions in 1952 and 1953 when she was taken 15 and 5 miles away, she returned during the sixth and fourth days

respectively. On the flights of 22, 17, and 21 miles, she returned on the first day after release. Concerning homing experiments with wild birds, Donald R. Griffin (1953. *American Scientist*, 41 (2):218) says, "While the percentage of returns falls off with distance, the speed of those birds which do get back tends to rise or at least to remain fairly constant."—Mrs. Alice D. Miller, *1150 Brewer Road, Leonard, Michigan, August 16, 1953.*

Screech Owl observed bathing.—On November 16, 1952, at about 7:15 p.m., E.S.T., my wife and I were driving along an avenue which borders a small park in Ann Arbor, Michigan, when we saw a gray Screech Owl (*Otus asio*) standing in a puddle of water. We stopped the car within a short distance and backed up until the scene was once more fully illuminated by the car lights.

The puddle of water in which the owl was standing was 1 to 2 inches deep and approximately 2 feet in diameter. The owl appeared to be quite unafraid of the lights and of the noise of the running motor. While we watched, from a distance of 12 to 15 feet, the owl bathed in the puddle, much in the manner of a passerine bird, pushing its head and breast into the water, beating its wings, and then shaking the water from its feathers. We watched for perhaps a minute. It was not until I got out of the car and approached to within 4 or 5 feet that the owl flew away. The car lights were still on and the motor was running.

Reexamination of the site the following morning showed the puddle to have been formed in the depression at the junction of a garage driveway and the street. Both driveway and street were paved. For sometime prior to November 16 the weather had been extremely dry, so that the water in which the owl was bathing was of artificial origin, possibly from a hose.—Walter R. Crowe, *Institute for Fisheries Research, Ann Arbor, Michigan, January 9, 1953.*

Ivory Gulls in western Lake Ontario.—On January 4, 1953, two Ivory Gulls (*Pagophila eburnea*) were observed at Hamilton, on Lake Ontario, Canada, by the writer in company with David Powell and Leslie Gray. The birds, which were seen under good conditions and studied at some length, apparently were immatures, being sparingly flecked with dusky brown at the tips of the primaries and at the bend of the wing. Size appeared similar to that of Bonaparte's Gull (*Larus philadelphia*), and the birds had a small-headed, pigeon-like profile that appeared quite distinctive. The dark eyes, black legs, and dusky bill with yellowish tip were seen clearly.

When first seen the Ivory Gulls were at the edge of the ice sheet with Ring-billed and Herring gulls (*Larus delawarensis, L. argentatus*) but a passing locomotive startled the flock into flight minutes later. The two Ivory Gulls circled and settled back on the ice, but all other birds in the flock departed. In flight the long, pointed, white wings and white mantle were noted; the wing-beat was rapid and tern-like. After settling, one bird walked to the open water and apparently drank there.

The gulls were about 50 yards from shore and observations were made from an elevated position on the bank, below Woodland Cemetery. The study was carried out in bright sunlight, with the aid of a 20-power spotting telescope on a tripod and binoculars.

The arrival of these rare stragglers, seldom seen away from their Arctic pack ice, was of great interest to local ornithologists, many of whom reported the presence of one or more Ivory Gulls around the same date.—Eric Walter Bastin, *43 Inglewood Drive, Hamilton, Ontario, Canada, January 15, 1953.*

Cassin's Sparrow in Cleveland County, Oklahoma.—On November 21, 1952, in the South Canadian River bottomlands just west of the town of Noble, Cleveland County, Oklahoma, I saw a small sparrow atop one of the small, shrubby trees lining the river bed. I collected the bird, which seemed reluctant to fly, finding it to be a Cassin's Sparrow (*Aimophila cassini*). It was an immature (the skull was incompletely ossified) female in extensive molt. I wish to describe the plumage in detail for little has been written about the molt of this species.

The flight feathers are molting symmetrically on both sides, and the major tracts of the body are studded with pin-feathers. The first three primaries and their coverts are old, worn, and brownish-gray edged with tan. They are noticeably different from the inner six primaries and their coverts, and the tertials, all of which are dark gray edged with light brownish gray. The fourth and ninth primaries (counting from the outside) are considerably shorter than the others. The tail is markedly graduated, the longest rectrices being the two innermost pairs. These four feathers are still sheathed at the base; the longest falls one millimeter short of the lowest tail measurement given by Ridgway (1901. *U.S. Natl. Mus. Bull.*, 50:253) for adult females of this species. The fourth pair of rectrices (counting from the outside) are about midway in length between the longest and the third pair. The latter are about one-half as long as the median four. The second pair of rectrices are about midway in length between the third pair and the outer-most pair which are as long as the upper tail coverts.

This bird was probably in a normal postjuvenal molt, for according to Phillips (1951. *Wilson Bull.*, 63:324) the species molts rather late. Swarth (1908. *Condor*, 10:114) states that an immature female taken by him in Arizona on October 26 was in the midst of a molt, covered with pin feathers, and that other Cassin's Sparrows which he observed during the first week in November were quite as ragged in appearance. It is interesting that this molting bird should be found in late November in central Oklahoma, for the species has previously been reported only from western Oklahoma (Cimarron, Jackson, and Harmon Counties), where it is reported to breed (Nice, 1931. *Publ. Univ. Okla., Biol. Surv.*, 3 (1):185).—Jean W. Graber, *University of Oklahoma, Norman, April 5, 1953.*

Red Crossbill in Oklahoma.—Griscom (1937. *Proc. Boston Soc. Nat. Hist.*, 41:165) stated that there were no records of the Red Crossbill (*Loxia curvirostra*) for Oklahoma. Subsequently the species has been recorded a few times. During the extensive invasion of the plains and eastern states by this species in 1950-51, birds were seen in several north-central localities in Oklahoma (see *Audubon Field Notes*, 1951, 5:4, 27, 192, 214). Dr. F. M. Baumgartner has kindly informed me that, so far as he knows, no specimens were collected in Oklahoma during this invasion.

It therefore seems worthwhile to place on record my notes on this species in the Black Mesa country of Cimarron County, made during a four and a half day collecting trip (November 28 to December 2, 1952) in the vicinity of Kenton.

Though piñon-juniper is the dominant tree growth of the area, there are many fine western yellow pines (*Pinus ponderosa*) about six miles southeast of Kenton on the Regnier Ranch. I encountered crossbills only in the vicinity of these pines. On December 1, I collected one of two males which were sitting quietly (not feeding) in a large pine. The following morning I saw and heard two crossbills flying over, and later in the morning, a single crossbill with a flock of House Finches (*Carpodacus mexicanus*).

My specimen, on the basis of both plumage and skull ossification characters (see Tordoff, 1952. *Condor*, 54:200–201) is an adult. The testes were considerably enlarged (approximately 5 mm. in length). The color is predominantly red, though there are many orangish feathers scattered throughout the plumage. The *brightest* red feathers on the bird are pinkish or rose colored, it being, then, a pale example of the species. It is also a rather large crossbill. Using Griscom's (*op. cit.*:138) system, it measures: wing, 92; tail, 55; culmen, 20; and bill depth, 10 mm.

With an understanding of the possible fallacy of placing a single vagrant crossbill subspecifically, I still feel that it is worthwhile to assign it a trinomial, since the specimen is so decidedly like *benti* in color and size characters. Though the culmen length is slightly over the size range given by Griscom for *benti*, the specimen is easily separable from a good series of Mexican specimens (*stricklandi*), from the Sutton Collection, on the basis of its paler color and smaller bill-depth, characters which should also separate it from *grinnelli*.

The specimen is in the Museum of Zoology, University of Oklahoma. My thanks are due Dr. George M. Sutton for the use of comparative material from his collection and the Oklahoma Collection.—Richard R. Graber, *Museum of Zoology, University of Oklahoma, Norman, February 20, 1953.*

Sharp-tailed Sparrow in Oklahoma.—Although there are several records for the Sharp-tailed Sparrow (*Ammospiza caudacuta*) for the adjoining states of Arkansas (see W. J. Baerg, 1951. *Univ. Arkansas, Agric. Exp. Sta. Bull.* 258, revised) and Kansas (W. S. Long, 1940. *Trans. Kansas Acad. Sci.*, 43:455), this rather secretive species has not been reported from Oklahoma. In the fall of 1952, while collecting for the Oklahoma Biological Survey, I made a concentrated effort to find Sharp-tailed Sparrows.

Due to drouth conditions in Oklahoma in the summer and fall of 1952, marshy places were especially scarce. There were however, a few places along the South Canadian River in Cleveland County which looked as though they would be attractive to marsh-loving birds. These were rather dense stands of three-foot high grasses, actually standing in an inch or two of water. Two grasses, barnyard grass (*Echinocloa crus-galli*) and gray leptochloa (*Leptochloa fasicularis*), were conspicuous in these stands, and in them I frequently encountered Swamp Sparrows (*Melospiza georgiana*) and Long-billed Marsh Wrens (*Telmatodytes palustris*). Though I visited such habitat frequently from mid-September, I failed to find either Sharp-tailed Sparrows or the similarly inconspicuous Leconte's (*Passerherbulus caudacutus*) until October 14. On this date I saw four Sharp-tails (two collected) and three Leconte's (one collected), about a mile west of Noble.

Both of my specimens of *Ammospiza* were fat males with incompletely ossified skulls. Neither resembles at all closely any of the several specimens representing the races *caudacuta*, *subvirgata*, and *diversa* in the Sutton Collection. One (RRG 1881) in a typical dark-backed, generally richly colored example of *nelsoni*; the other (RRG 1880) may also fall within the limits of this form, though it approaches specimens of *altera* collected in the fall at Ithaca, New York, in grayness of back and cheek-patch and in the paleness of ventral streaking. I prefer not to assign a trinomial to this second specimen until I know more about the range of color variation of immature *nelsoni*.

The specimens are now in the Museum of Zoology, University of Oklahoma. I wish to thank Dr. George J. Goodman for his identification of the grasses, and Dr. George M. Sutton for the use of the comparative material in his collection.—Richard R. Graber, *Museum of Zoology, University of Oklahoma, Norman, January 16, 1953.*

Ring-billed Gulls stealing fish from female American Mergansers.— During the 1951-1952 winter, I observed some interesting behavior of Ring-billed Gulls (*Larus delawarensis*) and female American Mergansers (*Mergus merganser*) at the McMillan Reservoir, Washington, D. C.

The gulls were present on the reservoir before the mergansers appeared. After January 3, 1952, when the mergansers first appeared on the reservoir, both species were present frequently and usually at the same time. However, male mergansers were not present after February 1.

I usually watched birds on the reservoir once in the morning, at noon, in mid-afternoon, and again after 5 p.m. I did not notice gulls paying any particular attention to the mergansers until February 4, when a gull attacked and tried to rob a female merganser of a fish it had just caught and was trying to swallow. This incident was re-enacted later on the same day and many times thereafter.

Five was the maximum number of female mergansers present at any one time. Usually one Ring-billed Gull would deliberately trail one or more feeding female mergansers on the water. Ordinarily, the gull would not go into action until a diving merganser surfaced with a fish, at which time, the gull would take flight, circle briefly in the air over the merganser, and then plunge at it in an attempt to rob the bird of its fish. As a rule, only one gull would follow a group of mergansers and would drive away any intruding gull which might settle on the water near the group. However, if other gulls were present, at a distance, they would often take off as a merganser came up with a fish and compete in the game of robbing the diver of its prey. Sometimes the merganser's dive served as the signal for the other gulls to take off and circle slowly in the air over the area where the bird dived or alight on the water near the place where the diver would surface.

Most often, in their efforts to elude the gulls, the mergansers would sprint across the surface of the water, propelling themselves with feet and wings, using their wings more or less as oars by beating the water violently with rapid wing strokes. They would start and stop abruptly as they attempted to evade the attacking gulls. The gulls were persistent, however, and tried repeatedly to rob the fleeing mergansers. The mergansers would dive only as a last resort when a direct hit from a plunging gull seemed imminent.

When a gull successfully wrested a fish from a merganser, it would leave the reservoir, at least temporarily, pursued by one or more gulls bent on robbing it in turn. During my observations, the gulls seldom succeeded in getting fish away from the mergansers.

On February 13, for the first time, I saw a pursuing gull twice force a merganser to take flight with its catch. This performance was repeated on February 19 and 21. Once a pursued merganser circled over most of the reservoir 5 times, landed on the water, and dived to escape one gull but took off again immediately to escape two other gulls that flew in to attack it as it surfaced. This time, the tiring merganser circled the reservoir an additional two and one-half times before it finally dropped its fish which was seized by one of the band of robbing gulls. This reservoir is large enough so that the birds traveled a good distance in their flight.

Until the 13th of February, the mergansers seemed reluctant to leave the water to escape the gulls. Beginning with the 13th, however, they tried to elude the gulls on each occasion by taking flight, and each time, they dropped their fish sooner or later in their flight. I observed the gulls to be more successful in getting fish away from

flying mergansers than when the mergansers remained on the water and dodged, swam, and dived to evade the gulls. The fact that I saw no gulls try to rob mergansers of their fish until after the male mergansers stopped frequenting the reservoir is also of interest.

After February 21, the mergansers came less and less frequently to the reservoir, and I noted no further action involving these birds and the gulls.—Donald Lamore, *3C Parkway Road, Greenbelt, Maryland, November 8, 1952.*

Whooping Cranes in Kansas in 1952.—Although the Whooping Crane (*Grus americana*) was once a reportedly common migrant in Kansas, few or no records have been published for the past several decades. In 1952, I was fortunate in acquiring records of two, and possibly seven, of these large cranes in Kansas.

Mr. M. Wayne Willis, wildlife artist residing in Wichita, Kansas, informed me that he saw a Whooping Crane eight miles north and six miles west of Wellington, Sumner County, Kansas, on the afternoon of 23 March, 1952. Mr. Willis observed the crane, with four Sandhill Cranes (*Grus canadensis*), flying over a maize field. The five cranes landed in the maize field, according to Mr. Willis, and began feeding, presumably upon the maize.

On the morning of 31 October, 1952, I was asked to inspect an unidentified bird being held captive in Sharon, Barber County, Kansas. The bird was a crippled Whooping Crane. Two boys from Sharon had found the crane the previous evening in a pasture eight and one-half miles southwest of Sharon. The crane seemed to be in good health, except that its right wing hung so that the tips of the primaries touched the ground.

Federal authorities were notified, and the injured crane was placed in the custody of Mr. John B. Van den Akker, Director, Salt Plains National Wildlife Refuge, Jet, Oklahoma, on the evening of 31 October. The bird died the following day while en route to the Aransas National Wildlife Refuge in Texas. The crane is preserved as a skin and complete skeleton (KU 31198) in the University of Kansas Museum of Natural History.

On 4 November, 1952, Mr. Fritz Zvlonie, a farmer, informed me that he had seen five "big, white cranes" standing in his pasture, which is two miles north and three miles east of Sharon. After questioning Mr. Zvlonic regarding the appearance of the birds, I am fairly certain that they were Whooping Cranes. He accurately described the birds, mentioning the red on the head, generally white plumage, and black wing tips. Mr. Zvlonic was uncertain as to the date on which he had observed the alleged cranes, but estimated it as 20 October, 1952.

The localities where Whooping Cranes were reported in 1952, in Kansas, are of approximately equal latitude (37° 15′ N). The Sandhill Cranes arrived at this latitude on or about the same dates; in 1952, I observed flights of Sandhill Cranes three miles north and one mile east of Sharon, Kansas, on 30 March, and on 19 and 31 October.—Thane S. Robinson, *Biological Survey of Kansas, University of Kansas, Lawrence, January 22, 1953.*

Cinnamon Teal and Avocets in Florida.—On March 8, 1953, we saw one adult male Cinnamon Teal (*Anas cyanoptera*) on Lake Alice at Gainesville, Alachua County, Florida. It was with a large flock of Blue-winged Teal (*Anas discors*), Shovellers (*Spatula clypeata*), and Gadwalls (*Anas strepera*). There are apparently only two

published records of this species in Florida, although Thomas W. Hicks tells us he observed single males of this species in the winter several years ago on the St. Johns River at Jacksonville, Duval County, and on Reedy Lake at Frostproof, Polk County.

On the morning of February 15, 1953, we observed two Avocets (*Recurvirostra americana*) at Cedar Key, Levy County, Florida. The birds were resting on a sandspit along the causeway connecting the key with the mainland, along with several Willets (*Catoptrophorus semipalmatus*), Forster's (*Sterna forsteri*), Royal (*Thalasseus maximus*), and Caspian (*Hydroprogne caspia*) terns, Western Sandpipers (*Ereunetes mauri*), and Brown Pelicans (*Pelecanus occidentalis*).

All during the previous night exceptionally high winds were blowing in from the Gulf of Mexico. These winds probably accounted for the Avocets' presence so far east. When we attempted to frighten the birds from the sandspit, they were unable to make any headway into the wind. This appears to be the third record of Avocets on the west coast of Florida, and one of less than a dozen records for the state.—Dale W. Rice and Edward L. Mockford, *Biology Department, University of Florida, Gainesville, March 18, 1953.*

Smith's Longspur: an addition to the Louisiana list.—On December 13, 1952, while walking across the old Municipal Airport, located just north of Shreveport, Louisiana, in a section of Bossier Parish lying west of the Red River, I flushed a single Smith's Longspur (*Calcarius pictus*). I was able to recognize it by the combination of its typical longspur "clicking" call notes and its pipit-like tail-pattern. Although I flushed it several times and covered a considerable part of the area, no other individuals were found that day. There are no previous records of the Smith's Longspur in Louisiana.

One week later I returned to the airport and soon flushed a flock of about 35 birds of this species. On the following day, December 21, I collected a female from the flock; it is now in the collection of the Museum of Zoology, Louisiana State University. The flock remained in the area for several weeks and was augmented with additional birds for a short period in January. I was able to make an almost exact count of the flock while it was in flight on January 25, 1953; there were 45 or 46 birds present, which seemed to be the peak of their numbers here. By February 22 the flock numbered about 33, and on March 1 only 10 longspurs remained. I next visited the airport on March 8, but was unable to find any birds of this species.

During the course of my visits to the area, it became apparent that the Smith's Longspurs showed a strong preference for a small part of the airfield which had a dense growth of a particular kind of grass that occurred only sparingly on the remainder of the field. Richard K. Speairs, of the Botany Department of Centenary College, has informed me that this grass is a species of *Aristida*. This provided such dense cover that I was seldom able to see the birds until after they flushed.

This airport has not previously been searched by a bird student in winter. In view of the considerable number of Smith's Longspurs which occurred in this one area, particularly in the month of January but also through a good part of the winter, and since the species was found in December, 1951, at Lonoke, Arkansas (Coffey, *et. al.*, 1952. *Audubon Field Notes*, 6:138), it seems likely that the Smith's Longspur will prove to be of regular occurrence in winter, at least in small numbers, in the northwestern corner of Louisiana.—Horace H. Jeter, *4534 Fairfield Avenue, Shreveport, Louisiana, March 26, 1953.*

Direct observation of the flight speed of the Common Loon.— In March, 1948, while flying a Piper Cub J–3 about 17 miles north of Charlotte, North Carolina, and 3 miles east of the Catawba River, at an altitude of 1200 feet, I sighted a Common Loon (*Gavia immer*) crossing diagonally in front of the plane at a distance of about 50 yards—a distance at which the identification of the summer plumaged bird was unquestionable. I immediately turned to follow the loon, which went into a shallow dive (about 15 degrees). Although full throttle was given the plane, the loon was slowly pulling away when such a low altitude was reached that the chase had to be abandoned. The indicated air speed of the plane during the first part of the shallow dive (45 to 60 seconds) was 90 miles per hour. During this period the distance between the loon and the plane remained approximately constant or increased slightly. The airspeed indicator of the plane was checked and proved to be accurate within plus or minus 10 miles per hour at that speed. It may thus be concluded that the true air speed of this loon while being pursued was approximately 80 to 100 miles per hour.—James A. Pittman, *Massachusetts General Hospital, Boston 14, Massachusetts, February 24, 1953.*

EDITORIAL

The 11th International Ornithological Congress, presided over by Sir Landsborough Thomson, London, will be held in Basel (Switzerland) from May 29 to June 5, 1954.

During the week of the Congress, 5 days will be devoted to meetings and 2 to excursions. Before and after the Congress (May 25–28 and June 7–19) excursions will be arranged to enable members to become acquainted with the Swiss avifauna, especially of the Alps and Lower Alps. The Congress fee is 30 Swiss francs.

The prospectus, containing registration forms and detailed information, has been distributed. Applications to attend, and to contribute scientific papers, should be sent in before February 28, 1954, and addressed to:

11th INTERNATIONAL ORNITHOLOGICAL CONGRESS
ZOOLOGICAL GARDEN, BASEL, SWITZERLAND,

which is at disposal for any inquiries needed.

The International Committee for Bird Preservation will have its 9th International Conference at Scanfs, Lower Engadine, Switzerland on May 23–28, 1954. The program has been planned to permit attendance, without conflict, at both this meeting and the 11th International Ornithological Congress, announced above.

The Southwestern Association of Naturalists was formed at an organizational meeting attended by fifty-two persons at the University of Oklahoma Biological Station at Lake Texoma on May 23, 1953. As stated in the constitution, "The object of the Association shall be to promote the field study of plants and animals, living and fossil, in the southwestern United States and Mexico, and to aid the scientific activities of its members." SWAN hopes to stimulate the study of the region by bringing together persons of like interests through publication of annotated membership lists, annual meetings, and perhaps later through the publication of a journal.

The officers elected for the first year were: W. Frank Blair (Vertebrate Zoology), University of Texas, *President*; George J. Goodman (Plant Taxonomy), University of Oklahoma, *Vice-President*; Herndon G. Dowling (Herpetology), University of Arkansas, *Secretary-Treasurer*. The geographic scope of the Association at present includes Mexico and the states of Arizona, Arkansas, Kansas, Louisiana, New Mexico, Oklahoma, and Texas. Persons interested in the natural history of this region are invited to join the Association. Membership blanks may be obtained from any of the officers.

Dr. Charles G. Sibley has recently taken up the duties of his new position teaching ornithology at Cornell University.

Robert M. Mengel is now at the University of Kansas where he is engaged in a bibliographic study of the Ralph M. Ellis natural history library; Mengel is also completing his study of the birds of Kentucky for the doctorate from the University of Michigan.

ORNITHOLOGICAL LITERATURE

PARENTAL CARE AND ITS EVOLUTION IN BIRDS. By S. Charles Kendeigh. Illinois Biological Monographs (vol. 22, nos. 1–3). University of Illinois Press, Urbana, 1952: 7 × 10¼ in., 356 pp. $4.00, paper; $5.00, cloth.

Lest this volume be accepted at its face value, it is necessary to examine it critically. It is an outcome of the well known House Wren work of Dr. Kendeigh at the Baldwin Bird Research Laboratory, especially that of mechanical recording of birds' visits to nests, plus information on the entire Class Aves carded by student assistants at the University of Illinois. The mélange is not a happy one.

After a brief description of methods, 79 pages are devoted to the House Wren, especially details of its visits to the nest in relation to nest building, clutch size, laying, incubating, feeding and brooding, illustrated with charts and tables of individual records. Similar, but shorter records from Ohio, with more details from the literature on 19 other species, from Killdeer to Song Sparrow, occupy the next 80 pages. These sections are mines of information on detailed activities at the nest, and will be a constant source of reference for students of bird behavior.

The author claims, of the 105 pages devoted to a survey of parental care: "The present summary should bring information on parental care up to date to the year 1950." But it is so sketchy and misleading that it is not even an important guide to the literature. One would gather the impression that practically nothing was known about whole groups of birds for which there is considerable information. This is best shown by some examples.

The family Nectariniidae (sunbirds), of some 104 species, is not listed by Kendeigh, though one species is mistakenly listed under Dicaeidae (flower-peckers) with only the statement that both sexes build and incubate. Checking the few references listed below, the following composite picture based on 16 species of Nectariniidae is possible: nest a pensile structure (usually), or a half oval sewed tailor-bird fashion to the underside of a large leaf; eggs 1–3; nest-building by female only (11 species), female accompanied by male on trips (6 species), and by male and female together (3 species); nest-building prolonged, with periods of days when birds are absent; duration of construction more than 22 days (1 species), 3–5 weeks (1 species), 30 days (1 species), but may be as short as 13 days (1 species), or 7 days for a second nest (1 species); trips to nest during construction made very quickly: 4 trips in 30 minutes and 27 trips in 29 minutes (1 species), 9 trips in 10 minutes (1 species), 14 trips in 60 minutes (1 species); one working day 10 a.m. to 3 p.m. (1 species); egg laid 8 a.m. (1 species); incubation period 12, 13 days (1 species); incubation by female only (8 species), the incubating female visited by male (1 species) or accompanied by male when off eggs (1 species), or incubation by male and female (2 species); young fed by female only (1 species) or by both male and female (4 species); trips with food at 3 minute intervals (1 species); 4–5 insects carried each trip (1 species). References: Baker, 1934, "The nidification of birds of the Indian Empire," Vol. 3, pp. 208–235; Bannerman, 1948, "The birds of tropical West Africa," Vol. 6, pp. 151–193; Cowles, 1936, *Auk*, 53:28–30; Moreau and Moreau, 1937, *Ibis*, 79:336; North, 1907, "Nests and eggs of birds . . . Australia," Vol. 2, p. 208; Potter, 1948, *Wilson Bulletin*, 60:159–163; Rand, 1942, *Bull. Amer. Mus. Nat. Hist.*, 79:354; Vincent, 1949, *Ibis*, 91:327–335.

Of the families that are included, some are very inadequately treated; for example: *Meliphagidae.*—Of the 160 known species Kendeigh has data, incomplete, on only

two species, one Australian and one New Zealand, with only the following data: female builds and incubates, leaving nest to feed; eggs 2; incubation and nesting period 18 days (1 species); both male and female incubate and feed (1 species).

From only two recent sources (Serventy and Whittell, 1948, "Birds of Western Australia," pp. 313–331; Rand, 1942, *Bull. Amer. Mus. Nat. Hist.*, 79:356, 358), it is possible to add the following composite picture based on 14 species: nest a cup or a pensile oval; eggs 1–4; nest building takes 4 days (1 species); female alone builds (3 species), making trips at 5 minute intervals (1 species), accompanied by the male (1 species), both male and female build (2 species); incubation period 14 days (1 species), less than 13 days (1 species); female alone incubates (3 species); both male and female incubate (2 species); nestling period 14, 15 days (2 species); both male and female feed young (3 species); in 70 minutes male fed 5 times, female 5 times (1 species); both male and female brooded young (1 species).

The lack of adequate coverage is indicated by the fact that such authors of standard source books for the birds of Africa as Bannerman, Jackson and Sclater, and Selater; of southern Asia as Stuart Baker and La Touche; and of Australia as Campbell, North, Mathews, and Serventy and Whittell, are not even mentioned in the bibliography.

Species are sometimes misplaced in families, for example for the family Prionopidae Kendeigh gives data on 5 genera. Of these five, 3 belong in other families: *Grallina* in Grallinidae, *Hemipus* in Campephagidae, and *Colluricincla* should join *Pachycephala* which Kendeigh has placed in the Muscicapidae.

The understanding of the known, detailed facts for a few species in a family in relation to the less well known behavior of most of its species is poor. This is best shown by the Paradiseidae (43 known species). Kendeigh quotes my studies at the nests of two species in which apparently male and female pair for the whole reproductive period. But he does not point out that these are exceptions in the family in that the male and female are alike, while extreme specialization of the male in plumage ornamentation and display is characteristic of this group. Probably in most species the males have nothing more to do with reproduction after mating with the females at the display grounds. Here, too, a bower bird should have been placed in the family Ptilonorhynchidae, which is not otherwise represented.

That a table showing "average" behavior by families has value, I doubt. Usual behavior, with variations, is something else, but judgment rather than addition and division becomes important here. This is particularly apparent in the birds of paradise (p. 286), mentioned above.

The concluding section is devoted to discussion. The thesis that habits are a good guide to relationships is accepted, and that the primitive condition in parental care is for each parent to take an equal part. Certain trends are pointed out, such as a tendency toward more nest duty by the males in the Palaeognathae; a tendency toward more nest duty by the females in the Passerines; a general tendency toward shorter incubation and nestling periods, and toward shorter and more frequent attentive periods in highly evolved groups.

Groups are variable within themselves and similar behavior has reappeared, probably independently, in many groups. It seems to be implied, based on faith rather than evidence, that order, family, genus, species and subspecies have progressively less differentiated types of behavior. The last few pages are devoted to parental care in the animal kingdom, with 8 lines devoted to contrasting primitive and civilized man.

Obviously, justice has not been done to the subject. This is due in part to the failure to collect the available data. It is also due to the difficulty inherent in drawing con-

clusions from such a small segment of such a very specialized complex of behavior patterns as birds' reproduction. Attentiveness at the nest, besides being affected by weather and individual variation, as pointed out by Kendeigh, should be correlated with courtship and display which precedes it, and with the condition of the young and their survival which follows it.

In the present study as a whole, as the subjects become more removed taxonomically from the House Wren, and their ranges become more removed geographically from Ohio, the value of the paper decreases.—A. L. Rand.

Finding Nests. By Bruce Campbell. Collins, St. James' Place, London, 1953:5 × 7½ in., 256 pp., 40 black and white photos. $1.76 (12s. 6d.).

The author of this first modern book devoted to techniques of finding nests states, in typically British manner, that the book "is an attempt to reinstate the finding of birds' nests as an important adjunct to ornithology as well as a wonderful sport in its own right." He adds: "I could not count the number of times I have heard competent field ornithologists explain, with a mixture of pride and shame in their tone: 'Of course, I'm hopeless at finding nests.' This has always sounded strange to me; . . . to discover how and why each species selects its nest-site, and to observe how each species visits the nest during its period of use ought to be integral parts of any study of bird behaviour."

Part One of "Finding Nests" contains three introductory chapters: "Why find nests?," "Methods of nest finding," and "Looking at nests." These chapters describe general techniques, well known to many field ornithologists, for finding and gaining access to nests, but which, for the most part, must be learned by personal experience. It is a delight to read these short chapters with their specific suggestions for locating nests.

The remainder of the book (12 chapters) is devoted to 222 species of birds, 184 of which regularly breed in the British Isles. For each of the regular breeding species, there is a concise statement on breeding distribution, the breeding season, habitat, nest-site, nest-composition, and methods for finding the nests. In addition, each chapter is prefaced by a short introduction which describes the similarities and differences between the species covered, and, where possible, indicates general methods of nest-finding applicable to certain groups. These introductory comments are especially interesting and revealing to one who has not been privileged to observe Reed-Warblers (*Acrocephalus scirpaceus*) or Spotted Flycatchers (*Muscicapa striata*) in the field.

The 40 excellent black and white photographs of nests, nest-sites, and adults at the nest add immeasurably to the value of the book.

Probably no one individual is qualified to write a similar book on the breeding birds of the United States or even of one quarter of the country. Such a book authored by several workers, however, undoubtedly would serve as a considerable stimulus to obtain more specific information on many poorly known species—note the dearth of information on many of the American warblers (*cf.*, A. C. Bent, *U. S. Natl. Mus. Bull.* No. 203, 1953). Judging from Mr. Campbell's comments on British birds, the nests of some American birds must be much easier to find. Many nests of the American Goldfinch (*Spinus tristis*), for example, can be found after one learns the "warbling" call of the female given from the nest during the building period as well as during incubation. Similarly, finding the nest of our Warbling Vireo (*Vireo gilvus*), which sings while incubating, frequently is but a matter of locating the singing bird. The loud and persistent food call of the nestling Cowbird (*Molothrus ater*) is also an excellent guide to nests of the hosts.

In the last analysis, there are two prerequisites for finding birds' nests: (1) a genuine interest in nests, and (2) a knowledge of preferred nest-sites. Mr. Campbell notes that:

"If energy and persistence are required to find nests by searching, the key quality in watching back [*i.e.*., watching the adult bird return to the nest] is patience, but as this is the key quality in real bird-watching—as opposed to 'bird-snatching,' the mere pursuit of rarities—it is presumably one which readers of this book already possess."

Mr. Campbell also states that "it is in a knowledge of the likely sites for each species that success in nest-finding lies: the breeding habitat is no more than a general guide. How far such knowledge can be acquired except by personal experience or instruction in the field I admit I am not sure. . . ." He adds further that "the chances of success in all types of searching are much increased if you know what you are looking for; this sounds obvious, but what I mean is that the more nests of the chaffinch you find, the better your mental picture of the 'ideal' chaffinch's nest," and "after a time the eye travels automatically to the likely sites in any habitat. I shall do my best to describe these . . . , but the eye can only be trained in the field."

Mr. Campbell's book is highly recommended to all American ornithologists, professional and amateur, who are interested in "training their eyes" to see birds' nests.—Andrew J. Berger.

Neue Ergebnisse uber die Ernahrung der Greifvogel und Eulen (New contributions on the food of hawks and owls). By Otto Uttendörfer. Published by Eugen Ulmer, Stuttgart, z. Z (14a), Ludwigsburg. 1952:6 × 8¾ in., 230 pp. (DM12).

This is a compilation, apparently, of all known information on the food of European hawks and owls up to the end of 1946, but important literature subsequent to that date is also cited. Several ornithologists in addition to the author contributed new data, and there are special discussions, credited to R. Kuhk and G. Bodenstein, in the book. The author's face is depicted in a drawing by H. Meissel and recognition marks of hawks and owls in flight are shown on three pages of drawings by Franz Murr.

Extensive data, many of them quantitative, obtained from observations at nest-sites and from stomach analyses are given for 35 species of falcons, hawks, eagles, and vultures and 14 species of owls. American literature is included for those species occurring in both continents. There is a useful summary also of the various species of hawks and owls that attack each species of prey. No serious attempt is made at analyzing the dynamics of predation or the effects of predation on prey populations, but for what it was intended the book is a useful source of information.—S. C. Kendeigh.

Search for the Spiny Babbler . . . An Adventure in Nepal. By Dillon Ripley. Houghton Mifflin Company, Boston, 1952:5⅛ × 8⅜ in., xiv + 301 pp., 18 photographs. $4.00

This is a popular account of Dr. Ripley's most recent expedition to Nepal. He begins with a general discussion of this little known Asiatic kingdom, touching on topics such as geographic position, history, politics, topography, and wildlife. This introduction to the main body of his narrative is of interest to the reader as comparatively little is known about this enigmatic kingdom.

Few outsiders, not to mention naturalists, have ever been inside Nepal. Dr. Ripley and his associates on the expedition were fortunate indeed. They were allowed by the king of Nepal to journey to the capital city of Katmandu. Once in Katmandu they had to obtain permission to visit the interior. The fact that they got this permission is now history but what a gamble it was! If they had not succeeded they would have traveled thousands of miles for nothing.

For years Nepal has remained virtually unknown to ornithologists. The only really extensive work prior to that of Dr. Ripley was done by an Englishman, Brian Hodgson. He, a clerk in poor health working for the British East India Company, was given the choice either of dying at home in England, or in the hills of Asia. He chose to remain and was appointed to assist the Resident placed in the court at Katmandu by the East India Company. Here Hodgson lived and thrived and became an outstanding student of Nepalese ornithology, other branches of natural history, ethnology and linguistics. He succeeded the Resident and remained in Nepal from 1821 to 1843. During this period he recorded 563 species of birds, most of which were brought to him by native collectors, foreigners not being allowed beyond the Katmandu valley. He described 150 of these species for the first time and usually gave the type locality merely as "Nepal." Much of Hodgson's material has now became useless or nearly useless because of "foxing" or through actual loss of specimens.

Nepal, lying lengthwise as it does, along the foothills and in the southern Himalayas, is a critical area in regard to avian distribution. This general area is the meeting place of the Burmese-Malayan tropical faunal elements with the Palaearctic faunal elements from the north. This is one of the reasons Dr. Ripley is so interested in the area, another being the fact that many of the birds that Hodgson reported had not since been recorded from Nepal. Among these were the Spiny Babbler, *Acanthoptila nipalensis*, and the Mountain Quail, *Ophrysia superciliosa*. Ripley found the Spiny Babbler, "whereby hangs the tale," but not the Mountain Quail. This latter bird may be extinct through destruction of its habitat, which leads us to a more sordid aspect of Nepalese conditions.

Ripley noticed the appalling misuse of land, a practice which is apparently increasing. He also noticed that many areas, which were in good condition just a few years previously, were ruined or being ruined. The lovely, wooded hills which lend so much to the scenic and scientific charm of India and Nepal are in many cases being denuded of their forest cover and tilled for crops. This practice leads to the rapid loss of soil during the torrential rains and results in subsequent arid sterility with a lowering of the water table, where once there had been green hills.

A refreshing note, in contrast to the account of the encroachment of "civilization" and the misuse of a beautiful land, was Dr. Ripley's poignant description of the pretty, little, remote mountain village of Dhamkuta. His description of this village is delightful. He has, I think, succeeded here in inspiring a feeling of near-nostalgia for a place very few of us have ever been to.

Dr. Ripley's narrative, for the most part, is vivacious and crammed with amusing, exciting, and sometimes exasperating incidents met with on his travels into the Katmandu valley and thence to western, and finally eastern, Nepal. Those of us who have been to the Far East can read with amusement the exasperating incidents involving uncooperative bearers and the like. Refrains such as "They are taking food, sir. They are just now coming" are probably most fully appreciated by those who have had the opportunity to experience them. The tale is told with feeling and a sensitivity which is to be admired. However, I had some difficulty keeping track of the time when certain happenings were taking place, because of the author's failure to give dates. This was a mild annoyance indeed, far overbalanced by the over-all excellence of the story telling.

Of course, as I have mentioned, the book is primarily a popular one and no great deal of ornithological information is incorporated. Dr. Ripley's party collected around 1600 bird specimens along with about 200 mammals. The bird specimens collected represented 331 species and subspecies. About 50 more species were identified in the field but not

collected. Dr. Ripley has indicated that, judging from subsequent study since the expedition's return, the faunal break between the tropical and palaearctic faunas takes place in eastern Nepal in the region of the Arun Kosi river valley.

Besides the text, the book contains end-paper maps and a bibliography of books about Nepal published in recent years.—W. C. Dilger.

LETTING UNCLE SAM DO IT

A contribution from the Wilson Ornithological Club Conservation Committee

Some recent actions by the 1953 General Assembly of the State of Indiana should be of general interest, not because of their approach to wildlife conservation problems, but because of the broader implication for conservation philosophy. A bill for repeal of veterans' free hunting permits was defeated. Also defeated were several bills for taking the Conservation Department out of politics. However, a bill providing for a statewide fox bounty was passed and promptly became law. No other conservation bills of major importance were acted upon.

The actions of this legislature have deprived a major segment of Indiana's sportsmen from personal participation in conservation—at least so far as their license dollar might go in wildlife's behalf. There is no good reason why every sportsman should not pay his own way. But proponents of repeal of the free hunting permits stressed that more licenses sold would automatically mean more federal aid money through Pittman-Robertson funds, and, *a priori*, more and better hunting and fishing in Indiana. Defeat of this bill by hasty politics merely postponed further attempts for two years when the Assembly will meet again. Meanwhile enough energy was spent in the last two years' campaigning for repeal to have planted a million pine trees; but no one thought of planting pine trees. The real point is that legislators, administrators, and John Q. Citizen seem more willing to bet their stake on continuing federal help than on developing a program wherein each person has a part to play.

This lack of individual responsibility for wildlife conservation is again reflected by passage of a fox bounty law. The only premise of this law reads, "Foxes are hereby declared to be detrimental to the wild life of the State . . . ." This legalistic declaration is contrary to the findings reported by the Indiana Pittman- Robertson Wildlife Research Project which showed that county fox bounties paid from 1875 to 1948 had no demonstrable effect upon fox populations. Fox food habits studies by the same project failed to show that foxes limit Indiana quail and rabbit populations. Some other states have handled their predator problems with trapper-trainee programs which placed the responsibility on the landowner by making him a participator. Ironically, some legislators who ignored Pittman-Robertson research findings in voting for the bounty in Indiana also voted for repeal of the veterans' permits. A vote for repeal was in effect a vote for more federal aid! The lack of a consistent conservation policy is not unique to Indiana for all too widely there is a growing tendency to "let Uncle Sam do it"—and then ignore research facts stemming from his aid, even when these facts are desperately needed in establishing state legislation. In spite of the vast accumulation of technical knowledge gained through the P-R program, Michigan, Wisconsin, and many other states continue their fox bounties as a means of "control."

It is really not so amazing that we have failed to arouse public sentiment to challenge questionable legislative actions. Annual contacts with 4-H youth and adults in conservation camps by one of the authors show that in general the youngsters and teachers share the same beliefs about wildlife: a widespread opinion that game and fur species alone are valuable or worthy of conservation. Predators and non-game species are commonly unknown or despised, and the principles of ecology and wildlife conservation are rarely understood. On the other hand, nearly all seem to be familiar with game farming and to everyone the words "Pittman-Robertson" have a familiar ring. The tragedy is that something basic is still lacking.

Leopold had a phrase for it—"ecological conscience." In explanation he wrote, "The only progress that counts is that on the actual landscape of the back forty, and here we are slipping two steps backward for each stride forward . . . .

"We have not asked the citizen to assume any real responsibility. We have told him that if he will vote right, obey the law, join some organization, and practice what conservation is profitable on his own land, that everything will be lovely; the government will do the rest.

"The formula is too easy to accomplish any thing worthwhile. It calls for no effort or sacrifice; no change in our philosophy of values. It entails little that any decent, intelligent person would not have done of his own accord . . . ." (Bulletin of the Garden Clubs of America, September, 1947).

Can we rely solely upon federal help to develop in our people an ecological conscience? Is this a place to "let Uncle Sam do it"? We believe not. And this is in spite of the fact that P-R funds have provided the greatest impetus for wildlife research and development that this country has ever enjoyed. Their accomplishments are both spectacular and essential. A mere glance into the annual reports invites the wonder of any sportsman. Gratifying benefits are received as well by non-game species from land acquisition and management. Any student can aspire to be a P-R project leader or become known as an expert on one or another species. But this is the question we would like to raise, "Is federal aid substituting for individual thought and action?" Along with the patches of restored habitat and reams of slick paper publications are today's sportsmen and youth also made aware of the need for their personal activity? Or do they, from sheer volume of money spent, projects completed, and publications listed, think federal aid and wildlife conservation are synonymous? In short will they be "for" conservation but against participation as long as Uncle Sam can do it?

In our own minds, in those of our teachers and leaders, and in those of our children we must guard against substituting subsidy for an ecological conscience.—Charles M. Kirkpatrick and William H. Elder.

Wilson Ornithological Club members will be pleased to note the remarkable growth of the Club Library during the past year. Very generous gifts from Dr. H. Lewis Batts and Dr. W. Powell Cottrille to the Book Purchase Fund enabled us to buy a number of newly published books and to fill in certain important gaps of long standing (for example, we now have all four parts of "Birds of the Lake Umbagog Region" by Brewster). A total of seventy-nine members donated books, reprints, pamphlets, and magazines during the year. Worthy of special notice are the large gifts of books received from Albert E. Greene, Karl W. Haller, Rosario Mazzeo, and Winsor M. Tyler. These gifts included a number of the standard reference volumes—Bonaparte, Chapman, Coues, Forbush, Ridgway, Roberts, Taverner, Todd—which are fundamental to serious bird study and essential to any bird library.

BOOKS: List B-1

Books added to The Wilson Ornithological Club Library since the publication of Complete List 2 (*Wilson Bulletin*, 64, No. 3, September 1952:176-185).

Bendire, C., Life Histories of North American Birds. (2 vols.) 1892-1896.

Blake, E. R., Birds of Mexico. 1953.

Blyth, Edward, and W. B. Tegetmeier, The Natural History of the Cranes. 1881.

Bonaparte, C. L., American Ornithology; or the Natural History of Birds Inhabiting the United States. (vols. 1, 2, 3) 1825-1828.

Brandt, Herbert, Arizona and Its Bird Life. 1951.

Cayley, N. W., The Fairy Wrens of Australia. 1949.

Chapman. F. M., Handbook of Birds of Eastern North America. (4th ed.) 1897.

Chapman, F. M., The Warblers of North America. 1907.

Coues, Elliott, Key to North American Birds. (4th ed.) 1890.

Davie, Oliver, Nests and Eggs of North American Birds. (5th ed.) 1900.

Dekay, J. E., Zoology of New York, or the New York Fauna. Part II. Birds. 1844.

Dwight, Jonathan, Jr., The Ipswich Sparrow (*Ammodramus princeps* Maynard) and Its Summer Home. 1895.

Forbush, E. H., Birds of Massachusetts and other New England States. (3 vols.) 1929.

Grosvenor, G., and A. Wetmore (eds.), The Book of Birds. (2 vols.) 1937.

Hann, H. W., The Biology of Birds. 1953

Hausman, L. A., The Illustrated Encyclopedia of American Birds. 1944.

Hollom, P. A. D., The Popular Handbook of British Birds. 1952.

Jefferies, Richard, Wild Life in a Southern County. 1879.

Joy, N. H., How to Know British Birds. 1942.

Koford, C. B., The California Condor. 1953.

Mayr, Ernst, Birds of the Southwest Pacific. 1945.

Miller, Alden H., An Analysis of the Distribution of the Birds of California. 1951.

Morgan, A. H., Field Book of Animals in Winter. 1939.
Mudie, Robert. The Feathered Tribes of the British Isles. (2 vols.) 1853.
Nuttall, Thomas. A Manual of the Ornithology of the United States and of Canada. Land Birds. 1832.
Pearson, T. G. (ed.-in-chief), Birds of Ameriea. 1936.
Peters, H. S., and T. D. Burleigh, The Birds of Newfoundland. 1951.
Peterson, Roger T., A Field Guide to Western Birds. 1941.
Pettingill, O. S., Jr., A Guide to Bird Finding East of the Mississippi. 1951.
Raine, Walter, Bird-nesting in North-west Canada. 1892.
Ridgway, Robert, The Birds of North and Middle Ameriea. Part 7. 1916.
Roberts, T. S., The Birds of Minnesota. (2 vols.) 1932.
Samuels, E. S., Our Northern and Eastern Birds. 1883.
Shiras, George, 3d., Hunting Wild Life with Camera and Flashlight. (2 vols.) [1935].
Shortt, T. M., and Sam Waller, The Birds of the Lake St. Martin Region, Manitoba. 1937.
Sprunt, Alexander, Jr., and E. B. Chamberlain, South Carolina Bird Life. 1949.
Stoner, D., and L. C. Stoner, Birds of Washington Park, Albany, New York. 1952.
Sutton, G. M., The Birds of Southampton Island. 1932.
Taverner, P. A., Birds of Canada. 1934.
Thomson, A. L., Bird Migration: A Short Account. 1943.
Todd, W. E. C., Birds of Western Pennsylvania. 1940.
Townsend, C. W., The Birds of Essex County, Massaehusetts. 1905.
Wright, H. W., The Birds of the Jefferson Region in the White Mountains, New Hampshire. 1911.

THE WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been recently received. From:

Andrew J. Berger—21 reprints
Herbert Bruns—2 reprints
William H. Burt—4 reprints
L. C. Finneran—1 pamphlet
Albert E. Greene—23 books
Karl W. Haller—3 books, 6 reprints
Harry W. Hann—1 book
Hildegarde Howard—1 reprint
Philip S. Humphrey—5 reprints
Leon Kelso—2 books, 24 magazines
Karl F. Lagler—5 reprints
Louise de Kiriline Lawrence—1 reprint
Ernst Mayr—15 magazines
Russell E. Mumford—1 reprint
Margaret M. Niee—6 reprints
Donald J. Nieholson—4 reprints
William H. Phelps—4 reprints
Georg Steinbacher—3 reprints
Winsor M. Tyler—3 books
University of Wisconsin Department of Wildlife Management—3 reprints
J. Van Tyne—1 book
Harry H. Wileox—1 reprint

PROCEEDINGS OF THE THIRTY-FOURTH ANNUAL MEETING

BY PHILLIPS B. STREET, SECRETARY

The Thirty-fourth Annual Meeting of the Wilson Ornithological Club was held at the University of Michigan Biological Station on Douglas Lake, near Cheboygan, Michigan, from Sunday, June 14, to Wednesday, June 17, 1953. It was sponsored by the University of Michigan and the Michigan Audubon Society.

There were four sessions devoted to papers, three evenings of motion pictures, and two business meetings. A meeting of the Executive Council was held on Sunday evening, June 14, and a motion picture, "South to Siesta Land," by Fran William Hall, was shown at the same time, followed by two of the Walt Disney True-Life Adventure Series. The Annual Dinner was held on Monday evening, with First Vice-President Burt L. Monroe delivering the address in the absence of President Breckenridge. Olin Sewall Pettingill, Jr., showed his new film, "Tip o' the Mitten," based upon summer studies at the Biological Station, and it was followed by a film on the life-history of the Bob-white Quail, by Charles W. Schwartz. On Tuesday evening, the staff of the Biological Station and the officers and members of the Michigan Audubon Society were hosts at an informal reception, following the motion picture session.

Early-morning field trips were held on Tuesday morning to nearby Reese's Bog and to Kirtland's Warbler country south of Onaway. All day field trips were held on Wednesday (1) to Kirtland's Warbler country, (2) to Wilderness State Park, and (3) to the Upper Peninsula.

First Business Session

Vice-President Monroe called to order the first general meeting at 9:30 a.m., Monday, June 15. Dr. Alfred H. Stockard, Director of the University of Michigan Biological Station, welcomed the Club to Douglas Lake. The minutes of the 33rd Annual Meeting were approved as published in *The Wilson Bulletin* for September, 1952.

Secretary's Report

The secretary, Phillips B. Street, summarized the principal actions of the Executive Council as follows:

1. Harrison B. Tordoff was unanimously re-elected editor of *The Wilson Bulletin.*
2. The Executive Council accepted the invitation of the Delaware Valley Ornithological Club, the Urner Ornithological Club, and the New Jersey Audubon Society to hold the 35th Annual Meeting at Cape May, New Jersey, on Saturday and Sunday, June 12 and 13, 1954. A meeting of the Executive Council will be held on June 11, and organized field trips will be offered on June 14.
3. An annual contribution of $5 was voted to the International Committee on Bird Protection.
4. The importance of life memberships in building up our endowment funds was discussed at some length, and those who are able are urged to give serious consideration to becoming life members.

Treasurer's Report

The treasurer, Leonard C. Brecher, reported on the finances of the club. The report was approved, subject to the report of the Auditing Committee, scheduled for the following day.

Report of Treasurer for 1952

Balance as shown by last report, dated December 31, 1951		$1,753.91
Receipts		
Dues:		
Active	4,050.00	
Sustaining	1,194.00	
Subscriptions to *The Wilson Bulletin*	472.50	
Sale of back issues and reprints of *The Wilson Bulletin*	277.50	
Gifts: Color Plate Fund	100.00	
Publication Fund	593.00	
Miscellaneous	71.43	
Transferred from Endowment Fund (interest on bonds, savings account, research grants, etc.)	221.29	
Contribution to Book Fund	8.00	
Total Receipts		$ 8,741.63
Disbursements		
"The Wilson Bulletin"—printing, engraving, and mailing	$5,885.77	
President's Expense—Supplies, postage, etc.	3.10	
Editor's Expense—printing, postage, clerical aid, etc.	140.00	
Secretary's Expense—printing, postage, etc.	115.41	
Treasurer's Expense—printing, postage, clerical aid, etc.	220.66	
Membership Committee Expense—printing, postage, etc.	65.20	
Annual Meeting Expense	67.17	
Purchase of book from Book Fund	3.50	
Bank charges, foreign exchange, corporation papers and miscellaneous expenses	11.40	
Purchase of back issues and reprints	33.43	
Transferred to Endowment Fund a/c Louis Agassiz Fuertes Research Grant	100.00	
Total Disbursements		$ 6,645.64
Balance on hand in Citizens Fidelity Bank and Trust Company, Louisville, Kentucky, December 31, 1952		$ 2,095.99

Endowment Fund

Cash balance in Savings Account, December 31, 1951		$2,047.29
Received during year:		
Interest on U. S. Bonds and on Savings Account	223.80	
Life Membership payments	445.00	
Transfer of Special Research Grants from checking account	100.00	
Total receipts		$ 2,816.09
Disbursed during year:		
Transferred to checking account (interest on bonds, etc.)	221.29	
Louis Agassiz Fuertes Research Grant payment	100.00	
Bank charges a/c State Tax	2.51	

Purchase of Massachusetts Investors Trust (116 shares @ $20.75)	2,407.00	
Total disbursements		$ 2,730.80
Cash balance in Savings Account, December 31, 1952		$ 85.29

*Securities owned***

U. S. Postal Savings Coupon Bonds dated July 1, 1935	$ 780.00
U. S. Savings Bonds, Series "G", dated September 1, 1943 (maturity value $1,000.00)	973.00
U. S. Savings Bonds, Series "G", dated September 20, 1944 (maturity value $1,500.00)	1,450.50
U. S. Savings Bonds, Series "G", dated June 1, 1945 (maturity value $500.00)	482.00
U. S. Savings Bonds, Series "G", dated July 1, 1945 (maturity value $900.00)	864.90
U. S. Savings Bonds, Series "G", dated October 1, 1945 (maturity value $1,400.00)	1,345.40
U. S. Savings Bonds, Series "F", dated February 1, 1947 (maturity value $2,000.00)	1,618.00
U. S. Savings Bonds, Series "F", dated April 1, 1948 (maturity value $2,000.00)	1,572.00
U. S. Savings Bonds, Series "F", dated October 1, 1948 (maturity value $1,450.00)	1,125.20
U. S. Savings Bonds, Series "F", dated April 1, 1950 (maturity value $1,000.00)	754.00
Massachusetts Investors Trust (116 shares at $20.75 per share)	2,407.00
Total securities owned**	$13,372.00
Total Endowment Fund	$13,457.29

**Bonds carried at redeemable value December 31, 1952

In reserve:

Louis Agassiz Fuertes Research Grant Fund (special gift)	25.00
S. Morris Pell Fund (special gift)	75.00

Respectfully submitted,
Leonard C. Brecher, Treasurer

Membership Committee

Ralph M. Edeburn, chairman, reported that the names of 155 prospective members enrolled since the 1952 Annual Meeting were posted for the inspection of members and for election by vote at the final business session. On December 31, 1952, the club had 1347 active, 238 sustaining and 82 life members, a total of 1667. Since January 1, 1953, 91 new members have been added. This number will be further increased by the reinstatement of delinquents. The total circulation of the *Bulletin* on December 31, 1952, was 1898; this included 156 institutional subscriptions and 75 exchanges. The membership appears to be in stable condition.

Research Grant Committee

John T. Emlen, Jr., chairman, reported that the year had been a discouraging one for his committee. Only $25 remained in the Louis Agassiz Fuertes Fund, and it was decided that announcements of a grant would not be distributed until such time as

sufficient money was available to make a full award of $100. The President's appeal in the March *Bulletin* for contributions brought forth two responses, but not in time to make a proper announcement for applications, and the award was accordingly deferred for this year.

No candidates were proposed for the S. Morris Pell Award.

It is with great pleasure that we announce a donation of $500 at the Annual Meeting to the Research Committee by an anonymous member of the club. It is most gratifying that this worthy tradition can now be perpetuated, and we sincerely hope that other members in a position to contribute to a research fund will follow this fine example.

Library Committee

George J. Wallace, chairman, reported the major activity of the committee was the publication of the complete book list in the September, 1952, *Bulletin*, which will enable one to see what books or monographs are available, if he wishes to borrow, and what are not available, if he wishes to donate to the library. Accessions to the library since June, 1952, totalled 612 items, consisting of 60 books, 428 reprints, 323 magazines, 99 pamphlets, 1 bulletin, and 1 bird song record. These contributions were made by 79 different donors. The above list substantially exceeds the accessions of any recent year, especially in the number of books. These contributions have been most gratifying.

Illustrations Committee

Robert M. Mengel, chairman, reported that the committee has (1) supervised completely the selection, reproduction, and delivery of the four-color frontispieces in the *Bulletin* and (2) redrawn for authors figures for three articles now in press and has consulted with the editor about numerous other illustrations and illustrations problems.

Temporary Committees

The following temporary committees were appointed:

Auditing Committee: Lawrence H. Walkinshaw, Chairman; John M. McCormick.

Resolutions Committee: Dwain W. Warner, Chairman; Betty Carnes; Harold S. Peters.

Nominating Committee: Maurice G. Brooks, Chairman; Albert F. Ganier; Robert A. McCabe.

Second Business Session

The second and final business session was called to order at 10 a.m., Tuesday, June 16.

The applicants for membership, whose names were posted, were elected to membership to the club.

Report of Auditing Committee

The auditing committee reported that they had examined the books of the treasurer and found them to be correct. They recommended that an accountant be employed to audit the books in the future, prior to the annual meeting date.

Report of the Resolutions Committee

WHEREAS the Wilson Ornithological Club at its Thirty-fourth Annual Meeting has had one of the most successful meetings in the history of the organization, therefore, BE IT RESOLVED that the Wilson Ornithological Club at its Thirty-fourth Annual Meeting, held June 14–17, 1953, at the University of Michigan Biological Station, Douglas Lake, Michigan, express its sincere thanks to those who have made this meeting a most memorable one; to Dr. Harlan Hatcher, President of the University of

Michigan, for making available the facilities of the Biological Station; to Dr. Alfred H. Stockard, Director of the Biological Station, and his staff for their generous and efficient service; to members of the Michigan Audubon Society; and especially to the Local Committee on Arrangements: H. Lewis Batts, Miss Hazel L. Bradley, Edward M. Brigham, Jr., Donald W. Douglass, Miss Irene F. Jorae, Harold F. Mayfield, Mr. and Mrs. Clarence J. Messner, Miss Theodora Nelson, Haven H. Spencer, George J. Wallace, Robert A. Whiting, Harold Wing, and particularly to Olin Sewall Pettingill, Jr., Chairman, and Nicholas L. Cuthbert, Vice-Chairman.

Election of Officers

Maurice G. Brooks, chairman, reported for the Nominating Committee and proposed the following officers for the coming year: President, Walter J. Breckenridge; First Vice President, Burt L. Monroe; Second Vice President, Harold F. Mayfield; Treasurer, Leonard C. Brecher; Secretary, Phillips B. Street; Elective members of the Executive Council, W. W. H. Gunn (term expires 1954), Joseph C. Howell (term expires 1955), and A. W. Schorger (term expires 1956).

The report of the Nominating Committee was accepted, and, there being no nominations from the floor, the secretary was instructed to cast a unanimous ballot for these nominees.

PAPERS SESSIONS

Monday, June 15

Theodora Nelson, Hunter College of the City of New York, *A History of Ornithology at the University of Michigan Biological Station*, slides.

C. J. Henry, U. S. Fish and Wildlife Service, *The Seney National Wildlife Refuge*, slides.

Miles D. Pirnie, Michigan State College, *Duck Nesting in Northern Michigan*, slides.

Lawrence H. Walkinshaw, Battle Creek, Michigan, *An Introduction to Some Bird Areas in Northern Michigan*, slides.

George J. Wallace, Michigan State College, *An Introduction to Some Bird Areas in Southern Michigan.*

Edward G. Voss, University of Michigan, *Botanical Features of the Douglas Lake Region*, slides.

S. Charles Kendeigh, University of Illinois, *Niche Requirements of Birds as Illustrated by their Community Distribution in the Douglas Lake Region*, slides.

Gordon Alexander, University of Colorado, *Introgressive Hybridization in Flickers*, slides.

Philip S. Humphrey, University of Michigan, *A Possible Mechanism of Hybridization in Ducks.*

Harrison B. Tordoff, University of Kansas, and J. R. Macdonald, South Dakota School of Mines and Technology, *Evolution in the Cracidae.*

Douglas A. James, University of Illinois, *Aggregatory Roosting Among Certain Passerine Birds: Aspects of the Internal and External Structure*, slides.

Margaret M. Nice, Chicago, Illinois, *The First Week in a Raven's Life.*

Dean Amadon, American Museum of Natural History, *The Helmeted Hornbill; Some Remarkable Adaptations*, slides.

Wesley E. Lanyon, University of Wisconsin, *The Development of Vocal Patterns in a Hand-raised Meadowlark*, tape and slides.

Tuesday, June 16

J. William Hardy, Michigan State College, *Swainson's Warbler: New Records and a History of its Occurrence in Southern Illinois.*

Josselyn Van Tyne, University of Michigan, *The Distribution of Kirtland's Warbler*, slides.

Aretas A. Saunders, Canaan, Connecticut, *Variations in the Song of the Red-eyed Towhee.*

Maurice Broun, Hawk Mountain Sanctuary, *Mid-summer Aggregations of Barn Swallows in Eastern Pennsylvania*, slides.

John T. Emlen, Jr., and Carl Jacoby, University of Wisconsin, *Territory and Survival in a Ring-billed Gull Colony in Mackinac Straits*, slides.

Robert W. Nero, University of Wisconsin, *Sexual Chasing in the Red-winged Blackbird.*

James Bond, Academy of Natural Sciences, *The Rediscovery of the Coré.*

William B. Robertson, University of Illinois, *Breeding-bird Populations in Tropical Florida*, slides.

Donald J. Borror and Carl R. Reese, Ohio State University, *Analytical Studies of Bird Songs* (presented on tape), slides.

Robert C. Stein, Cornell University, *The "Song" Types of the Alder Flycatcher*, tape and slides.

Robert W. Storer, University of Michigan, *A Hybrid Between the Chipping and Clay-colored Sparrows.*

K. T. Rogers, University of Michigan, *The Use of Embryology in Field Ornithology*, slides and motion pictures.

Lawrence I. Grinnell, Ithaca, New York, *Coastal, River and Savannah Birds of British Guiana*, motion pictures.

George E. Grube, Gettysburg College, *The Blue-winged Warbler: its Habitat, Habits and an Incidence of Predation Upon It*, motion pictures.

John M. and Mary R. Jubon, East Millstone, New Jersey, *Glimpses of New Jersey Birds*, motion pictures.

Harold S. Peters, U. S. Fish and Wildlife Service, *Funk Island, Newfoundland, Former Home of the Great Auk*, motion pictures.

Attendance

Members and guests in attendance at the meeting numbered approximately 350, including 41 children. The numbers of children accompanying adults and too young to register are listed in parentheses rather than by name. Twenty-six states, Ontario, Iceland, and Venezuela were represented.

From **Alabama:** 2—*Birmingham*, Mrs. Blanche E. Dean, Blanche H. Chapman.

From **Colorado:** 5—*Boulder*, Mr. and Mrs. Gordon Alexander, Douglas Alexander; *Denver*, Mr. and Mrs. Edwin R. Kalmbach.

From **Connecticut:** 1—*Canaan*, Aretas A. Saunders.

From **Florida:** 2—*Daytona Beach*, Mr. and Mrs. Conrad H. Ekdahl.

From **Georiga:** 1—*Atlanta*, Harold S. Peters.

From **Illinois:** 21—*Blue Island*, Karl E. Bartel, *Champaign*, Douglas A. James, Arthur A. Johnson, Mr. and Mrs. S. Charles Kendeigh (2 ch.), William B. Robertson, Mr. and Mrs. Lyell J. Thomas, *Chicago*, Charles Hartshorne, Alfred Lewy, Constance Nice, L. B. Nice, Margaret M. Nice, Mr. and Mrs. R. M. Strong, *East Moline*, Mr. and Mrs. Elton Fawks, *Murphysboro*, Richard D. Brewer, *Urbana*, Donald C. Goodman.

From **Indiana:** 16—*Connersville*, Edna Banta, *Fort Wayne*, Catherine Pusey, *Hanover*, Mr. and Mrs. J. Dan Webster (2 ch.), *Indianapolis*, Mildred Campbell, Mrs. S. G. Campbell, *Lafayette*, Mr. and Mrs. Albert G. Guy, *New Castle*, Ruby Stockinger,

Richmond, Miss C. E. Anderson, Millard S. Markle, Mary Jane Neal, Mrs. C. S. Snow, Jean Snow.

From **Iowa:** 4—*Cedar Rapids*, Lillian Serbousek, Myra G. Willis, *Davenport*, Mrs. Peter Petersen, Peter C. Petersen, Jr.

From **Kansas:** 13—*Baldwin*, Mr. and Mrs. R. F. Miller, *Lawrence*, Mr. and Mrs. Bert Chewning, Richard W. Fredrickson, Mr. and Mrs. Robert M. Mengel, Mr. and Mrs. Harrison B. Tordoff (3 ch.), *Shawnee*, Ben King.

From **Kentucky:** 6—*Anchorage*, Mr. and Mrs. Burt L. Monroe, *Louisville*, Mr. and Mrs. Leonard C. Brecher, Mr. and Mrs. Frederick W. Stamm.

From **Louisiana:** 1—*Baton Rouge*, Frances Crews.

From **Maryland:** 4—*Hyattsville*, Mary Catherine Crone, Katherine Keeley, *Laurel*, Seth H. Low, *Towson*, Richard D. Cole.

From **Michigan:** 123—*Ann Arbor*, Mr. and Mrs. Andrew J. Berger, Margaret G. Branch, Ralph M. Branch, Mr. and Mrs. Robert S. Butsch (1 ch.), Esther Byers, Marie Donegan, Francis C. Evans, Mr. and Mrs. Harry W. Hann, Maud Hukill, Philip S. Humphrey, Mrs. Reuben L. Kahn, Mr. and Mrs. William A. Lunk (2 ch.), Mr. and Mrs. Bradey M. Patten, K. T. Rogers, Mr. and Mrs. Haven H. Spencer (2 ch.), Peter Stettenheim, Mr. and Mrs. Alfred H. Stockard (2 ch.), Robert W. Storer, Josselyn Van Tyne, Edward G. Voss, Mr. and Mrs. Dale A. Zimmerman, *Battle Creek*, Mr. and Mrs. Edward M. Brigham, Jr., Edward M. Brigham, III, Lawrence H. Walkinshaw, *Brighton*, Mr. and Mrs. Don B. Savery, *Cheboygan*, David Rochelean, *Detroit*, Virginia Gorst, Esther McKercher, Douglas S. Middleton, Mrs. Forbes Miller, Mrs. Thomas A. Petts, Florence E. Roper, *East Lansing*, J. William Hardy, George Petrides, Mr. and Mrs. Miles D. Pirnie, T. Wayne Porter, Mr. and Mrs. George J. Wallace, *Farmington*, Madge Prior, *Ferndale*, Harold D. Mahan, *Glen Lake*, Mrs. Ove F. Jensen, *Grand Rapids*, Julia Barnes, Hazel Dennis, Mrs. Norman English, Alta Harrison, Agnes Kugel, Rose Mary Scott, *Grayling*, Mr. and Mrs. Fenn M. Holden, *Grosse Point*, Mr. and Mrs. Clarence J. Messner, *Hastings*, Hazel McKibbin, *Hickory Corners*, Arthur E. Staebler (1 ch.), *Holland*, Marbelle Geiger, Katherine Post, Lida Rogers, *Hudsonville*, Peter Hovington, James Ponshair, *Huntington Woods*, Mr. and Mrs. Neil T. Kelley, *Jackson*, Hazel L. Bradley, Mr. and Mrs. W. Powell Cottrille, Mr. and Mrs. Robert A. Whiting, Mr. and Mrs. Harold F. Wing (3 ch.), *Kalamazoo*, H. Lewis Batts, Jr., Marie E. Thompson, Sara Ubbes, *Lake Orion*, Gordon M. Garlick, *Lansing*, George A. Ammann, Donald W. Douglass, *Lincoln Park*, Helen Blanchet, *Marquette*, Mrs. Mary Spear Ross, Rollin K. Thoren (1 ch.), LaRue Wells. *Midland*, Eugene E. Kenaga, *Milford*, Lawrence A. Ryel, *Mt. Clemens*, Mrs. Taft Johnston, *Mt. Pleasant*, Mr. and Mrs. Nicholas L. Cuthbert (1 ch.), *Muskegon*, Alameda Boulton, Margaret Elliott, Mary Elizabeth Whelan, *Paw Paw*, LaVerne Argabright, *Plymouth*, Virginia Olmstead, Elsie W. Townsend, *Rudyard*, Mrs. H. Van Farowe, *Sault Ste. Marie*, Mr. and Mrs. Otto McNaughton, Jr., *Seney*, Mr. and Mrs. C. J. Henry, *Spring Lake*, Mr. and Mrs. Bernard W. Baker, David Baker, *The Heights*, Elsworth M. Harger, *Three Rivers*, Oscar M. Bryens, *Union City*, Mr. and Mrs. William A. Dyer.

From **Minnesota:** 14—*Duluth*, Mr. and Mrs. Harvey Putnam, *Minneapolis*, Mr. and Mrs. Lewis L. Barrett, Amy Chambers, Glenn R. Downing, Dwain W. Warner, *Northfield*, Mr. and Mrs. Fran W. Hall, Mr. and Mrs. O. S. Pettingill, Jr. (2 ch.), *Owatonna*, Mrs. Horson A. Northrop.

From **Missouri:** 1—*Kansas City*, Terence Rhoades.

From **Montana:** 2—*Bozeman*, Mr. and Mrs. Clifford V. Davis.

From **New Jersey:** 5—*East Millstone*, Mr. and Mrs. John M. Jubon (1 ch.), *Princeton*, Charles H. Rogers, *Tenafly*, Betty Carnes.

From **New York:** 12—*Albany*, Mrs. Lillian C. Stoner, *Allegany*, Stephen W. Eaton, *Brooklyn*, Paula Braden, *Buffalo*, Fred T. Hall, *Ithaca*, Mr. and Mrs. Lawrence I. Grinnell, Edward L. Seeber, Robert C. Stein, *New York*, Dean Amadon, G. Carleton, Theodora Nelson, *Waterloo*, Jason A. Walker.

From **Ohio:** 34—*Cincinnati*, Mr. and Mrs. John R. Bunnell, *Cleveland*, Vera Carrothers, Elsie C. Erickson, Adela Gaede, Mrs. Lucille M. Mannix, Mildred Stewart, *Columbus*, Mr. and Mrs. Edward S. Thomas (1 ch.), *East Cleveland*, Marjorie Ramisch, *Hiram*, Mr. and Mrs. Lincoln C. Pettit (3 ch.), *Painesville*, Mrs. Robert V. D. Booth, *Perrysburg*, Mr. and Mrs. Russel L. Burget (1 ch.), *Richmond*, Mr. and Mrs. Robert McCullough, *Steubenville*, Mr. and Mrs. Clinton S. Banks, Richard Banks, Mr. and Mrs. Albert R. Tenney, Lois Lee Tenney, *Toledo*, John M. McCormick, Mr. and Mrs. Harold F. Mayfield (4 ch.).

From **Pennsylvania:** 18—*Butler*, Mr. and Mrs. Frank W. Preston, *East Brady*, Mr. and Mrs. Leonard W. Wing (4 ch.), *Exton*, Mr. and Mrs. Phillips B. Street (1 ch.), Gettysburg, George E. Grube, *Kempton*, Mr. and Mrs. Maurice Broun, *Lebanon*, Cynthia Gingrich, *McConnellsburg*, Nancy Stevens, *Philadelphia*, James Bond, Frederick V. Hebard.

From **South Carolina:** 1—*Travelers Rest*, Ruth Gilreath.

From **South Dakota:** 5—*Sioux Falls*, Mr. and Mrs. Herman F. Chapman, Herbert Krause, Mr. and Mrs. J. Scott Findley.

From **Tennessee:** 3—*Knoxville*, Joseph C. Howell, *Maryville*, Ralph J. Zaenglein, *Nashville*, Albert F. Ganier.

From **Virginia:** 2—*Harrisonburg*, Mr. and Mrs. D. Ralph Hostetter.

From **West Virginia:** 8—*Huntington*, Mr. and Mrs. Ralph M. Edeburn, P. C. Bibbie, *Morgantown*, Robert L. Birch, Mr. and Mrs. Maurice G. Brooks (1 ch.), Earl N. McCue.

From **Wisconsin:** 23—*Madison*, John T. Emlen, Alice Fosse, Mr. and Mrs. Wesley E. Lanyon, H. C. Mueller, Robert Nero, Gerald A. Vogelsang, *Milwaukee*, Daniel S. Berger, Mrs. C. R. Decker, Jr., Mary Donald, *Oshkosh*, John L. Kasper, *Plainfield*, Mr. and Mrs. Frederick N. Hamerstrom, Jr. (2 ch.), *Two Rivers*, Mr. and Mrs. F. B. Mayer (2 ch.), *Viroqua*, Margarette E. Morse, Mary E. Morse, Lois E. Webster, *West Bend*, Marvin E. Vore.

From **Ontario, Canada:** 7—*Hamilton*, Eric W. Bastin, *Toronto*, Mr. and Mrs. O. E. Devitt, Mr. and Mrs. J. Bruce Falls, W. W. H. Gunn, Douglas S. Miller.

From **Iceland:** 1—*Reykjavik*, Finnur Gudmundsson.

From **Venezuela:** 1—*Caracas*, William H. Phelps.

No address given: 9—Mr. and Mrs. W. F. Davidson, Wilfred Goodman, Edith McLennan, Gordon C. Mandigo, Shirley Mann, Pauline Miller, Kay Petts, Edith Schultz.

This number of *The Wilson Bulletin* was published on October 31, 1953.

Suggestions to Authors

Manuscripts intended for publieation in *The Wilson Bulletin* should be neatly typewritten, double-spaeed, and on one side only of good quality white paper. Tables should be typed on separate sheets. Before preparing these, earefully consider whether the material is best presented in tabular form. Where the value of quantitative data ean be enhaneed by use of appropriate statistieal methods, these should be used. Follow the A. O. U. Cheek-List (fourth edition) and supplements thereto insofar as seientifie names of United States and Canadian birds are eonecrned unless a satisfaetory explanation is offered for doing otherwise. Use speeies names (binomials) unless specimens have aetually been handled and subspeeifically identified. Summaries of major papers should be brief but quotable. Where fewer than five papers are eited, the eitations may be included in the text. All eitations in "General Notes" should be ineluded in the text. Follow earefully the style used in this issue in listing the literature cited. Photographs for illustrations should be sharp, have good contrast, and be on glossy paper. Submit prints unmounted and attaeh to eaeh a brief but adequate legend. Do not write heavily on the backs of photographs. Diagrams and line drawings should be in blaek ink and their lettering large enough to permit reduetion. The Illustrations Committee will prepare drawings, following authors' direetions, at a eharge of $1 an hour, the money to go into the eolor-plate fund. Authors are requested to return proof promptly. Extensive alterations in eopy after the type has been set must be eharged to the author.

A Word to Members

The Wilson Bulletin is not as large as we want it to be. It will beeome larger as funds for publication inerease. The Club loses money, and the size of the *Bulletin* is cut down aeeordingly, eaeh time a member fails to pay dues and is put on the 'suspended list.' Postage is used in notifying the publisher of this suspension. More postage is used in notifying the member and urging him to pay his dues. When he does finally pay he must be reinstated on the mailing list and there is a publisher's eharge for this service. The *Bulletin* will beeome larger if members will make a point of paying their dues promptly.

Notice of Change of Address

If your address ehanges, notify the Club immediately. Send your eomplete new address to the Treasurer, Leonard C. Brecher, 1900 Spring Drive, Louisville 5, Kentueky. He in turn will notify the publisher and editor.

December, 1953

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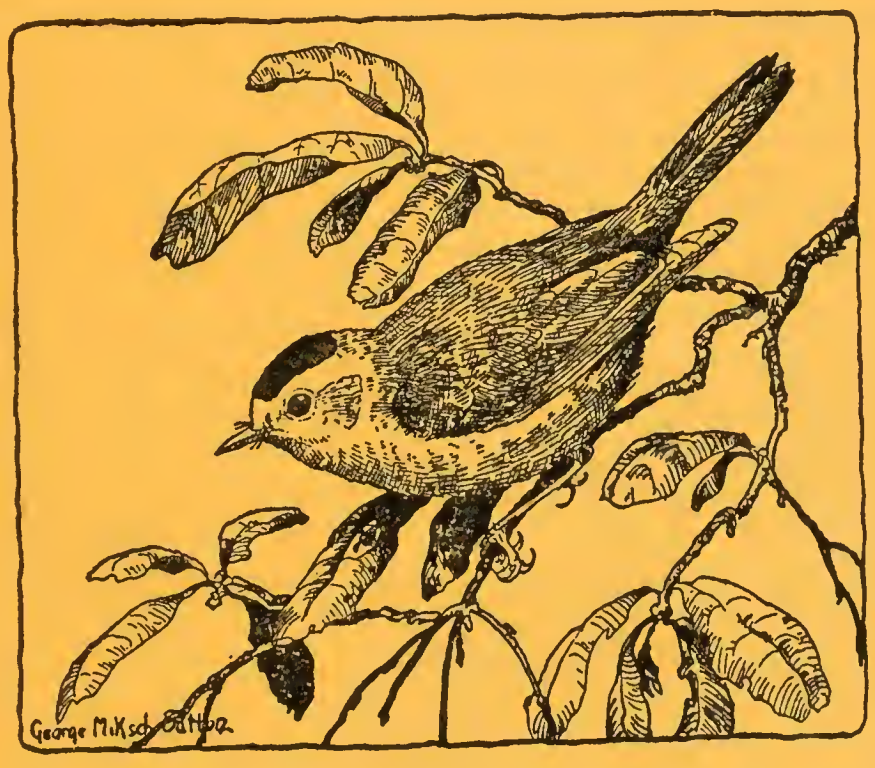
The Wilson Bulletin



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THE WILSON ORNITHOLOGICAL CLUB

Founded December 3, 1888

Named after ALEXANDER WILSON, the first American ornithologist.

Membership dues per calendar year are: Sustaining, $5.00; Active, $3.00. THE WILSON BULLETIN is sent to all members not in arrears for dues.

WILSON ORNITHOLOGICAL CLUB LIBRARY

The Wilson Ornithological Club Library, housed in the University of Michigan Museum of Zoology, was established in concurrence with the University of Michigan in 1930. Until 1947 the Library was maintained entirely by gifts and bequests of books, pamphlets, reprints, and ornithological magazines from members and friends of The Wilson Ornithological Club. Now two members have generously established a fund for the purchase of new books; members and friends are invited to maintain the fund by regular contributions, thus making available to all Club members the more important new books on ornithology and related subjects. The fund will be administered by the Library Committee, which will be glad for suggestions from members on the choice of new books to be added to the Library. George J. Wallace, Michigan State College, East Lansing, Michigan, is Chairman of the Committee. The Library currently receives 65 periodicals as gifts and in exchange for *The Wilson Bulletin*. With the usual exception of rare books, any item in the Library may be borrowed by members of the Club and will be sent prepaid (by the University of Michigan) to any address in the United States, its possessions, or Canada. Return postage is paid by the borrower. Inquiries and requests by borrowers, as well as gifts of books, pamphlets, reprints, and magazines, should be addressed to "The Wilson Ornithological Club Library, University of Michigan Museum of Zoology, Ann Arbor, Michigan." Contributions to the New Book Fund should be sent to the Treasurer, Leonard C. Brecher, 1900 Spring Dr., Louisville 5, Ky. (small sums in stamps are acceptable). A complete index of the Library's holdings was printed in the September 1952 issue of *The Wilson Bulletin*, and each September number lists the book titles in the accessions of the current year. A brief report on recent gifts to the Library is published in every issue of the *Bulletin*.

THE WILSON BULLETIN

The official organ of The Wilson Ornithological Club, published quarterly, in March, June, September, and December, at Lawrence, Kansas. In the United States the subscription price is $3.00 a year, effective in 1951. Single copies, 75 cents. Outside of the United States the rate is $3.25. Single copies, 85 cents. Subscriptions, changes of address and claims for undelivered copies should be sent to the Treasurer. Most back issues of the *Bulletin* are available (at 50 cents each for 1950 and earlier years, 75 cents each for 1951 and subsequent years) and may be ordered from the Treasurer.

All articles and communications for publication, books and publications for review should be addressed to the Editor. Exchanges should be addressed to The Wilson Ornithological Club Library, Museum of Zoology, Ann Arbor, Michigan.

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THE WILSON BULLETIN

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CONTENTS

FIG. 1. Muskeg about 27 miles north of the Albany River and about 45 miles inland from James Bay, Ontario.

FIG. 2. Open muskeg in the vicinity of the dancing ground.

MUSKEG AS SHARP-TAILED GROUSE HABITAT

BY HAROLD C. HANSON

IN their review paper on the ecology and distribution of the Sharp-tailed Grouse, *Pedioecetes phasianellus*, the Hamerstroms (1951) pointed out that little is known about the life history and ecology of the northern races (*caurus*, *kennicottii*, and *phasianellus*). In 1947, while investigating the Canada Goose in the extensive muskeg country west and south of Hudson Bay and James Bay, I had opportunity to study briefly a dancing ground of the race *phasianellus*. The nature of this dancing ground was so different from the commonly known types that it appeared to offer at least a partial explanation as to how this race has been able to adapt itself to a muskeg environment. While only one dancing ground was found, it is difficult to believe that the specialized habits of the one group of breeding birds observed are not common to other flocks of the region. Other general conclusions presented here are based on extensive low altitude flights, both in 1947 and again in 1949, numerous penetrations of the muskeg on foot, and a fairly extensive plant collection made in the region.

For support of field operations while in the James Bay-Hudson Bay region, I am happy again to acknowledge grants by the Arctic Institute of North America and Ducks Unlimited, which made the work possible. The manuscript was improved by the helpful criticism and suggestions given by Ralph E. Yeatter and Frederick and Franees Hamerstrom.

The range of the Sharp-tailed Grouse extends from central western Quebec west to Alaska and south to northern California, Utah, southwestern Colorado and central Wisconsin. Such a widespread species, which is not migratory in the usual sense of the word, must of necessity be sufficiently adaptable to meet its requirements in the diversified habitats found in such an extensive range. Some adaptations have probably become genetically fixed, a consequence which at least in part is likely to be paralleled by phenotypical differences (Mayr, 1950). At present six subspecies of Sharp-tailed Grouse are recognized.

The habits of the race *campestris* in Wisconsin best serve as a standard upon which to evaluate the Ontario observations. In early settlement times the sharp-tails of the southern Wisconsin prairies showed a preference for oak openings (Schorger, 1944); its original range within the forested portions of central and northern Wisconsin is believed to have been in and around edges of open bogs and marshes and on burns (Hamerstrom *et al.*, 1952). The observations made by me in northern Ontario in 1947 indicate that the designation of open bogs as an important original sharp-tail habitat in Wisconsin is undoubtedly correct. Because knowledge of the northern

races of Sharp-tailed Grouse has been so scanty, it does not appear to have been fully realized that muskeg apparently constitutes one of the primary habitats in the range of the nominate race, *phasianellus*, which breeds south of the timberline on both sides of Hudson Bay and James Bay from central western Quebec west to northeastern Manitoba south to about the Canadian National Transcontinental Railway in Ontario (Hellmayr and Conover, 1942; Snyder, 1935). The Sharp-tailed Grouse has been reported from all major sectors of the Hudson Bay lowlands or the "Great Muskeg," in some years being particularly abundant (Manning, 1952).

Snyder (1935) stated that the race *phasianellus* "in habits and behavior, is still an open-country bird; it still attempts to be a 'prairie dweller' in the openings of the forest in the north. But in such an area they must be rather irregularly established here and there in suitable habitats, which are more or less restricted locally and *definitely hemmed in by the flanking forest*" (italics mine). With more information available on the ecology of the "Great Muskeg" of northern Ontario, the above statements can now be modified considerably insofar as they apply to the District of Patricia.

Snyder's Map 1 (1935) indicates that the eruption and subsequent emigration of sharp-tails in 1932 occurred from the region south and west of James Bay and Hudson Bay, an area which coincides (without its western limits being delineated) almost exactly with the limits of the lower two-thirds of the Palaeozoic Basin. The latter, more commonly referred to as the Hudson Bay Lowlands (Anon., 1947), constitutes a 125,000 square mile area which supports, almost equivalent in size, perhaps the single greatest continuous tract of muskeg of its kind in the world. Aerial flights made over this area revealed that except for the south end of James Bay, this area is only partially or poorly timbered with stunted tamarack and black spruce, and these occur mainly in blocks of variable size (fig. 1). About five fairly distinct muskeg types (Hanson and Smith, 1950) can be recognized.

Instead of fairly scattered isolated tracts of suitably open habitat in otherwise forested country, the essentially open character of this muskeg furnishes perhaps the largest single continuous block, or series of interconnecting blocks, of habitat available to the species in the northern sector of its entire range. This is not to imply that every square mile of this muskeg is suitable for sharp-tails—a species is seldom able to occupy all areas of its range; there are innumerable lakes and areas of floating vegetation that occupy a considerable portion of this muskeg. Nevertheless, the sheer size of this breeding range coupled with a cyclic peak must in part account for the unprecedented numbers of these birds that occurred over northern Ontario and easternmost Quebec in the emigration of 1932 (Snyder, 1935).

For a species in which communal courtship is carried out, the presence

or absence of a suitable dancing ground may be the factor deciding whether an otherwise satisfactory range is inhabitable. In Wisconsin, the race *campestris* resorts to grassy knolls, buckwheat stubble fields, and open marsh (Hamerstrom, 1939). Grange (1948) reports that sharp-tails utilized booming grounds similar to Prairie Chickens (*Tympanuchus cupido*), but "exhibited an even greater preference for wet marshes," in one case utilizing a solid mat of grass which lay over eleven inches of water. In Utah (Hart,

FIG. 3. Sedge tussock used by Sharp-tailed Grouse cock as a pedestal on which to display. See text for locality and date.

Lee, and Low, 1950), dancing areas used by the race *columbianus* "are usually found on points of higher elevations, ranging from small knolls to high hills, and usually in a weed-grass cover type."

From these accounts and others in the literature (Bent, 1932) it seems apparent that most dancing grounds possess either little cover or cover that is most commonly of low grasses or sedges which does not prevent the grouse using them from readily seeing one another. A fairly firm substrate also seems to be desired. Both factors may account for the fact that small knolls are often chosen for dancing grounds. Indirect confirmation of the importance of the visual aspect of dancing grounds can be derived from the habits of the closely related Prairie Chicken. In agricultural regions of Illinois, Prairie

Chickens often resort to fields planted to forage crops or small grains. When, however, the growth of vegetation eventually hides one bird from another, the males will make vertical leaping flights as high as 4–5 feet—presumably to keep in visual contact with the other birds as well as to be better seen themselves (Ralph Yeatter, personal communication). The Hamerstroms (personal communication, 1953) have also noticed that Prairie Chicken cocks make jump flights, particularly when new birds arrive, and that when the cover is high, the jumps are high (2–4 feet), and when cover is sparse, the jumps are often low (1-2 feet).

The northern Ontario muskeg embraces three main vegetation types: blocks of close grown stunted spruce or stands of open grown tamarack; brushy areas on hummocky moss- and lichen-covered ground (fig. 2); and water-logged grass and sedge areas which in the vicinity of lakes and ponds extend out for some distance over the surface of the water as a floating sedge mat. The first type obviously does not provide dancing grounds; the latter two types either lack a firm enough substrate or, from the standpoint of unobstructed vision, seemingly would not provide adequate display grounds. Yet for this species, visual psychic stimulation appears to be of paramount importance for breeding success. The visual as well as the substrate problem appears to have been solved by the muskeg sharp-tails of northern Ontario by resorting to the use of vegetational pedestals or tussock mounds, as shown in fig. 3. This photograph was taken on July 1, 1947, about 10 miles up the Lawabiskau River, a stream flowing into James Bay 20 miles south of the mouth of the Albany River. About a dozen performing birds were seen. These birds, insofar as could be told before flushing, and later by inspection of the area, were making use of these sedge mounds. Although note was not taken of the fact at the time, the photograph suggests that the sedge on the top of the mound was trimmed by plucking as well as trampled to create the saucer-like depression. A ramp, formed of trampled vegetation, can be seen leading up to this elevated platform. Many of these tussock mounds support small and very stunted black spruce by virtue of their slight elevation above the surrounding water-logged sedge vegetation. A male specimen collected from the tussock figured was shot in the early afternoon. The presence of birds on the dancing grounds at this time of day is probably related to the heavy overcast at the time.

In Wisconsin, Prairie Chickens are also known to boom on tussocks. "One booming ground which has about six inches of water each spring, has persisted since at least 1939, with the cocks using the tussocks and lodged mats intensively and flattening the tops with their feet" (the Hamerstroms, personal letter, 1953).

Snyder (1935) discounted a food shortage as a factor causing the emi-

gration from the Hudson Bay-James Bay region in 1932, stating that the birds collected during the flight were in good physical condition. In fact, the main plant foods eaten by Sharp-tailed Grouse (Schmidt, 1936; Swanson, 1940; Grange, 1948; Hamerstrom and Hamerstrom, 1951) are so omnipresent in the "Great Muskeg" that a food shortage seems inconceivable. For example, buds, leaves, catkins, or fruits of the following are taken: tamarack, junipers, willows, aspens, *Myrica gale*, alders, white birch, bog birch, roses, brambles (*Rubus*), dogwood, leatherleaf, bearberry, small

Fig. 4. The Attawapiskat River at a point about 35 miles inland from the coast of James Bay, Ontario. Note black spruce on the higher ground of the natural levees along the river.

cranberry, as well as numerous herbaceous plants. All these plants, and in some cases many related species, occur more or less abundantly in the muskeg or its associated forest edge along the major streams. Fall movements and concentrations of Sharp-tailed Grouse in the muskeg area as a whole are more likely a part and result of seeking heavier timber cover in advance of the winter than a food shortage *per se*. When the much more limited and well protected timbered sites, which occur chiefly in linear patterns along the rivers (fig. 4), become crowded in years of cyclic peaks as the result of shifts in habitat by local populations, as well as limited migra-

tional movements of more northerly populations, it is more readily appreciated how simple population pressure in combination with migratory unrest could precipitate a mass emigration.

In conclusion, it would seem that the above findings offer support for the opinion expressed by the Hamerstroms (1951, p. 208) that "the great bulk of evidence, however, indicates that sharp-tails do not need grain. It is possible that sharp-tails require either grains as food or woody vegetation for shelter to get through the winter—that a highly concentrated diet may make up for a deficiency in cover."

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Illinois Natural History Survey, Urbana, Illinois. June 23, 1953

NEW LIFE MEMBER

Whitney H. Eastman was born at Fort Ann, New York, on April 24, 1888. A graduate of Dartmouth College, he is Vice President of General Mills, Inc. His deep interest in bird study has resulted in his acquiring a life-list of 749 species, which includes the Ivory-billed Woodpecker. A pair of these birds, which he located in Florida in March, 1950, were the first to be found in that state since 1924. He was instrumental in the establishment of a sanctuary for the pair. He maintains active membership in many ornithological societies and is on the National Executive Board of the Boy Scouts of America.

NOTES ON THE LIFE HISTORY OF THE BLACK-CRESTED ANT SHRIKE IN SURINAM

BY F. HAVERSCHMIDT

THE Black-crested Ant Shrike (*Sakesphorus canadensis*) is a medium-sized member of the large, neotropical family of antbirds (Formicariidae). In the male the head, sides of face, throat, and breast are uniform black. The abdomen and sides of the breast are slate gray, while the upper back is smoke brown. The wing coverts are edged with white as are the tips of the tail feathers. The male has a conspicuous black crest. The female is very different, as she lacks all the black, while the head, crest, and back are rufous, and the breast is ochraceous.

The weights of eight specimens collected by me in Surinam were: for five males, 20, 22, 24.6, 24.8, and 26.5 gm.; for three females, 20, 25, and 27.8 gm.

The species ranges from northern Colombia, Venezuela, Trinidad, and the three Guianas to northern Brazil. Peters (1951:160) recognized seven subspecies, the nominate race being confined to Surinam and French Guiana.

In the coastal area of Surinam the Black-crested Ant Shrike is a common bird in the undergrowth of secondary forest. It is especially numerous in the thickly overgrown sand reefs so characteristic of this region, but it also occurs in the vast "Parwa," the mangroves (*Avicennia nitida*) bordering the seacoast in a broad strip. In cultivated areas it is equally common in the coffee plantations and in waste land.

The birds are mostly seen in pairs, foraging not only in trees and shrubbery but also on the ground. Their flight is rather weak and they apparently do not like to cross open spaces, as they fly low over the ground when doing this.

In my garden, which is situated at the edge of a coffee plantation, they are seen the whole year 'round and in 1952 a pair nested twice, using the same nest, at a height of about three and one half meters in a tree (*Terminalia catappa*) and only about three meters from my balcony. This afforded an excellent opportunity to watch the birds during the whole breeding cycle, as they were quite confiding and never noticed me while I was watching them. Unhappily, in neither case was a brood reared, as the young were taken at night by an unknown predator or predators before reaching the fledging stage.

Song

I heard two different kinds of notes, which were uttered by both sexes.

The first of these, which I would call the song, is a rhythmical strophe of

similar but distinct notes like *u-u-u-u*, gradually becoming more rapid and ascending, instead of descending, the scale (Young, 1929:35). While the bird is singing the crest is erected to its full height and the head and tail go up and down with the calling. This song is uttered in such a way that the male and female are calling with this strophe to each other. I have heard a rather similar type of song, also uttered by both sexes, from relatives of this species, *Thamnophilus doliatus* and *T. punctatus*.

The other note of *Sakesphorus* is a questioning *tjuuurrr*, also uttered by both sexes.

Display

Though I never saw any display proper, I twice observed courtship feeding, in which the male fed the female with an unidentified object. The first case was on March 2, 1952, four days after the young of the first brood disappeared. The pair was foraging in a nearby bush when suddenly the male pushed something into the female's bill and immediately afterwards copulated with her.

The second instance was on April 11, 1952, the very day the repairing and rebuilding of the old nest was started in preparation for the second brood. Both birds were feeding about 20 meters from the nest tree, when suddenly the male fed the female. Then a second female arrived and was driven away by the pair. They were very excited, with long, erected necks, wings dropping somewhat, crests erected to their full height, and tails held somewhat elevated with the rectrices widely spread so that their white tips were very conspicuous.

Breeding Season

Eggs of this species in the Penard oölogical collection from Surinam now preserved in the Leiden Museum are dated January to May, and September (Hellebrekers, 1942).

My own data fall in the same periods. On January 16, 1947, I found a nest containing two eggs. The first egg of the first brood in my garden was laid on February 8, 1952, while the first egg of the second brood was laid on April 20, 1952. I also found a nest containing one egg on September 7, 1946. There are four seasons in Surinam, approximately as follows: a short rainy season, November 15 to February 15; a short dry season, February 15 to April 15; a long rainy season, April 15 to August 15; and a long dry season, August 15 to November 15. In all four seasons nests with eggs of this species are to be found, but data are too few to demonstrate nesting peaks and other characteristics of the breeding cycle.

Nest Building and Nest

The nest is a basket neatly woven of long and elastic pieces of straw, grass, and moss in the fork of two twigs in a shrub or a low tree, usually not far above the ground (fig. 1).

Nest building is accomplished by both sexes but the male is certainly more active than the female.

In the second brood in my garden the old nest of the first brood was used

Fig. 1. Nest and eggs of *Sakesphorus canadensis*, the Black-crested Ant Shrike. Photographed near Paramaribo, Surinam on January 16, 1947, by F. Haverschmidt.

again. It was only a small remnant, most of the bottom being gone. On April 11, the first day of construction, the male arrived with nest material six times, against one time for the female, beween 4:00 and 4:30 p.m. On April 12 I watched from 12:59 to 1:59 p.m. during which period the male

came 10 times and the female only twice. On April 13 I observed from 8:35 to 9:35 a.m., and the male came 12 times against 3 times for the female.

Nest building is conducted very rapidly in the first days but then it slows down and the finished nest is left alone for some days before the first egg is laid.

In the first nesting construction started on February 1, 1952, building was seen for the last time on February 4, and the birds were not seen again at the nest. The first egg was laid on February 6. Thus building lasted four days in this case.

In the second nesting the repairing of the old nest started on April 11, building was conducted actively on April 12 and 13, but on April 14 the birds were not seen at all. On April 15 and 16 nest material was taken only a few times to the nest in the early morning and then activity stopped. On April 17 the birds were not seen at all. On April 18 at 7:00 a.m. both birds were together at the nest. The female sat down in it for a moment; then both left. The first egg was laid on April 19. At the time the first egg was laid, in both nestings, I could distinguish the egg through the nest bottom while standing under the tree.

The building itself is interesting to watch. When weaving the long, elastic straws around the fork in which the nest cup will be made, the bird pushes a piece of straw forward over the twig and then pulls it under the twig backwards again. For the inner construction of the nest cup spider web as well as plant wool and moss is used. I never saw feathers in a nest. The nest cup is made of very fine and thin material, the shaping of it being accomplished by the usual wriggling movements of the sitting bird.

In the second nesting the pair had a rather difficult job completing the nest, as other birds (including *Pitangus sulphuratus*, *Thraupis episcopus*, and *Amazilia fimbriata*) regularly stole material from the nest in the course of construction.

Though rather flimsy and weak in appearance the nest is in reality very strong. This is necessary as it has to endure strong winds, in which the branch bearing the nest sways violently, as well as heavy rain showers. Long after this nest had been abandoned it was still in good condition.

Egg Laying

In all cases I know of the clutch consisted of two eggs, the regular number for the Formicariidae (Skutch, 1946:19). In both nestings in my garden the eggs were laid on alternate days.

In the first nesting the first egg was laid on February 6 between 12:00 n. and 4:00 p.m., the second one on February 8 between 7:00 a.m. and 5:00 p.m.

In the second nesting the first egg was laid on April 19 between 7:00 and 11:00 a.m., while the second egg was laid on April 21 between 7:30 and 11:45 a.m.

I refrained from weighing and measuring the eggs. For measurements the reader is referred to the material given by Hellebrekers (1942) from the Penard collection.

Incubation

In both cases regular incubation started after the laying of the second egg, though the first egg is covered during the day, from time to time, by one of the birds, but not at night. In the second nesting the first egg remained uncovered on April 19 during the entire day and throughout the following night though it rained hard. The nest was well protected by the big overhanging leaves but eventually the nest and its contents must have become thoroughly wet. On April 20 the female was at the nest at 10:00 a.m. and stayed until 10:07 when she was relieved by the male who stayed until 10:50. The female came back at 1:00 p.m. and sat in the nest until 1:30 when she was relieved by the male who sat until 1:55. Then the nest was left alone until 4:35 when the female came once more, only to leave at 4:38 when she was relieved by the male, who in turn remained only a few minutes. The nest was then left alone and the single egg was not covered during the night. The same was observed in the first nesting when the single egg was left uncovered during two nights.

This is in sharp contrast to the true incubation period, when the eggs are practically never left uncovered and both sexes incubate in very long sessions (see below).

The male and female shared in incubation, but only the female spent the night on the eggs. This has also been observed in other antbirds (Skutch, 1946:20). During the day, however, the male performed the larger part of incubation.

The night watch of the female was a very long one, as sometimes she had already been sitting on the eggs a rather long time before sundown, and relief the next morning often took place long after dawn. (Sundown in this region is between 6:00 and 6:30 p.m. and dawn about 6:00 a.m.) A few examples may illustrate this. February 10: female arrives at 5:45 p.m. and leaves next morning at 7:45 a.m. Male arrives at 7:55 a.m. February 12: female comes at 6:30 p.m., relieved by male the next morning at 7:40 a.m. April 25: female arrives at 5:00 p.m., relieved on April 26 at 6:25 a.m. April 26: female comes to nest at 5:54 p.m., relieved next morning at 6:32 a.m.

The nest relief after the night watch was practically the only instance in

TABLE 1
INCUBATION ON APRIL 27

Female		Male	
Intervals (based on 24-hour clock)	Time (in minutes)	Intervals (based on 24-hour clock)	Time (in minutes)
Dawn–0632	32	0632–0708	36
0708–0803	55	0803–0845	42
0845–1042	117	1042–1124	42
1124–1224	60	1224–1514	170
1514–1625	71	1625–1810	105
Totals	335 (5 hrs., 35 min.)		395 (6 hrs., 35 min.)

which the eggs were left uncovered even briefly, as the female sometimes left the nest before the male had arrived, especially when he was late. On April 22 the female left the nest at 6:45 a.m. and started calling loudly. In the distance I heard the note of the male. It was 7:14 a.m. before the male settled down on the eggs. In the intervening period the eggs were left uncovered.

Nest relief practically always began with calling of the relieving bird as it approached the nest. This calling was begun at a long distance, and resulted in the incubating bird becoming immediately active and starting to respond while still sitting. Its crest was erected to its full length and its body went up and down with its calling. Strangely, both notes were used during nest relief. I never could establish a difference in their meanings. In most cases the incubating bird hopped directly out of the nest on the arrival of its mate. Rarely it had to be pushed aside.

As already pointed out by Skutch (1946:20) for other antbirds, the sessions of the incubating bird are very long, especially in the afternoon. Particularly long sessions noted in the present study were observed on April 25 when the female was on the nest from 12:06 to 2:37 p.m. (2 hours, 31 minutes), and the male sat from 2:37 to 5:00 p.m. (2 hours, 23 minutes). Table 1 shows the details of one whole day's watch, April 27.

During the whole of the incubation period both birds brought, from time to time, a single stem of straw or grass which was worked into the nest. This maintenance coincided mostly with ordinary nest relief, but it was always less frequent. During the day of April 27 it was done four times: by the male at 7:38 a.m. and 12:24 p.m., and by the female at 3:14 and 4:25 p.m. Twice I observed nest repair that did not coincide with reliefs. In these cases the incubating bird rose from the eggs to allow the other to weave the piece of straw into the nest. This happened on April 27 at 7:38 a.m. and again on April 28 at 4:54 p.m., both times while the female was sitting. This nest

TABLE 2
FEEDING OF THE YOUNG

Date	Periods of observation (based on 24-hour clock)	Feedings by ♂	Feedings by ♀	Total feedings
		BROOD I		
February 23	1220–1320	2	2	4
February 23	1320–1420	0	1	1
February 24	1015–1115	0	0	0
February 24	1250–1350	1	2	3
February 25	1450–1550	1	1	2
February 26	1655–1755	2	1	3
Totals	six hours	6	7	13
		BROOD II		
May 5	1200–1300	1	0	1
May 6	1000–1100	3	2	5
May 7	1200–1300	2	0	2
May 8	1015–1115	1	2	3
May 9	1040–1140	0	0	0
May 10	1030–1130	6	3	9
May 10	1625–1725	3	1	4
May 11	950–1050	4	3	7
May 11	1350–1450	2	3	5
May 11	1620–1720	2	1	3
May 13	1011–1111	4	1	5
May 14	1020–1120	4	2	6
May 15	1030–1130	0	2	2
May 15	1219–1319	4	2	6
Totals	fourteen hours	36	22	58
Totals both broods	twenty hours	42	29	71

repair continued throughout the incubation period and was last seen on May 4, one day before the hatching of the eggs.

Incubation lasted 14 days in both cases. In the first nesting the first egg was laid on February 6, the second on February 8, when incubation began. The first egg hatched on February 22 at 6:30 a.m. and the second one at 10:45 a.m. In the second nesting the first egg was laid on April 19, the second on April 21, when incubation started. The eggs hatched on May 5 before 11:55 a.m.

REARING OF THE YOUNG

The newly hatched nestlings are, as in other formicariids except the genus *Formicarius* (see Skutch, 1946:21), completely naked and blind. The eyes

of those I studied began to open at the age of three days and were wholly open at four days. The gape is orange-yellow.

On the day of hatching they were constantly covered by one of the parents but by the second day they were left uncovered for some time after a feeding. On May 6 (eggs hatched May 5) the male fed the young at 10:37 a.m. and left immediately afterward. At 10:50 the male fed them again and left, returning with food at 10:57.

In the following days the young were covered very irregularly during the day but always during heavy rain showers; this lasted until the last days I was able to watch them, *i.e.*, on May 13 and 15 respectively, when they were 8 and 10 days old and the male sheltered them during heavy rains.

The young were fed by both parents and here again the male's share was slightly larger than the female's. In Table 2 is given the feeding frequency in both nestings as observed during 20 one-hour periods. The food consisted

Table 3

Daily Weights of the Young in Grams

Date	Age in days	Nestling 1	Nestling 2
May 5	0	3.3	—
May 7	2	6.1	3.5
May 8	3	8.0	4.1
May 9	4	10.3	5.8
May 10	5	10.3	5.8
May 11	6	11.6	6.6
May 12	7	13.6	8.7
May 13	8	15.6	10.9
May 14	9	15.8	10.9
May 15	10	16.8	—

mostly of insects brought one at a time and as the nest was so close by I was able to identify the food in several instances. I recognized spiders, small butterflies and moths, grasshoppers, caterpillars, and even a very small lizard which was taken to the young by the male on May 14.

The feces of the nestlings were swallowed by both parents, immediately after feeding, while they stood on the nest. In the cases of large droppings they were taken away. I also observed another kind of post-feeding behavior, called "nest-probing," which is of common occurrence in small passerine birds. After feeding, and the swallowing of a clump of feces, the bird remains on the nest, looks into the nest bottom, and starts pecking into the middle of it, afterwards swallowing an unidentifiable object. The following example illustrates a typical case: on February 26, the male arrived at 4:58 p.m., fed the young, and swallowed a clump of feces, afterwards pecking into

the middle of the nest, making wriggling movements to reach something on the bottom. When his head emerged again he swallowed something which remained unknown to me. He was busy in this way until 5:04 p.m., and remained thus engaged for six minutes at the nest. Though the meaning of this nest-probing is not yet quite clear it seems likely to be a removal of nest parasites and also of remnants of food. It is certainly something quite different from the swallowing of the feces.

Just as in the incubation period, only the female spent the night covering the nest. This lasted until the last day I watched this brood. The remaining nestling was then (May 15) 10 days old.

In Table 3 are given the daily weights of the nestlings of the second brood. As is clear from these figures one of them soon fell behind in weight and the difference in size was considerable in the last days. On May 15, at the age of 10 days, it lay dead in the nest. It was already decomposing and was apparently too big to be removed by the parent birds. In the morning of May 16 the remaining youngster had vanished and evidently had been taken the night before by an unknown predator, though the nest was entirely intact. The same had happened to the first brood when, on February 27 at 7:00 a.m., the nest proved to be empty but also quite intact. Whatever had happened had perhaps occurred just before the male arrived with food, followed by the female. Both birds sat on the nest rim looking into the empty nest, and then left.

Summary

Sakesphorus canadensis (Family Formicariidae) is a common bird in the undergrowth of the secondary forest in the coastal area of Surinam; it is equally numerous on the sand reefs, in the mangroves along the coast, and in the wastelands and plantations. The song, which is uttered by both sexes, is described. Courtship feeding occurs. I have recorded nests from January until May, and in September. The nest is a neatly woven basket in the fork of a twig, usually placed not far above the ground in shrubbery. Two successive nestings by one pair were observed and studied in some detail. The nest is built by both sexes though the male's share of construction is the larger. The clutch consists of two eggs which are laid on alternate days. Incubation starts after the laying of the second egg and lasts 14 days. The male and female share in incubation, the female sitting at night, and the male's share during the day being a trifle larger than the female's. The nestlings are fed by both parents but again the male's part is the larger. Daily weights of the nestlings are given as well as data on frequency of feeding. The nestlings are covered by both sexes during the day of hatching and later on, irregularly, during daytime. At night they are covered by

the female alone. The young are fed insects, one at a time. Once they were given a small lizard. The food was secured in trees, in shrubbery, and on the ground. Feces of the young were swallowed or taken away when too large. Another kind of post-feeding behavior, "nest-probing," possibly consisting of the removal of nest parasites and food remnants, was observed.

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Paramaribo, Surinam, December 31, 1952

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THE BIRDS OF CALICOAN, PHILIPPINE ISLANDS

BY NATHAN S. POTTER, III

FROM February 15 to November 5, 1945, I was stationed at the U. S. Naval Supply Depot on Calicoan, a coral island about 10 miles long and half a mile wide, lying approximately 300 yards off the southern tip of Samar in the Philippine Islands. Except for a few palm groves, the island was covered with a dense, nearly impassable forest. The island was sparsely populated. There was a thin layer of sandy earth in the palm groves and in a few of the low gullies which supported banana plants; the rest of the island was bare coral, even in the dense forest areas. The gulf shore was mostly narrow sandy beach, but the Pacific shore was a barren coral cliff from 10 to 60 feet high. A narrow ridge from 100 to 200 feet high ran lengthwise down the center of the island. This central ridge was densely wooded and impossible to penetrate except along one or two native trails, which were very difficult to find and equally hard to follow. Along the edge of the central ridge were a few areas of low, scattered brush. By early summer the palm groves and level areas had been cleared and taken over by naval activities.

Calicoan has probably not previously been visited by an ornithologist, although the central part of Samar was worked by the J. B. Steere expedition (1887-88), Bourns and Worcester (1890-92), and by Whitehead in 1896.

My field work was carried on almost daily from 4:30, or 5:00, to 6:00 p.m., and toward the end of the summer I spent most Sundays and an occasional full afternoon in the field, making a total of approximately 350 hours of field work. It was practically impossible to carry out any systematic research program due to the demands of naval service and the fact that the development of the naval base required the clearing of almost all of the island except the high central ridge. I was able, however, to obtain some data on the life history and behavior of several species and to collect specimens of most of these, some of which had not previously been recorded from Samar.

The greater part of my field work was done in an area of about 45,000 square yards in the central part of the island, determined from the available charts to be 10° 59' 30" N., 125° 47' 40" E. Part of the area was a small saucer-like valley forming one of the two or three natural breaks in the high central ridge. All specimens taken are now in the University of Michigan Museum of Zoology.

Butorides striatus carcinophilus. Little Mangrove Heron.—♂, September 29. Eyes yellow; bill black, with basal half of lower mandible greenish-ivory; pea-green spot at the base of the bill in front of the eye; legs and feet brownish in front, green to yellowish in back; foot-pads yellow.

I seldom searched the beach for birds, and the few birds of this species seen were single individuals, feeding on coral reefs in September and October.

Egretta sacra. Reef Egret.—♀, September 14. Eyes yellow; feet greenish-yellow. It was alone on the coral rocks at the edge of the ocean. Species not recorded from Samar or Leyte by McGregor (1909) or Hachisuka (1932).

I saw five or six birds of this species feeding at low tide on the coral reefs, the first on June 1. From June 20 through July, I saw one or two almost daily, feeding on the reefs at any time of day; thereafter I saw them only occasionally (through October). Probably not more than six individuals regularly frequented the half-mile of beach I observed. One was seen feeding in a tidal pool (about 25 feet in diameter) with a white egret, probably the same species in the white phase; they were antagonistic, and each would drive the other way when it approached closer than four or five feet. While feeding, the egrets actively searched the shallow water, their necks stretched forward just above the surface.

Haliastur indus. Braminy Kite.—Not collected. I saw the species, at least once a week from April to October, soaring high over the center of the island and occasionally up and down the shore.

Accipiter trivirgatus extimus. Crested Goshawk.—♂ and ♀, September 5. Bills brownish-gray; eyes, legs, and feet yellow. Stomach of ♂ contained lizard-like item, that of ♀ was empty. Wing lengths, 179 mm. in ♂ (182-188 reported by Mayr in Delacour and Mayr, 1945:106); 205 mm. in ♀ (208 reported by Mayr).

The pair collected were observed speeding through dense forest in a chase, the ♂ in the lead. The ♂ lit in low brush about 4 feet above the ground, and the ♀ perched at a height of about 15 feet, some 20 feet away.

Spilornis cheela holospilus. Serpent Eagle.—♀, July 19. Bill bluish-slate except for black tip; eye yellow; stomach held grasshopper and brown beetles 2½ inches long.

♂, August 19. Eye, feet, and legs yellow. An opaque scar on the cornea over the iris probably rendered this bird blind in one eye in the opinion of the two station doctors. The stomach was crammed with thick insects an inch long, a land crab, and some bits of shell. The crop contained a 17-inch brownish-black snake with prominent fangs. This specimen was shot at 5:30 when it flew into a tree after chasing a small bird into dense brush.

Two or three of these eagles were seen every week from March through October, usually in singles or pairs, perched, as a rule, on high dead limbs overlooking an open area. Once in October, I saw 5 in an area of 10,000 square yards.

Their call was a loud, high, tremulous whistle somewhat like that of a Screech Owl (*Otus asio*). They called back and forth and would reply if I imitated them.

Microhierax erythrogonys meridionalis. Samar Pigmy Falcon.—♀, May 10. Bill and feet black; eyes brown; stomach contained bright green orthoptera-like insects; ovary about 6 mm. One of a pair perched at dusk on a dead tree overlooking a pool of water. Mud was plainly evident on the bill and legs of the specimen taken.

♀, May 18. Soft parts colored as above. Taken at dusk from a dead limb at the top of a high tree.

I saw only five or six of these Pigmy Falcons on Calicoan. They flew and acted much like Purple Martins (*Progne subis*). Near the end of May, I saw a pair flying to and from a hole about 30 feet up in a high tree, each bird entering the hole alternately and sometimes remaining inside for about 30 seconds.

Pluvialis dominica fulva. Pacific Golden Plover.—2 ♂ ♂, September 17. Bills black; legs and feet slate; eyes brown.

The two specimens I collected were the only birds of this species that I saw. They were standing within a foot of each other on barren rock 50 yards from the sea at noon during low tide. McGregor (1909:104-105) gives no Samar record for this migrant but reports it elsewhere in the Philippines on grassy or wet sites away from the coast. Delacour and Mayr (1946:70) record it as a "common visitor" in the Philippines.

Numenius phaeopus variegatus. Whimbrel.—2 ♀ ♀, September 15, from a flock of 8 on the rocky coast. Bills black except the basal half of the lower mandible, which was flesh color; feet chalk blue.

♀, September 18, shot from a flock of four. Bill and feet as above; eyes blue-black. Stomach contained grape-like fruit full of small seeds similar to that found in the stomach of the Blue Rock Thrush.

A flock of eight, first seen about September 12, comprised, I believe, all the birds of this species that were in the area. One individual remained and was seen regularly until mid-October. They were always seen resting on the rocky shore, feeding on the exposed reefs at low tide, or flying over the water parallel with the coast line. They were usually feeding with several other species of shore birds, and when these mixed flocks were disturbed, each species formed a flock of its own and flew off, without reference to the actions or direction of the other flocks.

Heteroscelus incanus brevipes. Polynesian Tattler.—2 ♂ ♂, September 20. Bills black, except for yellowish base of lower mandible; eyes blue-black; feet and legs greenish-yellow; stomachs empty. They were shot from a flock of about 20 of the same species resting on the rocky coastal ledge at 5:45 during high tide. Both birds were very fat.

I saw three flocks of from 10 to 20 birds regularly from mid-September to mid-October. McGregor cites no record from Samar but notes that it occurs in great numbers on tide flats during migration.

Ereunetes minutus ruficollis. Little Stint.—♀. March 30. Caught by hand in coral sand along the coast at night during heavy rain and wind; possibly blinded by car lights.

I saw a group of 6 to 10 birds believed to be this species in the same general area for a week before and a few days after the date this specimen was taken. While walking along the beach in bright moonlight about 9 o'clock on March 23, I saw many small shore birds, which may have been this species, feeding along the water's edge.

While this species is not reported from Samar or Leyte by McGregor (1909:135), it is reported as common in the Philippines by Delacour and Mayr (1946:73).

Phalaropus lobatus. Northern Phalarope.—♀. October 1. This fat, crippled specimen was caught by hand at the rear of one of the naval warehouses against which it had probably flown. I saw no other phalaropes.

Since Mearns (1909:435) first recorded this species from the seas around the Philippines, it has been reported by McGregor (1918:10) at Luzon, and by Hachisuka (1932:323) at Mindanao and between Zamboanga and Isabella. It is reported by Delacour and Mayr (1946:73) as wintering in the sea south of the Philippines.

Phapiteron leucotis albifrons. Samar White-eared Pigeon.—♂, May 22. Bill purple with black tip; eyes red and edge of eyelid purple; feet reddish-purple; stomach contained large green seeds and red berries; one of a pair feeding at dusk in a bushy tree 20 feet high; testes moderately enlarged.

♂, July 8. Bill black with basal half purple; eyelids blue; feet dark red; testes moderately enlarged.

I saw only four of these pigeons, including the two specimens collected. Their flight was very rapid and direct. All four were seen in low brushy areas of the forest.

Ducula aenea chalybura. Bonaparte's Imperial Pigeon.—♀, September 16. Eye and edge of eyelid ruby red; bill slate-colored, with lower half of maxilla and tip of mandible pearl-gray; feet purple; the crop contained hard fruit the size of a hickory nut; shot in mid morning, one of a pair.

These pigeons were fairly common but were very hard to approach, partly because of the almost impassable woodland where they were usually feeding or roosting. From two to six were seen daily in late afternoon. They were active throughout the day, usually above the forest and using the upper branches of high trees for perches; and they seemed most active just before sundown. They chased, and were chased by, crows. Sometimes a group of four or five would be chased from the top of a high tree by the Tarictic Hornbill which, working up the tree by hopping from branch to branch, drove the pigeons away one after another. They were usually seen singly or in small groups of up to six individuals. Their voice was a low penetrating *coo.* They were very wary and when disturbed usually flew out of sight, settling down in some distant location rather than returning to their original perch. They are heavy, powerful birds and are difficult to kill. I have hit four or five of these birds very hard with size 7½ shot from a 20-gauge shotgun and seen them coast into the brush on set wings, but I never recovered one of them.

The flight of these birds is powerful and magnificent, usually direct and very fast. On March 20 I first saw one of them "swan dive." Flying rapidly and rather high, the bird threw back its head and wings and rose, at a 45° angle, to a point 50 feet above the previous line of flight. As it slowed almost to a stop, it pivoted, and, with head and wings in the same position, went into an almost perpendicular dive. At a height of from 20 to 30 feet above ground, it levelled off and flew out of sight. From the start of the upward swoop to the levelling off, the bird's head and wings were held in the same position that a man holds his head and arms while executing a swan dive. It was a remarkable display. I saw it at least twice when I was fairly certain no other birds of the species were in the immediate vicinity. The dive was performed from March 20 through October. The dive terminated (1) by an upward swoop on set wings to a high branch of a tree where the bird lit and *cooed,* (2) by an upward swoop to a branch where the bird perched silently, or (3) by continuing flight out of sight.

These birds fed in the same trees with Tarictic Hornbills, Philippine Cockatoos, Racket-tailed Parrots, and Coletos.

Cacatua haematuropygia. Philippine Cockatoo.—♀, April 27. Bill slate; eyes brilliant red; skin surrounding the eye alabaster with purplish tinge; feet slate-gray with blackish toes; crop full of white rectangular seeds ¾ of an inch long.

♀, August 22. Bill slate-blue; eyes coral red; skin around the eye alabaster; feet slate.

I shot the first specimen at dusk from a group of three birds going in and out of a large hollow limb 25 to 30 feet above the ground. For three or four days thereafter I saw two going in and out of the hole at dusk.

In late June I heard young in a nest in a hollow limb of a tree about 20 feet above ground. From March until September, I saw from 2 to 6 of these cockatoos daily, usually singly or in pairs. From September to November, I often saw small flocks of as many as 8 birds. They make a loud raucous call while feeding and occasionally even while in flight. Their flight is usually swift and direct with a rapid wing beat, although on three occasions I saw them elude capture by a hawk by rapid darting and weaving while squealing frantically.

Prioniturus discurus discurus. Racket-tailed Parrot.—♂, September 30. Legs blue-gray; bill lighter, or slate-blue.

I did not see these parrots until mid-summer, but from then on through October they were increasingly common. From the first of September through October 6 they could be seen at any time in the wooded areas. They were very noisy birds, screeching both in flight and while feeding in the tree tops with Bonaparte's Imperial Pigeons, cockatoos, Coletos, and Barred Graybirds. The flight was fast with a rapid wing beat, but seemed labored. The head of this specimen showed a molt in progress, the crown being mottled green and blue; the tail feathers were well-worn.

Loriculus philippensis worcesteri. Worcester's Hanging Parakeet.—♂, April 30. Eyes black; bill red; feet orange-brown; testes not enlarged.

♂, August 3. Shot feeding in vines 20 feet above ground in fairly open area; testes slightly enlarged.

♂, October 11. Bill red; eyes black; feet and legs orange; shot at dusk while feeding with Barred Graybirds, Coletos, and young Philippine Glossy Starlings.

I saw only five or six of these birds in addition to those collected. All were seen singly, foraging high in leaves or vines in tall trees. Their flight was fast and direct, appeared labored, and was accompanied by a high-pitched, rapid whistle somewhat like that of the American Golden-eye (*Bucephala clangula*). I did not witness the undulating flight reported by Delacour and Mayr (1946:103).

Cuculus saturatus horsfieldi. Oriental Cuckoo.—♀, October 22. Mandible black; maxilla blue-gray; inside of mouth and throat orange; feet and legs yellow; shot at dusk from the top of a stump six feet high; stomach contained iridescent green bugs and 2 "katydids" (orthopteran family Tettigoniidae). This specimen is the only bird of the species seen. It is reported from Mindoro and Palawan by McGregor (1909:372), and as a rare winter visitor by Delacour and Mayr (1946:106).

Cuculus canorus telephonus. Common Cuckoo.—♀, October 19. Eye brown; eyelid yellow; mandible black; maxilla green-gray; feet pure yellow; stomach contained gray worms 1½ inches long with yellow head and black stripes around the body; shot at dusk at the edge of dense woods after a shower; the only bird of the species seen. In action the bird was like a fly-catcher in that it took short flights back and forth from a perch, returning each time to the same tree to light on a limb or even on the vertical trunk of the tree.

Eudynamys scolopacea mindanensis. Philippine Koel.—♂, September 3. Eyes carnelian; bill grayish-blue except for brownish tip of maxilla; feet grayish-black; stomach contained two hard nuts the size of acorns; shot in dense low growth.

♀, October 14. Mandible light jade; maxilla slate color with brownish tip; eyes red; feet gunmetal; stomach contained hard seeds like dried peas; one of a pair in the top branches of dense woods.

I saw a total of eight of these birds, including three pairs, all in forest areas with dense undergrowth. I never heard them give any call. They were difficult to collect because of the dense brush, but they seemed curious and would watch me silently from one or two vantage points before disappearing. Once when I was trying to attract some small birds by "squeaking," one dived at me from some high cover, and I caught glimpses of it as it flew about in the brush for possibly 30 seconds before disappearing. The specimen collected October 14 was one of a pair which were well aware of my presence and watched me for two or three minutes from vantage points before I collected the female. After the shot, the other bird stayed around in the thick cover watching me for three minutes before leaving.

McGregor (1909:379) reports that the food usually consists of insects, but in one case fruit. Delacour and Mayr (1946:109) state, "mostly a fruit eater."

Centropus viridis viridis. Philippine Coucal.—♀, September 22. Eyes brilliant, dark red; bill black; feet bluish-gray; stomach contained a green insect similar to a katydid.

Only six of these birds were seen between June 30 and mid-October; (two seen singly, the others in pairs). They were shy and very difficult to see. On four occasions I heard them calling in the brush 5 to 15 feet from me and was unable to see or flush them. I did not even see the only specimen taken until after I shot it. I had been sitting silently in a fairly open low brushy area and heard the bird approach, occasionally calling, to the opposite side of a dense bush six feet away. I shot into the bush and found the bird in the center of the bush about two feet above the ground.

Their call is somewhat like that of a monkey: *chook, chook, chook, chook,* voiced fairly rapidly in a deep, low pitch. In flight the birds appeared reddish rather than brown, and their wing action was similar to that of a pheasant (*Phasianus*). The coucals were usually on the ground, sometimes in brush or low trees but never more than eight feet from the ground. On one occasion I followed a coucal for about one-half mile along the edge of the low brush at the coast. The bird covered this distance by a series of flights of about 75 yards each, commencing each flight after climbing up six or seven feet in the brush. The bird lit on the ground each time, and after two or three minutes made another flight.

Halcyon winchelli. Winchell's Kingfisher.—♂, May 13. Eye brownish-black; bill black; feet pale green; testes moderately enlarged; stomach contained bright green beetle-like insects.

This specimen was the only bird of this species I saw. It was perched motionless on a dead limb about 12 feet above ground in a fairly open forest area at dusk.

Halcyon chloris collaris. White-collared Kingfisher.—♂, June 13. Bill ivory except for black tip; eyes dark brown; feet brownish-gray; stomach contained claw of a crawfish; testes slightly enlarged.

♂, June 22. Bill ivory except distal 1/3, which was black; stomach contained green insects like katydids 2½ inches long; testes enlarged.

♂, July 3. Testes slightly enlarged.

Four or five of these common kingfishers could be seen at any time in open or grassy areas where there were a few scattered trees suitable for perches. They were frequently seen along the rocky coast and occasionally in the forest, but their preferred habitat was in the open palm tree areas. They were almost never seen over 150 yards from the sea but were seen only twice feeding at the water's edge or in the small tidal pools. They concentrated in areas where the underbrush had been cleared and burned by the Navy.

In voice, action, and flight they are similar to Belted Kingfishers (*Megaceryle alcyon*). Wolfe (1938:213) has reported a mating ritual in which both birds alternately leave their perch, fly to the ground and return. At Calicoan I saw this activity several times, but in each instance the birds were obviously feeding on ground insects. From a perch six or seven feet high they flew to the ground to catch an insect, returning immediately to the perch. The maximum successful detection distance was about 50 feet. Some single birds were also seen feeding in this manner. On only one occasion did I see both birds of a pair using perches in the same tree or bush while feeding in this manner.

In mid-morning one day in late May or early June I observed a somewhat similar activity. Two of these kingfishers were perched about a foot apart on the same limb

25 feet above the ground and 100 feet from the stump of a dead palm tree in which there were two old holes two or three inches in diameter and approximately 20 feet above the ground. The birds took turns flying to the dead palm tree, giving the rotten wood a peck, and returning to the perch. One bird would not leave the perch until the other had made its peck and returned. They were pecking at the stump of the dead palm tree near the two old holes. The birds did not light and then peck like a woodpecker, but hit the tree with their bill as they lit, occasionally giving an extra peck or two before returning to the perch. In spite of the soft rotten wood they seemed to make practically no headway on a new hole. I am unable to attribute any significance to this behavior, which I watched for nearly an hour and which was still going on when I left. Within the next two or three days, the area was cleared by bulldozers and I inspected the fallen stump. It was soft rotten wood and there were no visible insects. The two cavities showed no evidence of use as nesting sites, and the result of the recent work of the kingfishers was barely visible.

Single birds were often seen roosting at night in the branches of palm trees close to the trunk. Such a roost was used regularly by one bird for a period of about two weeks before I collected it on July 3. There was a great deal of chattering and calling in the early morning by this bird before he left his perch. On March 26 one was seen late at night roosting on a dead limb about eight feet above the ground; this perch was in a small patch of brush in a palm tree area.

Alcedo atthis bengalensis. River Kingfisher.—♀, October 7. Maxilla black; mandible orange-coral; eyes brown; legs and feet brilliant orange-coral; stomach contained aquatic insects.

The single bird of this species seen was found feeding in pools formed by the spray thrown up from the surf along the rocky coast. This bird was first seen late in September and finally taken on the above date while it was fishing from perches in the crevices of the rocks. It was usually found around the same pool, which was about 25 feet in diameter and surrounded on three sides by rock walls 10 feet high.

Merops viridis americanus. Chestnut-headed Bee-eater.—♂, October 14. Bill shiny black; eyes brilliant dark red; feet and legs grayish-black; wide pads on feet; stomach contained small bugs.

The flock of five bee-eaters from which this one was taken were the only bee-eaters I observed; I watched them for about two hours as they fed from trees of medium height at the edge of dense woods. They flew much like flycatchers, leaving their perch for a short flight after an insect and then returning to the perch, where they would stand very straight like a night heron (*Nycticorax*) and bow ceremoniously two or three times. They were feeding on the wing, catching insects in the air as well as off the leaves of adjacent trees. Their voice was rather soft and pleasant, a melodious whistle reminiscent of some of the notes of the Philippine Oriole.

Eurystomus orientalis orientalis. Dollar Bird.—♂, May 2. Bill and feet tomato-red, with the very tip of the mandible black; eyes brown; testes not enlarged; stomach contained insects.

♂, October 17. Eyes brownish-black; bill and legs orange; stomach contained bright, iridescent green bugs; taken at dusk while hawking insects from a perch on a dead stump 10 feet high.

These birds were rather common; as many as four or five could usually be seen during a half-hour walk. Their flight is strong and buoyant, much like that of the Nighthawk (*Chordeiles minor*). During all the months I was on the island, these birds would usually

form in flocks of 6 to 10 just before dusk and, flying high in the sky, give an astonishing exhibition of aerial acrobatics. Throughout these maneuvers they called in their peculiar harsh voice. In March and early April I observed what was probably a courtship flight. This flight was at about tree-top level and never approached the heights of the usual evening flights which were not as common at this time of the year. This possible courtship flight was similar to the "swan dive" of Bonaparte's Imperial Pigeon but much less spectacular. It was a graceful buoyant maneuver of short duration, lacking the speed and sweep of the Imperial Pigeon's dive.

The Dollar Birds are accomplished and graceful flyers. In late June I once saw one flying about 10 feet above ground, approach to within 4 feet of the trunk of a tree, and then rise straight upward and go directly into a hole 20 feet above the ground.

They call back and forth throughout the day in their unpleasant harsh squawk while in flight as well as while hunting or resting. The birds were active throughout the day and could be seen at any time resting or feeding from perches on dead limbs or stumps in open areas or at the edge of the forest. Their perches vary in height from 10 to 30 feet. I have seen them catch insects on the wing, from trees or bushes, and from the ground. They were attracted to the same holes which attracted Coletos and Crimson-backed Woodpeckers.

Buceros hydrocorax semigaleatus. Calao or Rufous Hornbill.—♀, June 8. Casque and base of bill red; eyes aquamarine; legs and feet red; stomach contained insects like katydids, and the intestines contained seeds like those of a watermelon; shot from a group of three feeding in dense woods.

♂, June 23. Casque and base of the bill red, shading through yellow to ivory near the tip; legs and feet red; eyes corn yellow; shot from a bushy tree while feeding on soft fruit the size and shape of a hazelnut.

♀, July 18. Casque, bill, legs, and feet same as June 23 specimen; eyes aquamarine; one of a pair; ovary not enlarged. This bird was covered with ticks and lice but seemed in good physical condition. Shot from the top of a tall tree while feeding with the ♂ taken the same date.

♂, July 18. Casque, bill, legs, and feet same as June 23 specimen; eyes corn yellow; presumed mate of preceding ♀; shot when it flew to where the ♀ had fallen; testes not enlarged.

♀, August 22. Eyes aquamarine; other soft parts as above; ovary not enlarged.

From February through August, I saw these birds singly or in pairs; twice, as on June 8, three birds were seen together. On the average, I saw one or two birds a week always in or above dense forest. In September all the local birds formed into a single flock of some 15 to 18 individuals. From this time on they became very noisy and could usually be heard calling at dawn and at dusk, or at any time during the day if disturbed in the forest. I believe the flock toured the island up and down the high central ridge for they passed my shooting spot almost every afternoon, going either up or down the island. There was certainly only one flock in the central part of the island, at least, because (a) one distinctively buff bird was always seen in the flock and (b) two flocks were never heard calling (their calls can be heard for at least a mile). I am certain that this flock moved at least two miles up and two miles down the island from my quarters.

The flight of these hornbills is much like that of a pelican (*Pelecanus*) in that it consists of a few wing strokes followed by a long glide. A pronounced "swish" was audible during their flight. Their voice or call was reminiscent of that of the Sandhill

Crane (*Grus canadensis*) in its eeriness and tonal carrying qualities. The native name, "Calao," gives an excellent idea of the sound of their call. I am quite sure I once heard one give the same call as the Tarictic Hornbill, and on another occasion I heard a noise which could have been made by beak-snapping or by knocking the beak against a large limb or the trunk of a tree.

On five or six occasions when these hornbills were feeding in the tops of trees near the extreme ends of branches, I have seen them lose their balance and fall from the tree until they were able to catch lower branches with their feet or wings, or until they recovered themselves sufficiently to fly. It was the noise of their falling through the branches that called my attention to the three birds seen on June 8. They sometimes fell nearly 20 feet before recovering flight.

The edges and insides of their bills were sticky with fruit or sap, and most of the bill was covered with a yellowish powder-like pollen.

The Calaos were easily frightened in the woods and at the first unusual sound would cease activity and concentrate on locating the source and cause of the noise. After a moment or two they would quietly fly away one by one or they would all leave at once with a frightful honking clatter. They usually commenced their flight with a short down swoop to gather momentum. A pair first seen on March 21 in the vicinity of four very tall bushy trees in dense forest stayed in that immediate area for a little over a month until the area was cleared by blasting and bulldozers. Usually two and never more than two were seen in that locality. During this time they would occasionally call at morning and evening, and six or seven times I heard them call during the middle of the day.

At about 5:00 p.m. one day in early October, the flock was leisurely crossing a low valley, feeding in the small bushes and banana plants. One bird flew up and lit on a bare limb 40 feet above the ground. Slowly, one by one, the others flew up and alighted side by side on the same limb, all facing in the same direction. Each of the last two or three had to knock another off the limb in order to find room to alight. While this jockeying for the last place on the limb was still going on, the whole flock suddenly scattered and resumed their feeding in the valley, slowly working into the forest and on up the island. It was about five minutes from the time the first bird flew to the limb before the flock resumed feeding.

It is interesting to note that in the above males the eyes were corn yellow, and in the females they were aquamarine. Hachisuka (1934:155) gives the iris as "light yellow, (light green in living birds)."

Penelopides panini samarensis. Tarictic Hornbill.—♂, May 12. Bill black, brown, and ivory; eyes dark red to reddish-brown; feet grayish to black near the toes; stomach contained dark green grape-like berries, which were full of flat seeds like those of a cucumber; testes not enlarged.

♂, May 26. Eyes ruby-red, feet slate-gray; stomach contained a bright green katydid and seeds; testes not enlarged.

♀, June 18. Bill agate with gray at the base; eyes red; stomach contained fruit, or vegetable matter, and a bright green beetle; ovary not enlarged.

♂, October 23. Eyes red; feet slate; stomach contained hard brown seeds like dried peas; shot from the top of a high tree on the edge of a cleared area; molting.

I saw the first pair of Tarictic Hornbills on March 26, and thereafter an average of two a week through October, always singly or in pairs except on two occasions in October, when three were seen together. They usually traveled in pairs, foraging up and down the island, never in the company of other birds.

Their call was loud and penetrating with good carrying qualities, and sounded exactly like a child's Halloween horn—a raucous and tinny *toot toot*. Often two birds as much as 150 yards apart would *toot* back and forth as they worked up or down the island. Their flight, consisting of a few wing strokes and then a glide, usually started with a downward swoop from the treetops and terminated in a short upward glide to one of the lower branches of a tree.

These hornbills seemed to have an active dislike for all other birds and were frequently seen to chase Imperial Pigeons and Racket-tailed Parrots from trees by hopping up the branches after them. They are awkward and gawky both in flight and while in trees, although adept at catching food. I once saw one leave the branch of a large tree and swoop down to the bare trunk of a tree some 100 feet away after a lizard which was climbing the tree trunk. Upon reaching the lizard, the bird seized it in his beak and fell, flopping helplessly to within four feet of the ground before recovering flight and returning to a different branch of the first tree to chew and swallow the lizard. On a few occasions I have seen a Tarictic Hornbill lose balance while reaching for food at the tip end of a branch and fall from the tree. These hornbills were almost always seen in the treetops in the forest although sometimes they hopped around on fallen logs or large limbs near the ground.

Dendrocopos maculatus leytensis. Pygmy Woodpecker.—♀, May 31. Eyes brown; maxilla black; mandible yellowish except for a black tip; feet green.

This specimen was the only bird of this species that I saw. It was traveling with a pair of Philippine Creepers, one of which I collected. The woodpecker was shot while pecking and chattering on a dead limb in the crown of a tree some 30 feet high. Its flight was typical of woodpeckers.

Chrysocolaptes lucidus rufopunctatus. Crimson-backed Woodpecker.—♀, May 10. Eyes pinkish-red; bill black; feet greenish.

♀, August 7. Eyes bright red; bill blackish-brown; feet greenish; stomach contained 1½-inch long grubs; shot at dusk 30 feet from the ground in a dead tree.

♀, September 9. Eyes red; bill black; feet greenish-gray; stomach empty; shot at 8:00 a.m.

♂, September 9. Eyes red; feet greenish-gray; bill black; stomach empty; shot at 8:00 a.m. with above specimen.

♂, September 9. Eyes red; bill blackish-brown; feet greenish-gray; stomach empty; shot at about 8:45 a.m. and about 100 yards from where the two previous specimens were taken.

In addition to the above specimens only five other birds of this species were seen, although a flock of five birds believed to be of this species was seen just at dark on April 3, some 30 feet up in a huge tree, working in and out of three or four holes in the tree. This same group of five birds was seen two or three times during the following week at the same holes just at dark.

In flight, voice, and behavior these birds are very much like the North American Flicker (*Colaptes auratus*). Alive they look or appear much more crimson than they do as skins, and their necks look incredibly thin for a bird of their size.

On September 9 I watched three of these birds for about 10 minutes before the pair was collected at 8:00 a.m. The other specimen collected at 8:45 on the same date is believed to be the third member of this group. The three birds were chasing each other in short flights between trees in a fairly open forest area. They would alight at the base of a tree and then chase each other up and around the trunk to the crown of the tree, then fly to

another tree to repeat the procedure. Sometimes only two would take part in a chase, although all three kept chattering. Finally the female and one male flew to opposite sides of the trunk of a tree, leaving the other male about 100 feet away. As the pair moved jerkily up the tree trunk, chattering and peeking around the trunk at each other, they were collected. The third bird flew into the woods and was probably the one collected three-quarters of an hour later.

Dryocopus javensis pectoralis. Black Woodpecker.—♂, May 4. Maxilla black; mandible bone color; eyes bright yellow; feet slate; stomach crammed with small winged insects like flying ants; shot at dusk in dense woods.

I saw a total of six, two pairs and two single birds, all during April and May. They were extremely wary and very difficult to approach. Twice the birds were seen around two very tall trees which had several holes in a perpendicular line such as those made by the Pileated Woodpecker (*Dryocopus pileatus*). These holes were at least 50 feet from the ground. I saw a single bird drumming on a dead stump in very dense woods.

Hirundo tahitica javanica. Pacific Swallow.—September 14. Two specimens taken along the rocky coast; neither could be sexed with certainty.

These swallows were never seen over wooded areas except during migration in October. They were found along the barren rocky coast from the time I visited that area in midsummer until the end of October. Two to four could be seen at any time flying along the coast in and around the rock formations.

On October 8, when I started my field observations at the usual time, 4:30 p.m., I saw a steady stream of these birds flying south. Those along the coast were flying about 20 feet above the water; those flying over the land were about 100 feet above the trees. During the hour and a half that I was in the field, from 20 to 40 were always visible. The flight continued at least until dark, and may have continued after dark. The wind was fairly brisk from northwest by west, and the birds were flying almost directly south. A large number of individuals must have passed over the island even during the short time I was aware of the flight. After this date I occasionally saw a few of these swallows along the coast. No specimen was collected from this flight, and the birds were not observed with binoculars; the identification is based solely upon familiarity with those seen along the coast, identified by the two specimens above.

Motacilla cinerea caspica. Gray Wagtail.—♂, October 2. Eyes and bill black; feet and legs cinnamon brown; stomach contained what appeared to be ants.

♂, October 18. Bill black; feet and legs tan; shot at dusk at the edge of dense woods; testes small.

Between October 2 and 18, I saw a single bird four times just at dusk, feeding along a bare rocky path in an open area of low brush. The two collected were feeding on bare rocky places where ants and flies had collected in large numbers. These wagtails are sleek, stately birds. Their flight is buoyant and undulating. Once or twice when alarmed, they ran over the rock and disappeared in the thick underbrush instead of flying away.

Anthus gustavi. Petchora Pipit.—♂, October 13. Eyes brown; maxilla black; mandible, legs, and feet flesh color; stomach contained ants; shot while it was walking on the ground in open woods.

This is the only bird of this species I observed. Although not previously reported from Samar, it has been widely recorded in the Philippines, including Leyte.

Coracina striata kochii. Barred Graybird.—♂, May 11. Eyes dark red; bill black; feet blackish-gray; stomach contained a green katydid; shot from the top of a dead tree near the edge of the forest.

♂, June 12. Eyes deep garnet red; stomach contained vegetable matter; testes somewhat enlarged; one of a pair that stayed very close together while working from tree to tree.

These birds were always seen in the woods in thick cover and near the tops of the trees. From May 11 until late August they were seen singly or in pairs. During this period they were silent and seldom seen—not over an average of one bird a week. The specimen taken June 12 was collected some 75 yards from a spot where I had seen a pair a few days previously. After this specimen was shot and fell to the ground, the other bird of the pair flew to its side three or four times before flying away as I approached to pick up the specimen. During this spring and early summer period, the graybirds did not appear frightened by my presence or actions, and they were never seen with other species.

In early September these birds began to appear in small flocks; and in October, flocks of as many as 100 would settle in two or three trees much like Starlings (*Sturnus vulgaris*) in the fall. During this time of the year they were often in the same trees with Coletos, Philippine Orioles, Philippine Cockatoos, and Glossy Starlings. While feeding in trees with these other species they were very noisy, sounding like a flock of Starlings, but upon the slightest disturbance they would become silent and fly off—one, two, or three at a time rather than in a general flock movement. In mid-October these large noisy flocks began to disappear rather rapidly.

Lanius cristatus lucionensis. Brown Shrike.—♀, March 26. Eyes dark brown; bill pearl-gray, somewhat purplish near base and black at the tip; feet pearl-gray; ovary slightly enlarged; taken by sling-shot in thick brush.

September 30. Two of undertermined sex, believed to be males; eyes black; feet and legs blue-gray; bills black except basal two thirds of mandible, which was ivory; stomach of one contained grasshoppers and beetles, the other grasshoppers only.

♂, October 6. Eyes brownish-black; bill shiny black except basal half of mandible, which was mother of pearl; feet and legs blue-gray; stomach contained two grasshoppers; shot while hunting from a small bush in an open area of about 2,500 square yards. Three others of this species were hunting in the same area.

October 14. One specimen, sex uncertain. Maxilla black, mandible pearl; feet slate-blue.

In the spring and summer these birds are shy and scarce; only three were seen from mid-February to mid-September, and they were quiet and elusive, inhabiting only the densest bushy areas. About the middle of September these shrikes began to appear everywhere in small noisy flocks; in October four or five could be seen within a half hour at any time of day. They hunted from dead twigs or branches about 10 feet high from which they flew to the ground and back, apparently hunting grasshoppers or other insects. Throughout the fall days they were noisy in flight and while hunting. In flight their tail feathers seemed to wave or flutter like paper streamers. The usual flock consisted of from five to eight birds, and the majority of the flocks appeared to be composed of young birds.

Artamus leucorhynchus leucorhynchus. White-bellied Wood Swallow.—Only one specimen, a juvenile of undetermined sex, was collected; it was taken July 22 from a flock of seven. At least three others in this flock were juveniles. There were three other, similar, flocks in the immediate vicinity. This is the only occasion on which I saw these birds either in or over the forest areas of the island. They were usually in palm groves or partially cleared areas. These wood swallows were among the most common birds of the island and were least disturbed by the activities at the Naval base, even nesting in the

center of the camp area. Four to six of these birds could be seen at any time, usually feeding on the wing or from perches. The perches were dead twigs or phone wires from 10 to 20 feet high; they would fly from these perches to the ground after insects from 10 to 100 feet away.

The flight of the White-bellied Wood Swallow is without parallel in grace and deftness. It is similar to the flight of the Purple Martin (*Progne subis*) and is the best exhibition of complete mastery of the art of flying that I have ever seen. At Calicoan these birds were most active in flight just before sunset. In the palm groves they soared back and forth just over the trees, riding the sea breeze with motionless wings. Often a flock of 15 or 20 would gather high in the sky at evening and for an hour or so perform aerial acrobatics. Except when they were feeding, their flight was accompanied by much twittering, which could even be heard during the high evening flights.

These birds apparently nested in May and June in the hollow tops of broken-off palm trees at heights of from 10 to 30 feet. As the palm areas where they were most numerous were cleared for warehouses, they moved into partially cleared or fairly open wooded areas. This change of habitat was fortunately after the presumed spring nesting season. They were especially attracted to areas that had been burned over.

Microscelis gularis gularis. Philippine Bulbul.—♂, May 2. Bill, eyes, and feet brown; testes enlarged.

♀, May 23. Eyes brown; bill and feet brownish-black; stomach empty; ovary moderately enlarged; one of a pair chasing noisily about in dense low brush; shot at 6:00 p.m.

These birds were very common and in flight, action, and habitat were much like our Wood Thrush (*Hylocichla mustelina*). Five to seven of these bulbuls could be seen at any time of day in thick brush, where they noisily chased one another. The voice and calls were quite varied, ranging from *cheep* and a cat-like *mew* to clear, liquid, melodious whistles. They were curious, and I could attract them by whistling or "squeaking"; then, after watching me for a moment or two, they would fly off through the woods while calling harshly and loudly.

Monticola solitaria philippensis. Blue Rock Thrush.—♂, September 18. Eyes blue-black; bill and feet black; stomach contained grape-like fruit full of seeds; wing 112; tail 70.

♂, October 7. Eyes brown; bill and feet black; wing 113; tail 76.

I never saw these birds anywhere except on the barren rocky coast. They were wary, always flushing just out of gun range and flying 50 to 75 yards farther up the coast, in and out of the rock formations. When flying toward me and on becoming aware of my presence, they would fly high or wide around me. They were extremely difficult to see, for they were usually on the bare rock, which their color perfectly matched. I sometimes saw them perched on low branches of scrub bushes or even weeds, usually within three feet of the ground. Although not previously reported from Samar, this migrant has been widely recorded from other islands in the Philippines.

The Rock Thrushes were seen from early September through October. Four to six were usually seen in three-fourths of a mile along the coast until nearly the end of October when they became much scarcer. I never heard them calling or singing.

Phylloscopus borealis. Arctic Willow Warbler.—♂, October 7. Maxilla brownish black; mandible, legs, and feet tan.

October 7. Two specimens of undetermined sex; eyes brownish-black; other soft parts as above except that one had mandible with dark tip.

The Arctic Willow Warblers appeared very suddenly and in great numbers on October 6 and 7, remaining only two or three days, although scattered individuals were seen during the following week. Their appearance was much like a wave of migrating wood warblers (Parulidae) in eastern United States. No voice or call was heard. They were seen feeding in the tree tops, the brush, and even in the sparse weeds and tufts along the coast. They seemed to feed from leaves and branches, as well as on the wing. They did not associate with any other species although they arrived with the large wave of migrants during the first week of October.

Orthotomus atrogularis frontalis. Sharpe's Taylor-bird.—♂, June 6. Eyes light brown; maxilla dark brown; mandible and feet flesh-color; testes slightly enlarged.

♂, August 30. Soft parts same as above; testes slightly enlarged.

These birds were regularly seen in the low bushes of either open or heavily wooded areas—an average of three or four per week throughout the time I was on the island. In the fall they traveled from bush to bush in small flocks of about 10 individuals. I observed such a flock on September 3 traveling with Oriental White-eyes, Philippine Flowerpeckers, and Van Hasselt's Sunbirds; the largest flock, consisting of 15 to 20 taylor-birds, was seen September 9. As these birds were always in dense low brush they were difficult to collect because they could not be seen at a sufficient distance to avoid blowing them to pieces, and it was nearly impossible to locate one after it had been shot. At no time did they appear to be disturbed by my presence; I frequently walked along with them as they slowly worked through the brush within two or three feet of me.

While working through the brush feeding, they uttered a very pleasant soft squeak and their song, heard mostly in the spring and early summer, was surprisingly clear and loud for such a frail bird.

Muscicapa griseisticta. Gray-spotted Flycatcher.—September 30. One specimen; sex not definitely determined. Eyes, feet, and bill jet black.

This specimen is my only positive identification of the Gray-spotted Flycatcher, although two birds believed to be of this species were seen during the following week. The specimen was collected while it was feeding on the wing in short flights from the limb of a dead tree in a fairly open forest area.

Rhabdornis mystacalis minor. Philippine Creeper.—♂, May 31. Eyes brown; bill and feet black. One of a pair traveling with a Pygmy Woodpecker. Testes moderately enlarged.

♂, June 22. Eyes brown; bill and feet black. Stomach empty. Testes slightly enlarged. Shot at 6:30 p.m. from the top of a tree approximately 30 feet high.

Only two other birds of this species were seen; both were single birds on dead limbs at the edge of the woods in the last of June or early July. In behavior these birds are similar to nuthatches (*Sitta*), although they seemed to spend most of their time in the crown of the trees, feeding from leaves or blossoms, rather than on the main branches. No call or song was heard.

Dicaeum papuense papuense. Philippine Flowerpecker.—April 30, May 8, May 20, June 26, July 3, August 31. Six males, all with enlarged testes except for the specimen of August 31; bills and feet black; eyes, brown (5), brownish red (1).

September 3, juv. ♂. Mandible and base of maxilla deep yellow; feet pale brownish-black.

These flowerpeckers were among the most common birds of the island, being seen singly, in pairs, and in small flocks of six or eight individuals. They were often seen traveling with white-eyes, sunbirds, and taylor-birds.

Their fast, darting flight was difficult to follow when they were chasing each other from tree to tree. During flight they were almost always twittering and from March through October they were active from dawn until dark. I have seen them hover like hummingbirds (Trochilidae) before flowers or clusters of leaves. They were usually seen in the forest or the tall trees at the edge of open areas, only rarely in low brush or bushes, never in palm groves. Their flight was usually from tree to tree but on several occasions I noted flights above the forest for a distance of one-fourth of a mile.

I am certain a nesting bird was located about May 20 some 12 feet from the ground in the thick vines covering a dead stump. For a period of two weeks I could frighten the bird from this place at any hour of the day by shaking the vines. When frightened, the bird flew about 100 feet into the woods, and when I returned about one-half hour later, it would have returned to the same place in the vines. McGregor (1909:626) notes that Bourns and Worcester reported these flowerpeckers breeding in August on Samar. Adult males collected at Calicoan on April 30, May 8 and 20, and July 3 all had much enlarged testes; the specimen of June 26 had testes about half enlarged; that of August 31 had small testes.

Dicaeum trigonostigma cinereigulare. Orange-breasted Flowerpecker.—3 ♂♂, May 11, May 14, and June 28. Eyes brown or dark brown; bills, legs, and feet black. All breeding birds; testes greatly enlarged. All shot from high perches on dead twigs of tall trees in fairly open brushy areas, singing (May 14 and June 28) in late afternoon or evening.

In addition to those collected, two or three others were seen in late May or early June, one of them in dense woods. Whitehead (Ogilvie-Grant and Whitehead, 1898:243) reported eggs found on Samar in July, while Bourns and Worcester (McGregor, 1909:633) reported the birds breeding in August.

Nectarinia sperata. Van Hasselt's Sunbird.—♂, March 18. Eyes, bill, and legs black; testes enlarged; stomach contained small flies, an ant, small spider, and a mosquito. One of a pair singing.

♂, May 30. Testes enlarged, singing from a dead twig 20 feet from the ground; chased from tree to tree for about 400 yards before collected.

♀, June 4. Eyes olive; bill and feet black; stomach contained 3 small snails and a green mosquito-like fly; ovary much enlarged.

A total of about 15 birds of this species was seen during the time I was on the island. Their actions were much like those of wood warblers, and their song was clear, loud, and very pleasing. They were often seen in the company of Yellow-breasted Sunbirds, Philippine Flowerpeckers, white-eyes, and taylor-birds, but were usually in the higher cover with flowerpeckers rather than in the lower brush that was worked by white-eyes, and taylor-birds. One large mixed flock containing at least four male sunbirds was seen traveling along the high central ridge of the island on September 3.

Zosterops palpebrosa basilanica. Oriental White-eye.—June 7. One specimen, sex undetermined; bill black, mandible gray at the base; feet pearl-gray; one of four that were singing and chasing each other in the tree tops.

♂, June 6. Eyes brownish-gray; bill gray, mandible gray at the base; feet pearl-gray; testes slightly enlarged; probably one of the four noted above.

Few white-eyes were seen, possibly a total of 15. It is probable that others were seen but not identified because of their similarity to other small birds in the area and because of the dense brush in which they were usually found. Those seen and identified were usually with taylor-birds or sunbirds in low thick brush. Their song was a clear pleasant whistle but lacked the power and distinctive notes of the sunbirds.

Aplonis panayensis. Philippine Glossy Starling.—September 9. Two juveniles of undetermined sex; eyes red; feet and bill black; shot from a flock of 12 to 15 birds.

♀, October 7. Eyes brilliant red; bill, legs, and feet black; stomach contained grape-like berries; shot from a flock of 6 to 8 birds which were working in and out of holes near the top of a high dead tree about an hour before dark.

October 14. Juvenile of undetermined sex (probably ♂) eyes red; bill and feet black.

In voice, flight, and behavior these birds are very similar to our Starlings (*Sturnus vulgaris*).

I have found no migration or local seasonal movements of this species recorded in the literature, but it is reported as a common resident throughout the islands. No birds of this species were seen on Calicoan prior to September, when juveniles appeared rather suddenly in flocks of 10 to 30 individuals. They stayed together in their own flocks; when not feeding they used high dead trees or branches for perches. When disturbed, they wheeled and flew off in a tight flock that could be broken up only by a shot. Occasionally a small flock would join a larger flock in a tree, but after a while approximately the same number that joined the first flock would fly away together. I never saw a flock consisting of both adults and juveniles, nor did I see both age groups feeding in the same area at the same time.

The adults appeared equally abruptly and in large numbers during the first week of October and, save for a few scattered individuals, disappeared in about one week. The largest concentration was on October 6, 7, and 8, when several flocks of as many as 50 birds could be seen at any time of the day. I estimated that between 300 and 500 of these adults were often feeding in the treetops in an area of about 10,000 square yards. The adults were much noisier than the juveniles. On October 14 a total of no more than 20 adults were seen, and a day or two later there were none except for an occasional pair or single bird, although a few scattered flocks of juveniles were encountered through October.

Sarcops calvus. Coleto.—♀, May 18. Eyes light brown; feet and bill black; wattles ruddy flesh-color; ovary much enlarged; stomach contained hard black seeds, pea-size; one of a pair.

♂, May 27. Eyes brown; one of five, high in a big tree.

♀, August 21. Eyes brownish-black; wattles flesh color; stomach contained 2 seeds the size of a pea; shot at 5 p.m.; ovary slightly enlarged.

These are among the most common and interesting birds of the island; usually seen in pairs or small flocks of four to eight individuals, though in the fall, flocks of as many as 50 were seen. They were active throughout the day, found in all localities except palm groves, often seen traveling with the Philippine Orioles, and feeding with them as well as Barred Graybirds, cockatoos, juvenile Philippine Glossy Starlings, and Bonaparte's Imperial Pigeons. Delacour and Mayr (1946:245) well describe the call note as "a peculiar click, metallic but not displeasing"; however their voice and calls are varied. They have a clear melodic whistle, somewhat like that of the Philippine Oriole, and were often heard mewing much like our Catbird (*Dumetella carolinensis*).

On March 10, just at dark, I saw three entering a hole in a tree some 20 feet above ground, presumably to spend the night. I noted this same procedure four or five times during the rest of the month at the same place, and three birds were always present. A pair of Philippine Orioles usually went to roost at about the same time on a branch about 15 feet from the hole used by the Coletos, and neither species seemed to pay any attention to the other. Some of the holes usually frequented by the Coletos were much like

those made by the Pileated Woodpecker (*Dryocopus pileatus*). Their flight is like that of the Grackle (*Quiscalus quiscula*), but they were often seen to alight with a nearly perpendicular upswoop of 10 to 20 feet to a branch, or directly into a hole without touching or alighting before entering. A pair was once seen taking turns flying from a hole to a tree about 100 yards away and returning to the tree. I think they were feeding on insects which were evident in great numbers on the tree.

Dicrurus hottentottus striatus. Spangled Drongo.—♂, June 28. Eyes deep reddish-brown; bill, legs and feet black; testes much enlarged; one of a pair singing in dense low growth.

♂, August 21. Eyes bluish-black; bill and feet black; testes not enlarged; stomach contained small insects.

Although usually seen in dense woods on Calicoan, these drongos came out into cleared or open areas at evening and were seen apparently catching insects on the wing, off tree trunks, or from the leaves of banana plants. At this time I have also seen them flying around a puddle much like butterflies. They would occasionally light on a tree trunk to pick off a few insects before resuming flight. At dusk they would sometimes perch on a limb about five feet from the ground or on a fallen log and give a slow series of five or six sharp whistles, each call in the series being a little higher in the tonal scale than the preceeding one. If disturbed in this activity, they would fly to a similar place about 100 feet away and continue calling.

These birds were usually seen singly or in pairs until fall, when flocks of four or five were frequently seen. They were fairly common, and two to four could be seen at any time of day during a half-hour walk in the forest. Three birds were frequently heard calling or singing in an area of one acre. They seemed particularly attracted to deep ravines or low thick bushy areas.

The song and call of these Spangled Drongos was very similar to that of our Catbird (*Dumetella carolinensis*) or Brown Thrasher (*Toxostoma rufum*), being a series of clear, loud, melodious whistles. They also *mew*ed like the Catbird.

Oriolus chinensis chinensis. Philippine Oriole.—♂, May 8. Eyes brownish-purple; bill translucent reddish-purple, darker near the base; feet slate-color; testes much enlarged; stomach contained fruit like a grape and some seeds.

♂, June 21. Eyes brownish; bill translucent flesh-color; feet blue-gray; testes slightly enlarged; stomach contained seeds and vegetable matter.

During the time that I was on the island, from 2 to 10 of these orioles could be found on any day. Prior to mid-summer they were mostly seen in pairs, while in the fall they were usually seen in small flocks. In every month they were seen frequently with Coletos, and in the fall were often seen feeding and traveling with juvenile Philippine Glossy Starlings, Barred Graybirds, and cockatoos. They were usually seen in fairly open forest or at the forest edge. They were never seen in the palm groves.

Their voice and call was much like that of that of the Cardinal (*Richmondena cardinalis*), a clear loud liquid whistle, the notes of which are unusually well suggested by the native name *tu li hi ao.* The call was easily imitated, and during the time I was on the island, one or more of these orioles were frequently decoyed by my whistles. Another call given by these birds was similar to that of the cockatoo, but not so loud nor so harsh.

The only display noted was a bowing ceremony between two birds facing each other on a dead log late in the afternoon of February 21. This ceremony was interrupted by my presence, and the birds flew off. Just at dark on several days in early spring a pair

of these orioles gathered in the same tree with three Coletos as reported above. Their movements were not particularly localized, and they were often seen to fly out of sight; only crows, hornbills, hawks, cockatoos, and pigeons seemed to range farther.

Corvus macrorhynchus philippinus. Large-billed Crow.—♂, July 9. One of a pair; testes moderately enlarged (8 mm. by 6 mm.); one of a pair, the other remaining in the immediate vicinity cawing for some time and then following me for a quarter of a mile before flying away. Wing 305, tail 216, culmen 61.

Crows were regularly seen during the entire time I was stationed on the island. Although there was no variation in the overall numbers seen daily, there was a local concentration of some 20 to 25 birds at a point on the shore where garbage was being dumped into the sea.

In flight and general behavior these birds were like the North American Crow (*Corvus brachyrhynchos*). They ate garbage and carrion along the roadside. They chased and were chased by other birds, including Bonaparte's Imperial Pigeons and Serpent Eagles. They were usually seen in pairs or small flocks of 5 or 6, but would gather quickly in larger flocks to chase a hawk while cawing loudly. The maximum chase after a hawk was not over a quarter of a mile. They were not much disturbed by men or automobiles but were careful to move a bit away (out of gun range) and return to their carrion or former perch as soon as one had passed.

As there are two species of crows reported from Samar it is unfortunate that I did not identify or collect the smaller one, *Corvus enca*. It is especially unfortunate that a crow was not taken while giving the very uncrowlike call noted by previous observers. Two entirely different calls were made by the crows on Calicoan, the first was the usual deep gutteral *caw caw* too well known to require comment. The other call was a loud, piercing shriek or whistle heard daily from March to mid-July, usually at dawn or just at dark in the evening. I have heard both calls from crows in the same tree. I was never able to see any difference in size or behavior of the crows seen. I actually heard one, apparently no different from *Corvus macrorhynchus*, give this piercing whistle as it flew directly over me and well within gun range, but I didn't have time to shoot before it had passed and disappeared in the forest.

For a few days during the last week of June, four crows spent the night in a palm tree near our tents, although they usually were seen roosting in the tall trees in the dense growth along the high central ridge of the island. They usually roosted in small groups of 5 to 7 birds but occasionally in the spring birds roosted alone. Throughout the time of my observations, a daily regular northward flight up the center of the island was seen. This flight consistently had peaks of 35 birds visible at one time, at 4:45 p.m. and again at 5:45 p.m. The time of these flights was so regular that I had no need to consult a watch to gauge my field time properly so as not to miss dinner. They were, perhaps, flying to a communal roost but I never saw them returning in a regular flight. I never heard these birds give the piercing call during this evening flight.

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Route 5, Huntington, New York, March 1, 1953

NEW LIFE MEMBER

Stuart Houston, born on September 26, 1927, received his M.D. from the University of Manitoba in 1951. His interest in ornithology developed and grew with the founding (in 1942) and growth of the Yorkton Natural History Society, in Yorkton, Saskatchewan where he makes his home. He is now president of this society and also of the Saskatchewan Natural History Society, and a contributor to "The Blue Jay," the official bulletin of the latter organization. The photo, taken during the Christmas bird count at Dilke, Saskatchewan, in 1951, shows Dr. Houston wearing buffalo coat and moccasins, clothing appropriate to the 28° below zero weather of that day. His interest in birds has led him to band over 6200 individuals of 83 species.

THE ANALYSIS OF BIRD SONGS BY MEANS OF A VIBRALYZER

BY DONALD J. BORROR AND CARL R. REESE

TO analyze a bird's song one needs to determine its loudness, rhythm, and frequencies. Since these characteristics cannot be accurately determined by the ear alone, most published accounts of bird songs are merely subjective descriptions and not accurate analyses. Attempts have been made (*e.g.*, Arleton, 1949, and Mathews, 1904) to represent bird songs with the musical scale, but these are often inadequate because they cannot accurately indicate the unusual intervals, slurs, or erratic rhythms in many songs, and they do not indicate the frequency composition of the individual notes. Saunders (1935 and 1951) has devised a graphic method of representing bird songs, showing time on the horizontal axis and pitch on the vertical axis, and while his graphs are useful for identification they do not always show the minute details of rhythm, and no attempt is made to show frequency composition except by an accompanying description indicating the quality and phonetics of the song. Brand (1935) introduced a new method of bird song analysis—the microscopic study of songs reproduced on sound film. This method makes possible the accurate determination of the minute details of rhythm and the frequencies of the fundamentals, but it does not give any information on the harmonics or other frequencies present. A few other means have been used (*e.g.*, Metfessel, 1934, and Fish, 1953) to obtain graphic analyses of bird songs, and while some of these give an accurate picture of the rhythms they do not give frequency composition, a feature that determines the quality of a note. The determination of loudness in all these analyses has been entirely subjective. In this paper the authors wish to report briefly on a method of bird song graphing that has been little used (Bailey, 1950), one which not only gives a picture of the minute details of rhythm but shows all the frequencies present and gives some data on loudness.

Two types of graphs, or vibragrams, can be obtained with the Vibralyzer (manufactured by the Kay Electric Company, Pine Brook, New Jersey). One type shows frequencies along the vertical axis and time along the horizontal axis, and variations in intensity appear as corresponding variations in the darkness of the mark produced. A second type (a "section" vibragram) shows frequencies on the vertical axis and intensity on the horizontal axis, for any given point (actually integrated over 0.005 sec.) in time; this type gives more accurate data on intensities than the first type. Vibragrams are made on 5⅝ by 12¾ inch facsimile paper; frequencies are portrayed over a vertical distance of about 4 inches and time over a horizontal distance of about 12½ inches. This paper is fastened to a drum which rotates synchronously with a magnetic disc; the stylus is a 10 mil stainless steel wire. The marks on the paper are made electrically.

A simplified diagram of the principal circuits of the Vibralyzer is shown in Fig. 1. The input signal (from a tape recording of the song) is recorded on a magnetic disc (with the switch S_1 in the "record" position) by means of a record amplifier; once the

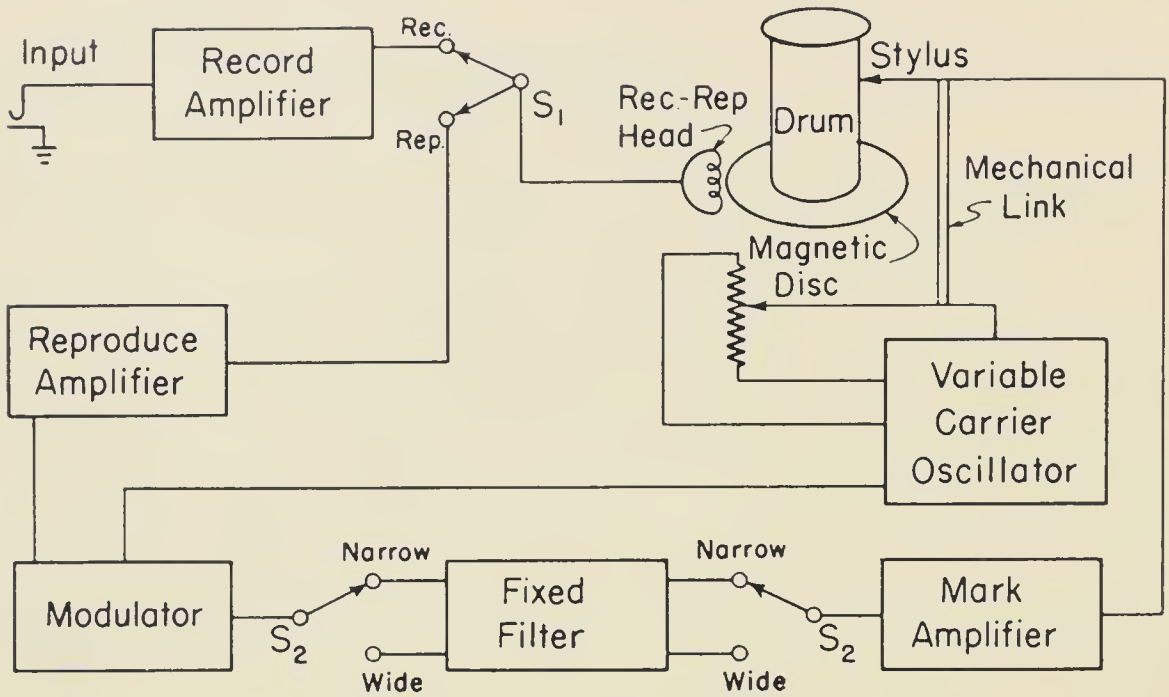

FIG. 1. A simplified diagram of the principal circuits of the Vibralyzer; several circuits are omitted, including the monitor amplifier, the erase head on the magnetic disc, and the sectioner.

signal is on the disc, S_1 is turned to the "reproduce" position. The signal on the disc may be heard by means of a monitor amplifier (not shown in the diagram) each time the disc rotates. When the vibragram is made the disc is rotated at the rate of 80 revolutions per minute and the signal is played back from the disc by means of a reproduce amplifier, and the output of this amplifier is fed into a modulator which modulates the playback signal with the output of a variable carrier oscillator. The frequency of this oscillator is determined by the position of the stylus, by means of a mechanical linkage. The modulated signal is fed to a fixed frequency filter, and the output of the filter actuates the mark amplifier which in turn supplies a marking voltage to the stylus. As the vibragram is made the stylus moves upward on the drum one inch for every 96 revolutions of the drum, causing the oscillator to sweep through its frequency range and thus effectively scan the recorded signal over this range. The frequency of the oscillator at any given position of the stylus determines what frequencies in the recorded signal will give rise to a difference frequency* that passes through the filter and results in a mark by the stylus.

The filter is set for a frequency of 15,000, and the carrier oscillator frequencies vary from 15,133 to 28,300; thus the reproduced frequency range is from 133 to 13,300 cps. The frequency range covered in any given vibragram depends upon the speed of rotation of the magnetic disc when the signal is being put on it; this disc can be rotated at four

*If one sine wave, $c_1 = E_1 \sin 2\Pi f_1$, modulates a second sine wave, $e_2 = E_2 \sin 2\Pi f_2$, the resultant signal (e) can be represented by $e = E_2 \sin 2\Pi f_2 + E_1 \cos 2\Pi (f_2 - f_1) - E_1 \cos 2\Pi (f_2 + f_1)$. The second term in this value of e gives rise to the difference frequency, $f_2 - f_1$. This difference frequency, due to the proper selection of parameters in the Vibralyzer, is the only frequency in the resultant signal which falls within the range of the analyzing filter.

TABLE 1

FREQUENCY RANGE, RESOLUTION, AND RECORD DURATION OF VIBRAGRAMS MADE OF SIGNALS PUT ON THE MAGNETIC DISC AT DIFFERENT DISC SPEEDS

Speed of disc when signal is put on	*Frequency range of vibragram**	*Effective band width of filter*		*Duration of sample*
		Narrow	*Wide*	
Lowest	5–500 cps	2 cps	20 cps	20 sec.
Low	15–1500 cps	6 cps	60 cps	6.6 sec.
High†	44–4400 cps	20 cps	200 cps	2.25 sec.
Highest	133–13300 cps	60 cps	600 cps	0.75 sec.

* The range can be reduced to one-half this value by a switch on the control panel.
† Most bird songs are fed to the Vibralyzer with the disc rotating at this speed.

different speeds. Two band widths are available in the filter, a wide band and a narrow band. The degree of time and frequency resolution of the vibragram depends on the disc speed (when the signal is put on it) and the band width of the filter, the narrow band filter giving greater frequency resolution and the wide band filter giving greater time resolution. The characteristics of vibragrams made under different conditions are shown in Table I.

Vibragrams of any given song will vary in appearance depending on the settings on the control panel of the instrument; the controls can be set to bring out specific characteristics of the song. Time intervals can be measured with greater accuracy if the tape recordings fed into the Vibralyzer are run at a reduced tape speed.

The following general conclusions may be drawn from the few hundred vibragrams of bird songs that we have made to date:

(1) Relatively few bird notes are simple or "pure"; most of them are composed of many frequencies, and the most intense frequency is seldom the lowest in the note. Few notes show distinct harmonics. Most bird notes, except those that are clear whistles, are somewhat intermediate between musical tones and noises, *i.e.*, they may contain two or three predominating frequencies but also contain all (or nearly all) of the frequencies in between. If the frequency spread is narrow (*e.g.*, the second note in the Red-eyed Towhee song, Fig. 3), the note appears musical; if the frequency spread is an octave or so (*e.g.*, the lower notes of the Song Sparrow's trill, Fig. 6), the note appears more like a noise. The frequency of a musical note can be determined fairly accurately by ear by comparison with a standard, but it is difficult or impossible to determine any predominant frequency by ear in a noise-like note.

(2) Some birds may begin a note with a particular frequency composition, and before ending that note begin another containing a different (usually higher) group of frequencies (see Figs. 2 and 3).

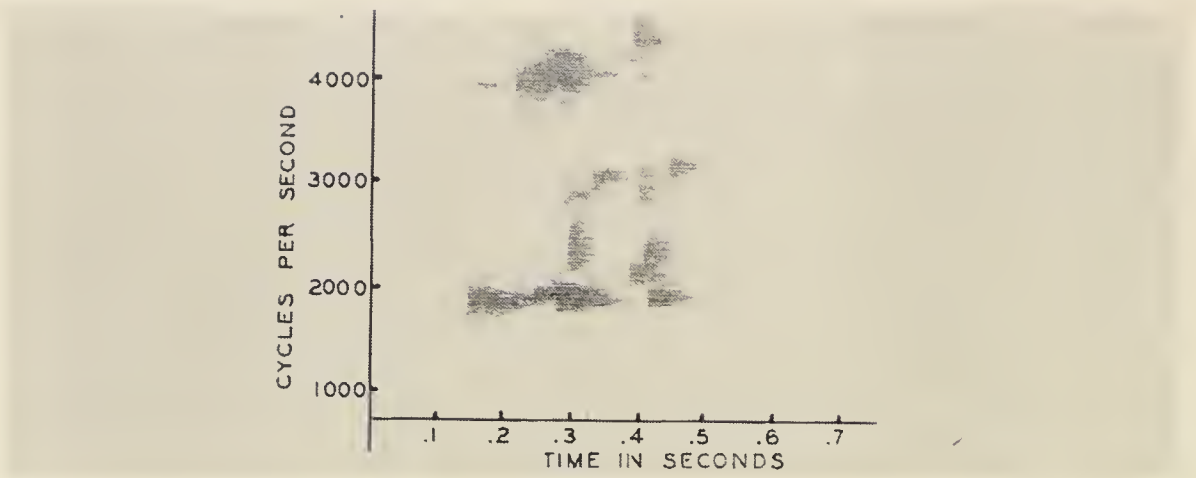

Fig. 2

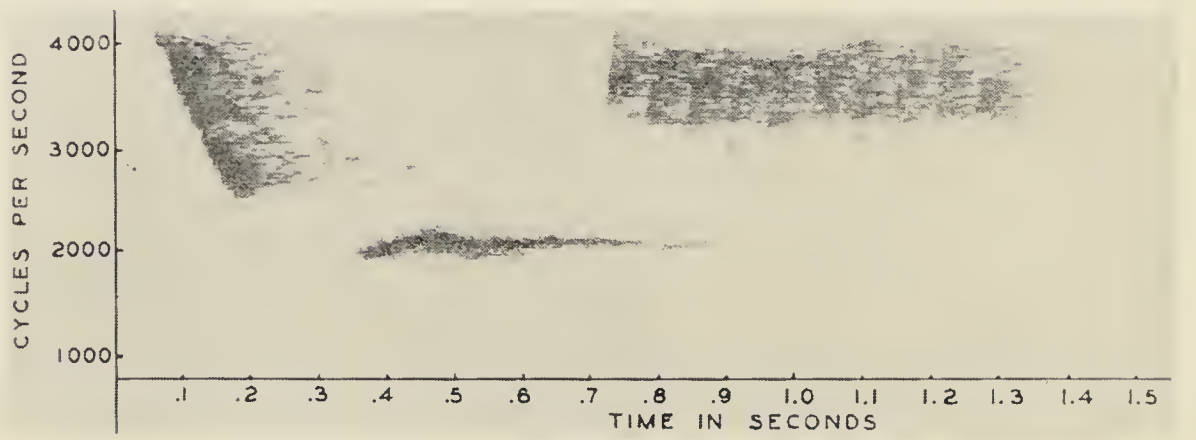

Fig. 3

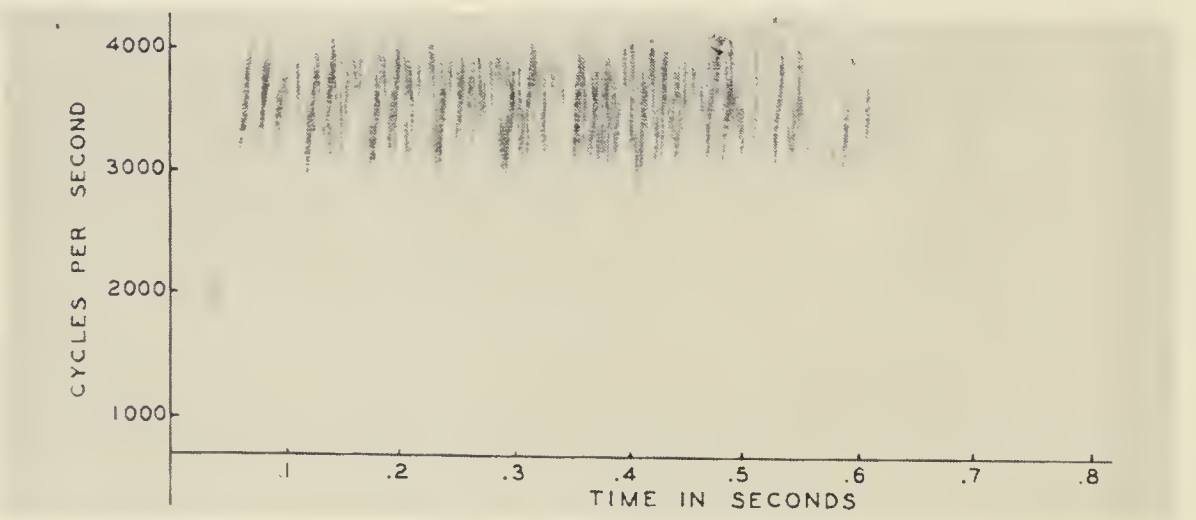

Fig. 4

FIGS. 2–4 (top to bottom). Vibragrams of bird songs, from tape recordings made in central Ohio. Fig. 2, the somewhat squeaky "song" of the Blue Jay (*Cyanocitta cristata*); Fig. 3, the *drink-your-tee* song of the Red-eyed Towhee (*Pipilo erythrophthalmus*); Fig. 4, the final *teeee* of the same song shown in Fig. 3, made to give better time resolution and showing the pulses in this note. The vibragram in Fig. 4 was made using the wide band filter; the other vibragrams were made using the narrow band filter.

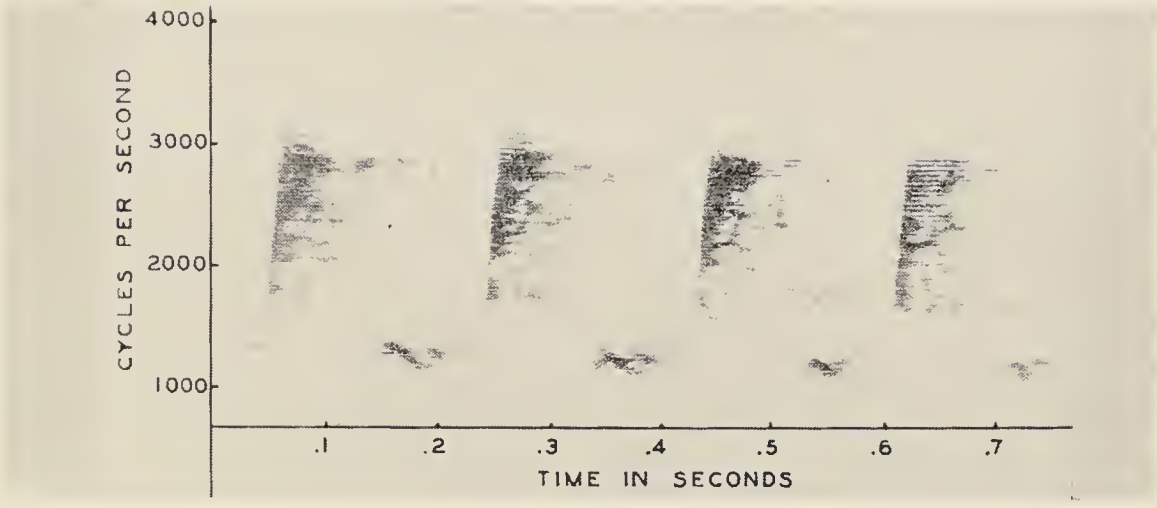

Fig. 5

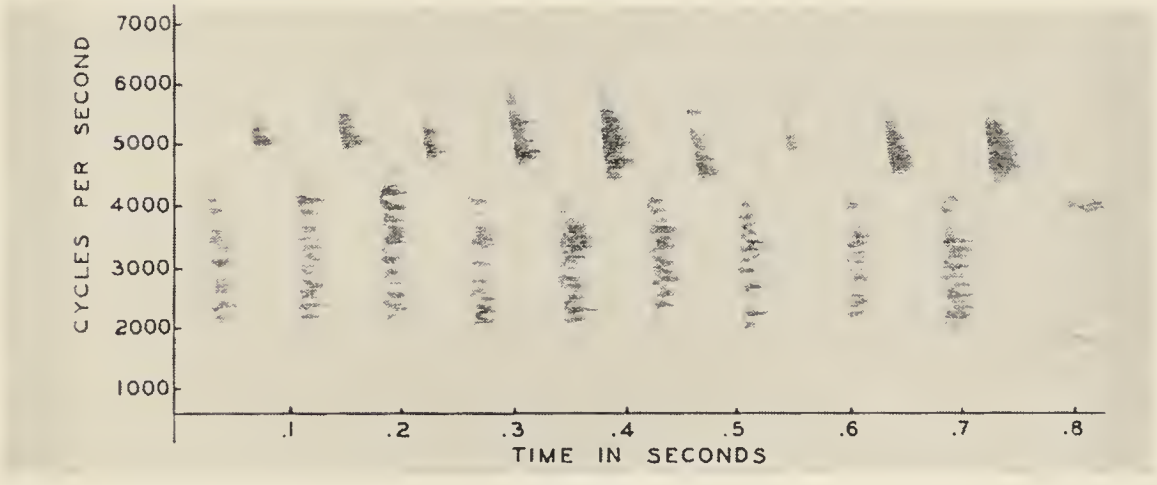

Fig. 6

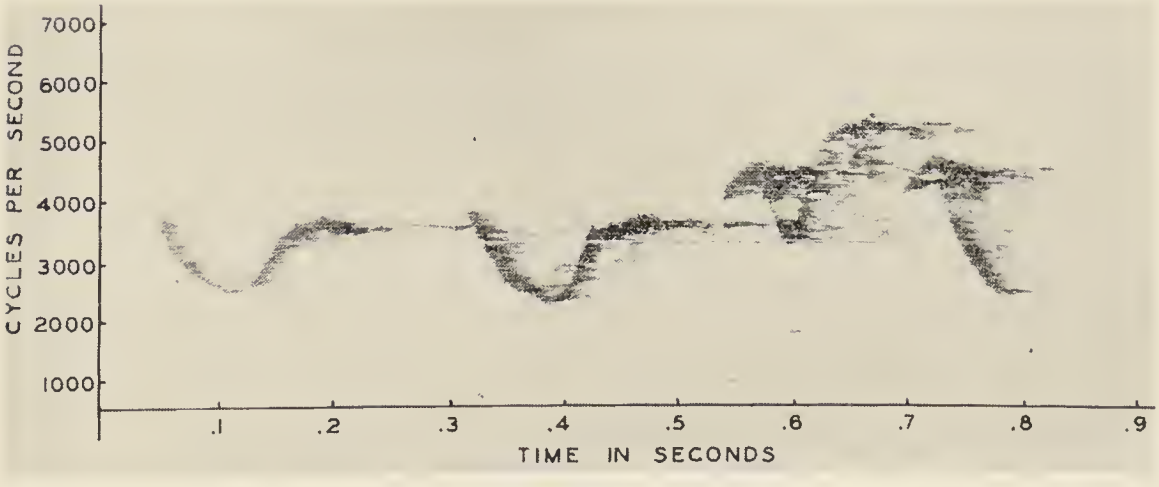

Fig. 7

FIGS. 5–7 (top to bottom). Vibragrams of bird songs, from tape recordings made in central Ohio. Fig. 5, part of the song of a Cardinal (*Richmondena cardinalis*); Fig. 6, a trill in the song of a Song Sparrow (*Melospiza melodia*); Fig. 7, the song of a Hooded Warbler (*Wilsonia citrina*). These vibragrams were made using the narrow band filter.

(3) Many bird notes are slurred upward (*e.g.*, Fig. 5) or downward an octave or so in 0.01 second or less.

(4) Notes which appear buzzy to the ear (*e.g.*, the final *teeee* of the towhee's song, Fig. 4) usually contain a wide range of frequencies and are modulated, with pulses coming at the rate of 100 or more a second.

(5) Many bird songs contain more individual notes than are apparent to the ear (note particularly Fig. 2).

(6) Some bird notes (*e.g.*, the final note in the Hooded Warbler's song, Fig. 7) consist of two groups of frequencies, one maintained steady and the other slurred; or, such a bird might be said to sing two notes at once, one a steady note and the other slurred.

Analyses of this sort will provide objective data that are more detailed and accurate than those obtained by most of the methods heretofore used in studying bird songs, and should be of value in behavior and taxonomic studies. They suggest some interesting lines of future investigation, *e.g.*, a study of the intraspecific variation in bird song, and a study of the syringeal mechanism to determine how these vocal gymnastics are produced.

We wish to express our appreciation to Dr. J. Allen Hynek, Department of Physics and Astronomy, Ohio State University, for making a Vibralyzer available for these studies, and to Mr. William Protheroe, of the same department, for his assistance in the operation of the Vibralyzer.

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Department of Zoology and Entomology, The Ohio State University, Columbus 11, Ohio, February 11, 1953

GENERAL NOTES

The Carolina Chickadee in Kansas.— W. A. Lunk (1952. *Wilson Bull.*, 64:7-21), in an interesting and useful paper on variation in the Carolina Chickadee (*Parus carolinensis*), has described a new form, *P. c. atricapilloides*, ranging from Kansas through Oklahoma to central Texas. Among the Kansas records, two listed from Douglas County aroused the curiosity of Wetmore, long familiar with that area through his undergraduate days at the University of Kansas at Lawrence. The Black-capped Chickadee (*Parus atricapillus*) is common there, but the other species, except for this record, has never been reported. On inquiry, Lunk kindly indicated that the two skins concerned were at the University of Oklahoma, allegedly having been collected by Charles D. Bunker on September 10, 1898.

Sutton examined the two specimens, comparing them and their labels with all specimens of *P. carolinensis* and *P. atricapillus* in the collection, and consulting all available catalogues. Deciding, finally, that Wetmore, who knew Bunker and his methods well, should see all specimens of comparable locality, date, or catalogue number, Sutton sent a series of seven to Washington. With this material in hand, Wetmore decided that the two moot birds had been wrongly labelled through some clerical error.

Bunker was associated with the University Museum at Norman for a period. He not only collected at numerous localities in Oklahoma, but also took a small number of specimens near his home at Lawrence, Douglas County, Kansas, during this connection. It was his practice to use small tags marked only with a number in the field, and to prepare labels with complete data on locality, date, and other details later. In some way these two Carolina Chickadees, which bore only field numbers, must have become confused with certain Lawrence specimens, and so were wrongly attributed to that locality.

The mixup becomes the more evident through direct comparison of the two moot birds with a specimen of Black-capped Chickadee that it appears was actually taken by Bunker at Lawrence on September 10, 1898. The "make" of this Black-cap and the type of its field label differ decidedly from the "make" and field label of the two Carolinas. The field number of the Black-cap is 89, of the other two 324 and 325 respectively. Obviously the three birds are not of the same series. It seems probable that the two Carolinas were taken not in Kansas, but in Oklahoma, and by another collector, and that they were labelled wrongly through some confusion later, when permanent labels were prepared.

The northern limit of *P.c. atricapilloides* in Kansas is not, therefore, Douglas County, but Meade, Greenwood, and Montgomery counties, instead, and range statements concerning the form should so read.—Alexander Wetmore and George Miksch Sutton, *Smithsonian Institution, Washington, D.C. and Museum of Zoology, University of Oklahoma, Norman, May 4, 1953.*

Nesting of the White-throated Sparrow in West Virginia.—A considerable southward extension of the known breeding range of this species, *Zonotrichia albicollis*, is worthy of record. The A.O.U. Check-List of 1931 gives the most southerly localities of its nesting as the mountains of northeast Pennsylvania and New York. Todd ("Birds of Western Pennsylvania") suspected it of nesting in the northwest corner of that state but had no records.

On June 18, 1952, while leading a group of young nature students from Oglebay Institute through the bog formed in the valley at the headwaters of White-oak Spring Run, four and a half miles northeast of Terra Alta, West Virginia, Buchanan flushed a bird of this species from its nest containing three eggs. A fourth egg was subsequently laid. The bird was seen well by Buchanan and others in the group, and the nest and eggs were typical for the species. On June 19, while further exploring the swamp, the group found another nest. This nest contained two eggs of the White-throat (one dented), one of the Cowbird, and the shell of another White-throat's egg lay on the ground beneath. The female was flushed and was well seen by several of the group.

The first nest was placed 18 inches above the ground, supported by a small rhododendron bush which was thickly grown over with dead as well as green growth of fringed sedge (*Carex crinata* Lam.), the sedge forming a screened canopy over the nest. It was well constructed of coarse sedge stems ("straw") and a few grass blades, and lined with fine grass stems. No leaves were used in the construction. The location was in the intermittent shade of hemlock and maple trees as well as that of rhododendron and alder that grew in the bog. Some spruce was present not far distant. The second nest was of similar construction though in a little more open situation. It was also placed 18 inches above the ground, supported on a leaning dead shrub of shrubby St. Johns-wort, and a leaf of skunk cabbage partially shaded the nest.

On June 22, Ganier, Buchanan and others returned to the site and again identified the first bird as it flushed five feet away. The nest was photographed *in situ* (see illustration), and in view of the importance of the find, the nest and eggs were collected for future reference. The eggs average a little smaller (measurements in inches: .81 × .60, .80 × .60, .80 × .57, and .82 × .56; average, .81 × .58) than those described by various authors, and are beautifully marked. The account of Davie (1898. "Nests and Eggs of North American Birds") describes the eggs quite accurately and is here quoted: ". . . ground color . . . pale greenish-blue, spotted, sprinkled and clouded with cinnamon-rufous and bay." The second nest mentioned was found to have been deserted.

On June 17, we had found good evidence of the nesting of this species about three and a half miles to the northeast, in the more extensive Pine Swamp bog at Cranesville in Maryland. We there found White-throats at two locations without making any

special search for them. One pair, discovered by George Breiding of Wheeling, West Virginia, seemed much disturbed by our presence and evidently had a nest close by. Ganier sat for half an hour while the birds flew uneasily about in nearby trees and shrubs, keeping 30 to 50 feet away, but they were not seen to go to the nest. The thick, knee-high marsh grass all about made a thorough search impossible in the time available. Maurice Brooks has written us that he and Carl Haller saw a male in this swamp on June 3, 1936, and felt at the time that the White-throat might eventually be found nesting in the West Virginia mountains. However, none were found in the high, mountainous area around Davis, Tucker county, about 25 miles south, in a week-long census by The Brooks Bird Club, June 9–17, 1951 (127 species recorded).

Barrows (1912. "Michigan Bird Life") states that in Michigan, all nests of which he had record were built on the ground. The elevated nests described in this paper may have been the result of occasional floodings of the bog by the stream which drains the valley.—Albert F. Ganier, *2112 Woodlawn Drive, Nashville, Tennessee, and* Forest W. Buchanan, *Amsterdam, Ohio, September 17, 1952.*

Unintentional live-trap for American Mergansers.— On June 20, 1950, my wife and I arrived at a camp situated in the Winnipeg River just north of the Lake-of-the-Woods and six miles south of Minaki, which is only a few miles from the western border of the province of Ontario. Minaki is a small settlement and trading post on the Canadian National Railroad. The camp is situated on a wooded island of about two acres in extent, and there are half a dozen cabins scattered about it. Beneath an ice house on the island we found a nest with ten eggs of the American Merganser (*Mergus merganser*).

The morning after our arrival we found a female American Merganser in a mess hall adjacent to our living cabin. The bird had entered through the chimney during the previous night and we permitted it to escape. This experience was repeated on three successive mornings and in each instance the bird was unharmed and permitted to go free.

On the second day of our encampment there we visited a neighboring island a half mile distant where there was a single, large, unoccupied cabin with no open entrance revealed by subsequent, careful search except for the chimney. On the floor of the cabin were eleven female American Mergansers, all except two of which were dead. The two were permitted to escape by the door as we entered. They all had entered the cabin by way of the chimney and fireplace, and the nine apparently had died of starvation. After this experience we took pains to cover the chimney of this cabin, as well as the others at our encampment, with chicken wire held in place by stones of suitable weight. We subsequently learned from natives of the region that covering chimneys was a common practice, as female mergansers had a habit of entering unoccupied cabins in the spring.

During our stay of ten days we saw a great many American Mergansers, but we did not discover a natural nesting site. There were few large trees; and, because of the very high water, fully ten feet above normal, most of the short stumps were covered. This condition may have contributed to the behavior of the birds. Undoubtedly they were seeking nesting sites when they entered the cabin chimneys.

It should be added that in June, 1951, we revisited this region. The water was much lower on this occasion, and the behavior of the mergansers was not repeated. We did find a nest with a clutch of eggs under the ice house on this occasion, just as we had previously.—William D. Dugan, *221 Pierce Avenue, Hamburg, New York, January 27, 1953.*

Casting of a Pileated Woodpecker.—On February 2, 1952, in a forest of hemlock and hardwood trees on Green Hill, Mahwah, Bergen County, New Jersey, we flushed an adult male Pileated Woodpecker (*Dryocopus pileatus*) from a dead hemlock tree where he had been chiseling characteristic wedge-shaped holes. The ground beneath was covered with fresh chips. On top of the chips and close to the tree was a fecal casting of the bird.

The casting resembled that of a chicken (*Gallus*). It was composed of a paper-like sheath encasing a solid mass of chitinous material. The sheath was light greenish with traces of dark green. Inside, the chitinous matter, apparently mouth and leg parts of ants, resembled tobacco. The casting was 3 to 3½ inches long and 5/16 inches in diameter. The diameter was easy to measure but the length difficult because the casting broke when I attempted to measure it. After the casting dried out, the paper-like sheath became whitish in color.

I sent the casting to Dr. Marion R. Smith, of the U. S. National Museum, Washington, D. C., for examination. The following is his reply: "The casting of the pileated woodpecker appears to contain, exclusively, fragments of workers of the black carpenter ant, *Camponotus pennsylvanicus* (*Degeer*). It is impossible to estimate definitely the number of workers contained in the casting, but I believe a conservative guess would be a hundred more or less. The carpenter ant, as you may know, is a wood nesting form with variable sized workers. Some of the workers are very large and it would not take the fragments of many of these workers to give the appearance of more individuals involved than there really are."

A few days later I revisited the place and retrieved another short piece (about an inch) of the casting which I knew had fallen into the chips on the first visit. This piece would raise the number of ants in the casting about one-third.—Eleanor E. (Mrs. John Y.) Dater, *Ramsey, New Jersey, November 20, 1952.*

Five nestings of a pair of captive Mourning Doves.—A pair of Mourning Doves (*Zenaidura macroura*) kept at the Ornithology Laboratory at Ohio State University during the summer of 1951 made five nesting attempts which are shown below.

Nesting Attempt	Eggs Laid	Hatched	Fledged
1.	2 (early in April)		Deserted
2.	1 no date	May 1	May 12
3.	1 May 15	May 30	Both, June 14
	1 May 16	May 31	
4.	1 June 18	July 2	July 12
	1 June 19	July 4	July 15
5.	1 July 18	Aug. 2	Both, Aug. 14
	1 July 19	Aug. 3	

The birds were confined in a pen 6 feet × 9 feet × 6 feet. The nest used for the entire period was a small watering crock located in a three-sided covered box. Except for some brief interchanges the male incubated from about 7:00 a.m. till 5:00 p.m. and the female stayed on the nest at night. The young of one nest were fed by the male at least until both eggs of the next clutch were laid. A careful check on egg laying times was not kept but both eggs of set No. 4 were laid in the afternoon, one at 5:40 p.m., the other between 5:30 p.m. and 7:00 p.m.—L. S. Putnam and C. E. Knoder, *Dept. of Zoology and Entomology, Ohio State University, Columbus, Ohio, May 20, 1953.*

EDITORIAL

President Breckenridge has appointed committee chairmen, to serve during the year 1953–1954, as follows: *Library*, George J. Wallace; *Research Grant*, Ernst Mayr; *Endowment*, Charles H. Rogers; *Membership*, Ralph M. Edeburn; *Conservation*, William H. Marshall; and *Local Committee on Arrangements for the 1954 meeting at Cape May*, Phillips B. Street.

Other 1953–1954 appointees are: *W.O.C. representative on the American Ornithologists' Union Council, meeting at Los Angeles*, R. Allyn Moser; *W.O.C. delegate to the 1954 International Congress at Basel, Switzerland*, Olin Sewall Pettingill, Jr.; and *Investing Trustee*, Phillips B. Street, to succeed A. W. Schorger, whose term has expired.

THE LOUIS AGASSIZ FUERTES RESEARCH GRANT

It will again be possible in 1954 to make the award of a Louis Agassiz Fuertes Research Grant, thanks to the generosity of an anonymous donor. Applications for this grant of $100 and inquiries about it should be directed to the chairman of the Research Committee, Prof. E. Mayr, Museum of Comparative Zoology, Cambridge 38, Massachusetts. Any member of the Club or one of the Affiliated Societies will be eligible. Applications, which should state the qualifications and the need of the applicant as well as details of the planned research project, must be received as soon as possible so that the award can be made at the June meeting.

The Membership Committee would like to be able to report to the Cape May meeting in June that the membership roster contains 2000 names. This will require an increase of 212 members beyond the total for December, 1952. Each member probably knows of one or more persons who would profit by association with us. It is up to you, the membership, to invite such persons to join the Wilson Club, and to turn in their names to the Membership Committee, using for this purpose the nomination forms which accompanied dues notices. We, as a committee, have no other way of obtaining many of these names. Last year's nominations brought in about 50 new members, a very profitable effort. May we have your continued support? Send the nomination forms to the Treasurer, or to any one of the Membership Committee listed below:

Ralph M. Edeburn, Chairman, Marshall College, Huntington, W. Va.
Mrs. Herbert E. Carnes, 25 Kenwood Road, Tenafly, N. J.
Ben B. Coffey, Jr., 672 N. Belvedere, Memphis 7, Tenn.
Robert C. Conn, 769 Park Avenue, Bound Brook, N. J.
Alfred E. Eynon, 5 Beach Road, Verona, N. J.
G. E. Grube, Gettysburg College, Gettysburg, Pa.
Harold D. Mitchell, 378 Cresmont Avenue, Buffalo 14, N. Y.
C. Chandler Ross, 7924 Lincoln Drive, Chestnut Hill, Philadelphia 18, Pa.
Edward L. Seeber, Laboratory of Ornithology, Cornell University, Ithaca, N. Y.
George M. Sutton, Department of Zoology, Univ. of Oklahoma, Norman, Okla.
T. G. Watson, 4110 Drummond Street, Houston 25, Texas.

ORNITHOLOGICAL LITERATURE

Our Amazing Birds. By Robert S. Lemmon. American Garden Guild and Doubleday & Company, Inc., Garden City, New York. 1952: 7 × 10 in., 239 pp., 102 black and white text-figs. and pls. $3.95.

This attractive work can hardly fail to teach the lay reader a great deal about birds, and to impress him with some of "the little-known facts about their private lives." Based on the not-unreasonable premise that facts about almost *any* bird are "little-known" and "amazing," it presents much basic and interesting life-history information, in easily readable form and embellished with numerous fine illustrations. The latter were done by Don Eckelberry, who according to the foreword had also a considerable part in the selection and preparation of text material.

While each of the 102 one- to two-page accounts treats a single North American species, or occasionally a small group, there has been a commendable effort to include comments of broader taxonomic and geographic application. The selected representatives of about 51 families include some rare and spectacular (and even extinct) birds, as well as some of the most commonplace. There is no semblance of systematic arrangement, and scientific names have properly been almost entirely omitted. The breezy, colloquial style is highly anthropomorphic, and laden with superlatives and glowing comparisons. It is sometimes refreshing, sometimes tiresome, and occasionally not altogether lucid ("The brown creeper belongs to a very small bird family . . . But it is not at all embarrassed by loneliness."). Some errors of fact are apparent. The male Tree Swallow, for example, ordinarily does *not* incubate; and "all true woodpeckers" do *not* "live primarily" on food gathered by "banging away with chisel-pointed bills until they have hammered a hole." The illustration showing a male hummingbird hovering solicitously beside the nest, while not impossible, at once strikes a false note.

Eckelberry's wash drawings are unquestionably the main attraction for the ornithologist. As is frequently the case, the best of the smaller text figures have more freshness and life than some of the more ambitious plates; but with few exceptions they range from good to superb. Throughout the series the artist's originality and excellent draftsmanship are apparent. We are looking up from below at the kingfisher, and down from above at the robin, and the Blue Jay is facing almost directly away; there are few conventional profiles. In almost every case the portrayal of forms and attitudes is impressively convincing. The backgrounds, employing a wide variety of treatments, are excellent, except for occasional lapses, as in the case of the branch which to my eye persists in making the Winter Wren appear several times as large as it should.

I noticed only one typographical error. The format of the book is neat and modern throughout, the paper and print very good, and the brief index adequate for its purpose.—William A. Lunk.

The Yellow Wagtail. By Stuart Smith. Collins, St. James Place, London. 1950: 5½ × 7¾ in., xiv + 178 pp., 26 paintings, 11 black and white photographs, 4 line drawings, 4 maps. 12s. 6d.

This is one of the excellent "New Naturalist Monographs." Based on seven years' study it discusses *Motacilla flava* in general and particular as may be judged from the table of contents: the bird and its breeding distribution; winter quarters and migrations; territory, pair-formation and aggressive display; nuptial display; the nest; the clutch; the brood; the final phase; the story of a name; the Yellow Wagtail group.

This bird prefers water-meadows as a rule, but certain colonies nest in heather and on moor-lands. The life history story is given in leisurely manner with description of typical events and comparisons with other species. No birds appear to have been banded, but plumage differences facilitated recognition of individuals. The birds immediately distinguish each other's sex through the respective coloration.

Wagtails are highly social birds outside of the nesting season, but decidedly territorial after being joined by mates. Territorial display and fighting are described and vividly portrayed in paintings by Edward Bradbury. The male's initial displays to his mate are simple affairs but later become spectacular with hovering over the mate and a song flight. "During this fluttering descent, the cock sings with a musical trill, 'sree-sree-sree', very rapidly repeated, which is a beautiful and musically refined edition of the normal call notes" (p. 45). "There are, however, very few people who appear to have heard the true song of the Yellow Wagtail."

The female chooses the nest site and builds the nest, yet the male helps incubate. Incubation lasted 12 to 13 days; the young left at 12 to 13 days and were able to fly at 16 days. A very high rate of success was found in the 19 nests watched, only three nests coming to grief. From 99 eggs 66 young were raised, or 66.6 per cent. Strangely enough Dr. Smith states that baby wagtails are not fed nor do they defecate until "the second day after the hatch," (p. 76) *i.e.*, when they are about 24 hours old (p. 81). The author assumes a 40 per cent survival of adult birds and 25 per cent of young that left the nest. From my experience with Song Sparrows, *Melospiza melodia* I would consider 50 per cent survival of adults and 20 per cent survival of young a better estimate for many small birds. Where only 38 per cent of returns of adults are reported I suspect that some survivors were missed.

It is surprising to read in regard to "starvation in winter or death from a predator" that "it is fairly certain that the number of small birds which die from such causes is trivial compared with those struck down by the unseen army of parasites which infest the bodies of birds" (p. 147). The author does not discuss the intriguing problem of why the wagtail wags his tail. There is an index and a 21-page bibliography, besides appendices that give details of breeding distribution in Europe and Britain and list the parasites of wagtails. The paintings and photographs add much to the attractiveness of this interesting book.—Margaret M. Nice.

The Redstart. By John Buxton. Collins, St. James Place, London, 1950: 5½ × 8 in., xii + 180 pp., one color photograph, 19 black and white photographs, 20 maps and diagrams. 12s. 6d.

It was a pleasure to read John Buxton's fine monograph, "The Redstart," and become acquainted with this European thrush, *Phoenicurus p. phoenicurus*. Although the author disclaims credit for describing behavior of all Redstarts, the thoroughness of his observations and his keen awareness of the ornithological literature are apparent throughout the book. He studied Redstarts in Britain, Norway, and during the five years that he was a prisoner of war (World War II) in Germany. Most of his studies were concentrated on a small number of birds, particularly four pairs. For one pair a mass of notes covering 850 hours of observation by the author, with the help of camp comrades, was accumulated in April, May and June, 1941, in Germany.

The book conveys the subtle joy that the author experienced in this study and his appreciation of Redstart individuality. He deplores a fact that is true of many migrants—that specimens are brought back from their winter homes frequently enough, but no information on the habits of the living birds there accompanies the skins.

Full song by the male, usually from low perches, starting early in April when the bird is taking territory, is continued vigorously after the arrival of the female, especially when he is enticing her to the nest hole which is always selected by the male. As soon as the female starts building, song suddenly ceases, but is resumed when the nest is complete and reaches its peak during the incubation period. Song ceases when the young hatch, not to be resumed unless there is another nest. Some individuals mimic other species.

The cock makes several types of display. In courtship pursuits, wings and tail are spread widely, the latter depressed. In a post-coition display, he makes circular flights around the hen, uttering excited calls. All Redstarts have a peculiar mannerism of "shivering" the bright chestnut tail in a rapid up-and-down motion which the author believes has definite functions.

During courtship, to interest the female in the nest site, there are three types of enticement display, which occur in the following order of frequency: (1) Entering box or hole, flashing white frontal patch at entrance. (2) Entering box, flying out a few inches, and back in at once without alighting. Both displays are made in silence. (3) Gliding down to box from a branch, singing in flight, wings and tail spread.

Nests are built by the female in cavities between rocks, in rock walls, trees, or in nest-boxes in open areas at varying heights, and sometimes on the ground. Incubation is also done by the female and starts with the laying of the last egg. The light blue eggs, usually unmarked, hatch in 12 to 14 days. The male flies to the nest often, presumably to see if the eggs are hatched. The pair cooperates in feeding the young, which leave the nest on the 15th or 16th day and are dependent for about three weeks longer.

The Redstart is a short-lived bird; more than three-quarters die within their first year. The oldest known lived six years.

Chapter 9 is devoted to migration; Chapter 10 to history and distribution; Chapter 11 to taxonomy. These are followed by a Select Bibliography which gives page numbers of the references cited. The text of the book is not interrupted by their inclusion.

Appendices provide distributional maps and banding recoveries.

A beautiful color photograph by Eric Hosking shows a male Redstart at the nest cavity.—Amelia R. Laskey.

INDEX TO VOLUME 65, 1953

BY JANE S. MENGEL

In addition to names of species and authors, this index includes references to the following topics: banding, behavior, display, ectoparasites, food, fossils, hybrids, measurements, migration, nesting, new forms, predation, pterylosis, releasers, taxonomy, voice, and weights. Names of new forms described in this volume are in **boldface** type.

This issue of *The Wilson Bulletin* was published on April 15, 1954.

Suggestions to Authors

Manuscripts intended for publication in *The Wilson Bulletin* should be neatly typewritten, double-spaced, and on one side only of good quality white paper. Tables should be typed on separate sheets. Before preparing these, carefully consider whether the material is best presented in tabular form. Where the value of quantitative data can be enhanced by use of appropriate statistical methods, these should be used. Follow the A. O. U. Check-List (fourth edition) and supplements thereto insofar as scientific names of United States and Canadian birds are concerned unless a satisfactory explanation is offered for doing otherwise. Use species names (binomials) unless specimens have actually been handled and subspecifically identified. Summaries of major papers should be brief but quotable. Where fewer than five papers are cited, the citations may be included in the text. All citations in "General Notes" should be included in the text. Follow carefully the style used in this issue in listing the literature cited. Photographs for illustrations should be sharp, have good contrast, and be on glossy paper. Submit prints unmounted and attach to each a brief but adequate legend. Do not write heavily on the backs of photographs. Diagrams and line drawings should be in black ink and their lettering large enough to permit reduction. The Illustrations Committee will prepare drawings, following authors' directions, at a charge of $1 an hour, the money to go into the color-plate fund. Authors are requested to return proof promptly. Extensive alterations in copy after the type has been set must be charged to the author.

A Word to Members

The Wilson Bulletin is not as large as we want it to be. It will become larger as funds for publication increase. The Club loses money, and the size of the *Bulletin* is cut down accordingly, each time a member fails to pay dues and is put on the 'suspended list.' Postage is used in notifying the publisher of this suspension. More postage is used in notifying the member and urging him to pay his dues. When he does finally pay he must be reinstated on the mailing list and there is a publisher's charge for this service. The *Bulletin* will become larger if members will make a point of paying their dues promptly.

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