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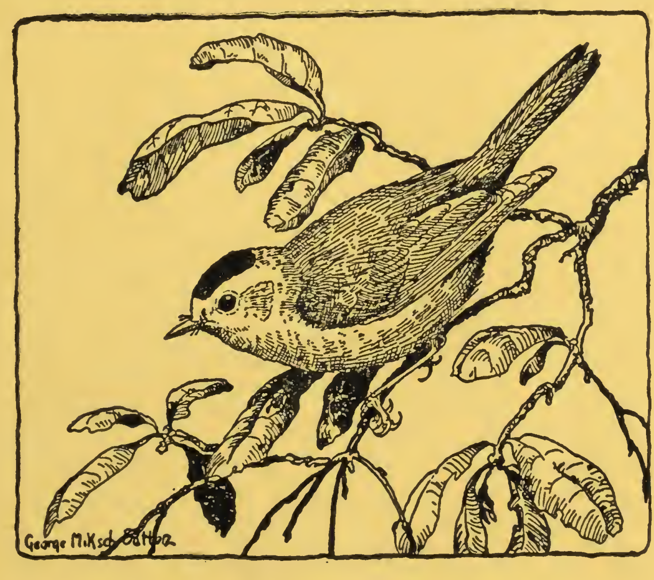

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The Wilson Bulletin

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A QUARTERLY MAGAZINE OF ORNITHOLOGY

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THE PRESIDENT'S PAGE

This copy of *The Wilson Bulletin* should reach you in March, but, publisher's deadlines being what they are, the President's Page is being written on the first day of the new year. Time and occasion make it proper that we look at what is ahead for The Wilson Ornithological Club.

Our next major event is, of course, the Thirty-second Annual Meeting at Davenport, Iowa, on April 26–29. Only once before, in 1929, has the Club met in Iowa, the meeting of that year having been in Des Moines. Not since the Minneapolis meeting of 1940 has the Club assembled on the banks of the Mississippi. This year we return to the great central river of the continent, in good time to see some of the spectacular migration along the Mississippi flyway. A full program of outstanding papers, social events, and field trips is already assured.

Plans for the 1952 meeting are well advanced. Subject to ratification by the Club, this will be in late April at Gatlinburg, Tennessee, the gateway to Great Smoky Mountains National Park. The Gatlinburg meeting should have many of the informal features which were afforded at Jackson's Mill, West Virginia, in 1950. Certainly the Club will not have met in more attractive surroundings. Chuck-will's-widows and Sycamore Warblers nest near the Park entrance. On Clingman's Dome, more than 5000 feet above Gatlinburg, is the last southeastern extension of the alpine spruce-fir forest, with its Olive-sided Flycatchers, Brown Creepers, Golden-crowned Kinglets, and Winter Wrens. Visitors will live with the unbroken sweep of Mt. Leconte, 6500 feet high, directly before them.

Once again many of our younger members are, or soon will be, in the armed services. Older Club members have the opportunity to repeat, and to expand, a service which was so much appreciated by members in service during World War II. Many a man in uniform found pleasure and profit in his free time because some bird student nearby offered guidance and transportation in acquainting him with local ornithology. If you are in a training center in this country, your officers urge that you use the Club's facilities for getting in touch with nearby field students. We will gladly give you names and addresses of members who may be in your vicinity.

During World War II it was a constant surprise, and a source of gratification, that so many members in service asked that their copies of the *Bulletin* be sent to the far corners of the earth where our forces were engaged. *The Wilson Bulletin* was a tie with home, and a symbol of more normal times and interests. Once more we offer this small service to members in uniform. No matter how often your address may change, we shall try to see that the continuity of your interest in the Club is unbroken.

The Wilson Bulletin is, of course, the Club's lifeline. The Editor is always happy to receive articles and notes of general interest, as well as attractive and scientifically significant illustrative material. For lack of funds there awaits reproduction in our pages a magnificent kodachrome by Hal H. Harrison of a Wilson's Warbler at its nest. Perhaps you would like to contribute to the publication in color of this highly appropriate subject.

In keeping with the season as this is written, your President wishes for all of you a busy and productive New Year.

Maurice Brooks

MALE HYBRID WARBLERS OF THE GENUS *VERMIVORA*
(For explanation see footnote on opposite page)
Painting by William C. Dilger

THE GENETICS OF THE GOLDEN-WINGED × BLUE-WINGED WARBLER COMPLEX

BY KENNETH C. PARKES[1]

PERHAPS the best known and most thoroughly documented case of hybridization between species of wild birds, at least in the North American avifauna, is that of the Golden-winged Warbler (*Vermivora chrysoptera*) and Blue-winged Warbler (*V. pinus*). These two species seem to hybridize more or less freely wherever their ranges overlap, producing two general hybrid types which were originally named as species: the Brewster's Warbler ("*Vermivora leucobronchialis*") and the Lawrence's Warbler ("*V. lawrencei*"). Before the hybrid nature of these two types was thoroughly established, many theories were proposed to account for the interrelationships observed. Some of these theories seem fantastic to the modern student. Early field observations and the various theories were summarized and synthesized by Faxon in two excellent monographs (1911, 1913).

The purpose of this paper is to review briefly what is known of these hybrids, to discuss a commonly accepted genetic explanation for the observed inheritance of characters, and to point out what shortcomings remain in our knowledge of their interrelationships. Original observations on the possible phenotypical detection of heterozygotes will also be presented.

The Parental Species

The Blue-winged and Golden-winged Warblers are neither strictly sympatric nor strictly allopatric. In general, the Blue-winged has the more southern breeding range, but there is a broad strip, roughly through southern New England, southern New York, New Jersey, Pennsylvania, Ohio, southern Michigan, northern Illinois and southern Minnesota, where the ranges of the two species overlap. It is in these areas, as would be expected, that the hybrids

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[1] The hybrid warblers shown in the color plate opposite are, from top to bottom:

F_1 Brewster's Warbler. Genotype WwSsPp. American Museum of Natural History specimen No. 380136. New Haven, Connecticut, May 17, 1892.

Back-cross Brewster's Warbler. Genotype WWSSPp. American Museum of Natural History specimen No. 392172. Bonilla, Costa Rica, September 27, 1920.

Lawrence's Warbler. Genotype wwsspp. American Museum of Natural History, L. C. Sanford collection No. 10846. Stratfield, Connecticut, May 19, 1917.

Heterozygous Golden-winged Warbler. Genotype WwSsPP. Chicago Natural History Museum No. 148778. New Haven, Connecticut, May 11, 1900.

Crossover-type Golden-winged Warbler. Genotype WWSspp. American Museum of Natural History No. 506277. Cumbre de Valencia, Venezuela, January 31, 1910.

Crossover-type Blue-winged Warbler. Genotype wwSsPP. American Museum of Natural History No. 380055. New Haven, Connecticut, May 17, 1893.

are found most commonly. In a number of outlying areas, either the Blue-winged or the Golden-winged is found only as an intruder, often recent, into the range of the other species. In such areas, the hybrids are quite sporadic (see Parkes, 1949, for a summary of such a situation in central and western New York). On the other hand, in certain areas where the parents are almost equally common, the hybrids are frequently observed. This is especially true of the area around southern New York, Connecticut and northern New Jersey. Most of the hybrid specimens I have examined are from this general area.

There is a small amount of ecological distinction between these two species in the areas where their ranges overlap, but the ecological preferences seem to overlap just as do the ranges. In general, the Golden-winged Warbler prefers the higher and more wooded portions of slopes, the Blue-winged the lower and more open. There is much local variation, occasionally even a reversal of the usual situation. Both species commonly live "in clearings, at the edge of the forest, and in abandoned fields, and it is probable that the hybridization is of recent date and caused by man-made habitat disturbances" (Mayr, 1942: 262). The theory of recent origin of the hybridization, whether or not assisted by man, is given added support by the fact that, although the region where the hybrids are now most frequent was one of the earliest to be studied, faunally, in the United States, the Lawrence's and Brewster's Warblers were not described until 1874. A few earlier specimens have since turned up in old collections.

The suggestion that *Vermivora chrysoptera* and *V. pinus* be considered conspecific has received little modern support, even among the most ardent of "lumping" taxonomists. The two parental types are too distinct to warrant such a step, and Mayr (*loc. cit.*) has called our attention to the fact that "hybridization has not led to a blurring of the border between the two species."

The Blue-winged and Golden-winged Warblers differ in three readily perceptible major color characters. These are (1) the ground color of the body (especially as regards the white or yellow of the underparts), (2) the presence or absence of a black throat-patch, and (3) the number and color of the wing-bars. Genetic speculation seems hitherto to have been limited to the first two of these; all three will be discussed in this paper.

Mating Behavior of Hybrids

It has long been known that the hybrids were fertile, and the literature abounds with breeding records for both the Brewster's and Lawrence's Warblers. There is an unusual phenomenon connected with the breeding of these hybrid types. In surveying published breeding records, one inevitably reaches the conclusion that the hybrids do not breed *inter se*, but only back-cross with birds that are at least phenotypically (that is, of the external appearance) of one of the parental types. Several authors have remarked upon the absence of records of hybrid-hybrid matings (Faxon, 1911: 71–73). I have been able to locate but two published references to matings in which both of the parents are stated to have been hybrids. Sutton (1928: 206) recorded a nest found on June 6, 1922, near Hartstown, Pennsylvania, containing three heavily incubated eggs and two young birds. The supposed parent birds were taken, and were mailed to Sutton in the flesh by the collector, John G. Thomas. Both were of the Brewster's Warbler type. The male had an immaculately white breast, while the underparts of the female were strongly washed with yellow. Unfortunately these specimens were not preserved.

Hicks (1929: 44) recorded "a pair of typical Brewster's Warblers feeding young" in Hocking County, Ohio, on June 11–12, 1927. In his later list of Ohio birds (1935: 168), he modified this statement to read "Two Brewster's Warblers, *apparently* mated and feeding young . . ." (italics mine). Further data on this brood would undoubtedly have been gathered by Hicks had he realized the unique nature of the observation.

These appear to be the only recorded matings between hybrid warblers. While neither record is conclusive, each tends to weaken the concept that hybrids mate in back-crosses *only*. On the basis of presently available data, there certainly seems to be a marked *tendency* toward back-crosses. It must be acknowledged that over much of the range of the hybrids, availability of mates is the primary factor. In a region such as central New York, where the Golden-winged is the dominant species and the Blue-winged of purely fortuitous occurrence, a hybrid would be limited to Golden-winged Warblers in its choice of mates. However, in a well-studied area such as the lower Hudson Valley, where the hybrids are of regular occurrence (it has been said that they may occasionally outnumber the parental species locally), it would seem that hybrid-hybrid matings would have been recorded if no preferential factor or other reproductive barrier were in operation.

The best recent summary of extensive field observations of these warblers is that of Carter (1944). His studies would seem to indicate the presence of some preferential factor in mating, at least in this particular study area. A banded individual male Brewster's Warbler was observed for six successive years, and his mate and nest found in five of these years. Each year he mated with a female Golden-winged Warbler. Carter and his co-workers were of the opinion, based on banding and individual variation, that the female was a different individual each year. That female warblers other than Golden-winged were available as mates is indicated by the fact that in this small (about four acres) area in Passaic County, New Jersey, during this six-year study, observations were made of the following: a male Lawrence's x female Golden-winged nesting, a male Blue-winged x female Golden-winged nesting, four additional Brewster's Warblers, and two additional Lawrence's Warblers. Young birds were raised successfully in all of the nestings observed, and certain birds banded as nestlings returned to the same area in subsequent years. Phenotypically, some of these young birds were certainly hybrids. Therefore there would seem to have been in the neighborhood an ample supply of hybrid birds from which the male Brewster's Warbler might have selected a mate. He did not do so, however, nor were any of the other hybrids in the study area known to have taken hybrid mates.

Although Carter's observations are, to my knowledge, the only published records showing the mating behavior of an individual hybrid *Vermivora* over a number of years, there are a number of instances from within single breeding seasons which support the thesis that hybrids do not mate with hybrids even when such mates are available. Faxon, for instance, described (1913: 311) the situation in 1910 in a swamp near Lexington, Massachusetts. The *Vermivora* population here consisted of a mated pair of Golden-winged Warblers; two female Brewster's Warblers, each mated to a male Golden-winged; and a male Brewster's Warbler which remained unmated throughout the season. (It is, of course, impossible to say *why* the male Brewster's Warbler was not paired with one of the female hybrids.) Since there were four male warblers and only three females in the area, one of the males must obviously have been forced to remain unmated. Possibly chance dictated that the unmated male should be the Brewster's; however, observations of situations of this sort are frequent enough to warrant the discounting of chance as the only factor involved.

It has been suggested that hybrid males may remain unmated because of a low adaptability in competing for mates. Male Brewster's Warblers are, however, frequently found mated to female Golden-winged Warblers in Golden-winged country where plenty of male Golden-winged competition exists.

Genetics of the Throat-patch

One of the major color differences between the Blue-winged and Golden-winged Warblers is the black throat-patch of the latter. Correlated with the presence of this patch is the broadening of the black transocular line of *pinus* into a black mask extending to the ear coverts in *chrysoptera*. This transocular mask I shall discuss later in this paper. The presence or absence of the throat-patch is believed to result from the action of a single gene.

The first use of letter symbols for the characters involved in these crosses seems to have been that of Nichols (1908). His notation has been employed by Faxon (1911: 73) and more recently by Pough (1946: 153). For the sake of convenience, therefore, Nichols' symbols will be used in the remainder of this paper. According to this notation, the allele for the dominant plain throat of the Blue-winged Warbler is assigned the symbol P. The black-throated condition, therefore, is represented by p. A homozygous ("pure" of many early authors) Blue-winged Warbler would carry the genes PP, and a homozygous Golden-winged Warbler pp. The first generation (F_1) hybrid, receiving a gene from either parent, would have the heterozygous ("impure") genotype Pp. As P is dominant over p, this hybrid would have a plain throat.

Genetics of Underparts Color

The diagram given by Pough (*loc. cit.*) ascribes the presence or absence of the throat-patch and the white or yellow of the underparts to the action, respectively, of two single genes. In the case of throat-patch inheritance, this seems to be correct. Inheritance of underparts color, however, does not involve simple presence- or absence-characters such as those determining color of the throat-patch, as will be seen later. For purposes of preliminary explanation let us assume a single gene to control underparts color, of which the allele W (white) is dominant over the allele w (yellow). Thus the homozygous Golden-winged Warbler would have the genotype WWpp, since it has white underparts and a black throat-patch. Similarly, the Blue-winged Warbler, having yellow underparts and a plain throat, would have the genotype wwPP. The F_1 hybrid would have the genotype WwPp, the new combination of dominants thus giving us a white-breasted, plain-throated bird. This is obviously the hybrid type known as Brewster's Warbler.

The Origin of Lawrence's Warbler

Pough's diagram illustrates the theoretical Mendelian ratio in the F_2 generation resulting from crossing two F_1 Brewster's Warblers. Phenotypically, the expected ratio in the offspring of such crosses would be 9 Brewster's to 3 Golden-winged to 3 Blue-winged to 1 homozygous recessive (wwpp) bird. This last type would have yellow underparts and a black throat-patch: in other words, be a Lawrence's Warbler.

We have seen earlier that the Brewster's x Brewster's cross illustrated by Pough represents the exception in nature. I therefore undertook to compute the various means by which the double recessive, Lawrence's Warbler, might be recovered by crossing hybrids with birds of one or the other parental phenotype. There are a number of possible crosses by which this might be accomplished. In all cases it must be assumed that one or both parents, although phenotypically of one of the parental types, is actually heterozygous for one of the two characters here considered. The theoretical proportion of Lawrence's Warblers in the offspring of various crosses is shown below.

WwPp (F_1 Brew.) x wwPp (hetero. Blue-wing) WwPp (F_1 Brew.) x Wwpp (hetero. Golden-wing)	12.5% Lawrence's
Wwpp (hetero. Gold.-w.) x Wwpp (same) wwPp (hetero. Blue-w.) x wwPp (same) Wwpp (hetero. Gold.-w.) x wwPp (hetero. Blue-wing)	25% Lawrence's
wwpp (Lawrence) x Wwpp (hetero. Golden-wing) wwpp (Lawrence) x wwPp (hetero. Blue-wing)	50% Lawrence's

The relative frequencies in nature of the Brewster's and Lawrence's Warblers support the hypothesis that the latter hybrid represents the homozygous recessive. In the hybridization zone as a whole, the Lawrence's is much less common, although field observations in a limited area of heavy interbreeding may occasionally seem to reverse this proportion. In many localities, only the Brewster's hybrid has thus far been recorded. In the Buffalo, New York, region, for example, a small isolated population of Blue-winged Warblers and a larger population of Golden-winged Warblers have co-existed for many years. There have been a number of records of Brewster's Warbler from year to year, culminating in several breeding records in the past few years. With the subsequent recombination of characters, the appearance in this area of the double recessive Lawrence's Warbler was to be anticipated. This anticipation was realized in the spring of 1949, when the first Lawrence's Warbler was seen in the region.

What is the "Typical" Brewster's Warbler?

Throughout the ornithological literature one finds references to the "typical" Brewster's Warbler. Inevitably this adjective is applied to those Brewster's Warblers whose underparts are immaculately white, without a trace of yellow (Faxon, 1911: 58; Forbush, 1929: 214; Chapman, 1932: 449; Todd, 1940: 495; Peterson, 1947: 188; etc.). The specific epithet "*leucobronchialis*" may in part be responsible for this concept of a white-breasted bird as the 'typical' Brewster's Warbler. In the manuals mention is usually made of the variation in the color of the underparts, as a large proportion of the individuals, instead of being immaculately white beneath, are quite yellowish. Usually this 'variation' is dismissed by calling such birds "individual variants", "intermediates", or "intergrades" with *Vermivora pinus*, or by employing the obsolete genetical term "blending inheritance." With the possibility in mind of finding a genetic theory to account for these yellowish-breasted individuals, I examined 46 specimens of Brewster's Warbler (as well as specimens of the other pertinent forms of *Vermivora*) in the collections of the Chicago Natural History Museum, the American Museum of Natural History, the University of Michigan Museum of Zoology, and the Fuertes Memorial Collection at Cornell University.

It is my belief that the allele W for white underparts is incompletely dominant over the allele w for yellow. Birds which are heterozygous (Ww) for underparts color, therefore, are *basically* white but actually partially yellow. All F_1 Brewster's Warblers resulting from the mating of homozygous Blue-winged (ww) and Golden-winged (WW) parents are of this heterozygous type, the complete genotype of which is WwPp. This genotype may also be recovered in the offspring of a number of other crosses.

According to this theory, Brewster's Warblers with immaculate white underparts must be homozygous for this character, and thus have the genotype WWPp. One cross by which such a genotype may be obtained is that of an F_1

Brewster's Warbler (WwPp) and a homozygous Golden-winged Warbler (WWpp). As we have seen earlier, this is a frequently observed mating in regions of hybridization. One fourth of the offspring of such a cross would be expected to be of the homozygous white-breasted Brewster's type (WWPp). One fourth would be heterozygous yellowish-breasted Brewster's similar to the F_1 (WwPp). One fourth would be homozygous Golden-winged Warblers like the parent (WWpp), and one fourth would be heterozygous Golden-winged Warblers (Wwpp).

Plotting the expected offspring of all possible crosses, and bearing in mind that the initial interspecific cross would be expected to occur most frequently (in the range of the birds as a whole), we find that the yellowish-breasted individuals should outnumber the white-breasted ones by a substantial margin. This is supported by published field observations, and by museum specimens examined, of which 9 were white-breasted and 37 more or less yellow-breasted.

It follows, therefore, that the typical Brewster's Warbler, if by "typical" we mean the first generation offspring of a Blue-winged and a Golden-winged Warbler, has underparts with a definite yellowish tinge. The white-breasted form represents the offspring of a later cross, usually between an F_1 Brewster's and a Golden-winged Warbler.

The Heterozygous Parental Types

If, as postulated above, the allele W for white underparts is incompletely dominant, we should be able to detect the heterozygous (Wwpp) Golden-winged Warblers, for we would expect their underparts below the throat-patch to have a yellowish tinge. In a given museum series of Golden-winged Warblers, only a small number of such individuals would be expected, for two reasons: (1) most specimens usually come from within that part of the range of the species where no opportunity for hybridization exists, and (2) such heterozygotes cannot appear until the second or later hybrid generations. However, at least seven specimens examined fall readily into this category (reference specimens: ♂ CNHM 148778, 148785. ♀ CNHM 148779, AMNH 55041). Carter (1944) mentioned field observations of several individuals of this type in his study area of heavy hybridization. It should be mentioned here that in the normal first winter plumage of *Vermivora chrysoptera* the white underparts are often washed with yellow. However, as will be shown later, these birds can usually be separated from the heterozygotes by the condition of the wing-bars. Spring specimens showing yellow on the underparts are almost certainly heterozygotes.

The genotype of a heterozygous Blue-winged Warbler would be wwPp. Since the allele P for plain throat is believed to be completely dominant over p, it follows that the heterozygous Blue-wings would be externally indistinguishable from the homozygotes. I have never examined nor heard of a specimen of

Brewster's Warbler or Blue-winged Warbler with a faint or partial throat-patch, as might possibly be expected in those individuals heterozygous for the throat-patch character. Specimens of Golden-winged and Lawrence's Warblers in which the throat-patch does not extend as far as the chin represent, not heterozygotes for the throat-patch character, but (according to Dwight, 1900:247) first-year birds. Faxon's field observations of young birds (1911: 66) confirm this point.

The Wing-bars

There is a correlation, hitherto apparently unrecorded, between the color of the underparts and the color of the wing-bars, a correlation which leads me to believe that these two characters are probably rather closely linked in a genetical sense: that the genes determining them are on the same chromosome. The pure white condition of the underparts seems to be linked with the single, broad, pure yellow wing-bar of the Golden-winged Warbler. Yellow underparts, similarly, are linked with the two white wing-bars of the Blue-winged Warbler. Brewster's Warblers with yellowish on the underparts show a definite tendency toward the latter type of wing-bars. Apparently the gene for wing-bars is not only linked with that for underparts color, but exhibits the same sort of behavior in inheritance in that one allele is incompletely dominant over the other. I shall designate the dominant allele for single yellow wing-bar as S; the allele for double white wing-bar is therefore s. Just as the underparts color allele W is incompletely dominant over w, so S is incompletely dominant over s. The F_1 Brewster's Warbler, with the heterozygous wing-bar genotype Ss, has wing-bars intermediate between those of the parent species. This intermediacy is usually manifested by doubleness and whiteness of wing-bar, but the distinctly yellow tips and edges of the white areas of the feathers involved create the gross appearance of two pale yellow wing-bars. Since I have postulated that underparts color and wing-bar color are linked, a bird which is heterozygous for one of these characters would also be heterozygous for the other. It would be expected, therefore, that the heterozygous Golden-winged Warblers described earlier would have intermediate wing-bars, and such is indeed the case.

The wing-bars of the Blue-winged Warbler, being linked with the recessive yellow underparts, should theoretically be consistent. Occasionally, however, a specimen of this species is found to have yellowish wing-bars (reference specimen AMNH 95449). There is a simple genetic explanation for this. Such a bird may have had as one parent a Brewster's Warbler in whose underparts and wing-bar chromosome a crossover had taken place. If the other parent had been a normal Blue-winged Warbler, the result would have been a bird with the total genotype wwSsPP: in other words, a Blue-winged Warbler with intermediate wing-bars as described above.

Such a crossover can also readily account for other very rare combinations which may appear. AMNH 506277, for example, is a typical male Golden-winged Warbler except that its wing-bars are of the intermediate type. Such a bird could be the offspring of a crossover Brewster's Warbler (like that described above) and a normal Golden-winged Warbler, and would have the genotype WWSspp.

Obviously only a small proportion of all Blue-winged or Golden-winged Warblers is of mixed ancestry, so the proportion of individuals with intermediate wing-bars in a series of either parent from all over the range of the species is small. On the other hand, *all* Lawrence's Warblers are obviously of mixed descent, so that a higher proportion of crossover types should be found in a series of these hybrids. My observations confirm this: of 17 Lawrence's Warblers examined, 13 had the normally expected Blue-winged Warbler type of wing-bar, and 4 were intermediate, indicating a crossover parent (or earlier ancestor).

Genetic Problems for Future Study

Although I believe the genetic theories outlined in this paper to be basically correct, some of them are admittedly oversimple. This is especially true of that concerning the inheritance of white versus yellow underparts. The *presence* or *absence* of yellow seems to follow the pattern of inheritance described quite closely. As yet, however, no hypothesis has been worked out to account for the great variation which exists in the *extent* of this yellow, both in Brewster's Warblers and in heterozygous Golden-winged Warblers (of which CNHM 148778 probably represents the extreme development). This is probably a matter of quantitative inheritance based on the interaction of several genes, the exact number of which will perhaps never be known.

Another variation of which the genetic basis is uncertain is that of the transocular black line. In occasional specimens of Brewster's Warbler (reference specimen UMMZ 73519) this normally thin line is expanded until it approaches the width of the black auricular patch normally present in the Golden-winged Warbler. Another case of linkage may be involved here, with one gene controlling the presence or absence of the throat-patch and the other the presence or absence of the transocular line enlargement. Brewster's and Blue-winged Warblers with expanded black transocular lines are so rare, however, that linkage must be particularly close, and crossovers consequently highly infrequent.

Correlation Between Genetic Theory and Field Work

There is great need for intensive field work in areas of heavy hybridization. Parent birds and their offspring should be color-banded and followed through successive seasons. Very few cases in which the parentage of a hybrid brood was unequivocally known and the brood followed through the post-juvenal molt have been reported. The correlation between juvenal and later plumages is poorly known, and my own experience (Parkes, 1949) as well as that of Faxon (1911, 1913) and Nichols (in Carter, 1944) indicates that accurate prediction as to the type of plumage into which a given juvenal will molt is probably impossible.

The few cases of young birds of known parentage which have come to my attention all fit the basic genetic theories outlined in this paper. Faxon's 1911 paper summarized all such cases reported to that date, and his interpretations were essentially correct in the light of what was known at that time. He quoted one case (p. 69) reported by Beebe (1904) in which a male *lawrencei* was mated with a female *pinus*. All six of the offspring were described by Beebe as being typical *pinus*. Faxon could not understand why these young birds were identified as *pinus* rather than *lawrencei*. Beebe was correct, however, as according to the theories outlined here, the offspring of a mating between *lawrencei* and homozygous *pinus* should be phenotypically 100% *pinus*.

Summary

The Blue-winged Warbler (*Vermivora pinus*) and the Golden-winged Warbler (*V. chrysoptera*) hybridize over an extensive area of eastern North America where their respective ranges overlap, producing two general hybrid types. The commoner, Brewster's Warbler, is considered to be the F_1 offspring of the original interspecific cross. The rarer, Lawrence's Warbler, is considered to represent the combination of recessive characters. Two records are cited of supposed matings between Brewster's Warblers, but evidence is presented to indicate that back-crosses to a parental phenotype are the rule, and hybrid-hybrid crosses a rare exception, even when opportunity for such matings is present. The modes of inheritance for the throat and underparts colors are presented. The rare Lawrence's Warbler (recessive) type may be recovered by a number of possible crosses other than inter-hybrid matings.

Brewster's Warblers with yellowish underparts are considered to be mostly F_1 hybrids (plus the offspring of certain later crosses), while those with white underparts are back-crosses to the Golden-winged parent species. The allele for white underparts is considered incompletely dominant over that for yellow underparts. Heterozygous Golden-winged Warblers may be detected by this means. Chromosomal linkage is postulated for the genes determining underparts color and wing-bar type. Occasional variants from the expected character combinations are ascribed to a simple crossover. Other problems in the genetics of these birds are indicated, and the importance of field work in their study is emphasized.

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FOOD OF YOUNG RAPTORS ON THE EDWIN S. GEORGE RESERVE

BY F. N. HAMERSTROM, JR. AND FRANCES HAMERSTROM

DURING the nesting seasons of 1941, 1942, and 1946 we studied the food of several young Cooper's Hawks (*Accipiter cooperii*) following Errington's (1932) method of squeezing stored food from the gullet. Our work began while the birds were still in the nest. We continued it by tethering the hawks on the ground during a period in which they would normally have been flying. We attached a jess to each tarsus, fastening the two jesses with swivels to one short chain, thus obviating trouble with broken legs. In 1946 we studied also the food of two young Red-tailed Hawks (*Buteo jamaicensis*) and one young Barred Owl (*Strix varia*), again tethering the birds on the ground.

We did this work on the Edwin S. George Reserve, a tract of about 1300 acres of former farm land in southwestern Livingston County, Michigan. It is owned by the University of Michigan and administered by the Museum of Zoology as a field study area. The terrain is rough and morainic. Present cover types are about as follows: "26 per cent mixed hardwoods (mainly *Quercus-Carya*), 11 per cent tamarack (*Larix laricina*) swamp, 6 per cent brush, largely around the margins of swamps and bogs, 4 per cent bog, 7 per cent marsh, and 46 per cent grassland" (O'Roke and Hamerstrom, 1948).

The area ordinarily supports from three to six breeding pairs of raptors including, in varying combinations, the following: Turkey Vulture (*Cathartes aura*), Cooper's Hawk, Red-tailed Hawk, Marsh Hawk (*Circus cyaneus*), Great Horned Owl (*Bubo virginianus*), Barred Owl, and Long-eared Owl (*Asio otus*). Some of these—notably the Turkey Vulture and Long-eared Owl—have nested much less often than the others. The Cooper's Hawk is one of the most regular nesters. Our data concerning this species we obtained from four broods—two in 1941, one in 1942, and one in 1946. Two of the nests (Nos. 1 and 3) were found by Dr. Arthur E. Staebler.

The general plan was to visit the nests or tethered young once or twice daily. When we could identify the gullet contents on the spot, we returned the food at once. In most cases, however, we had to take diagnostic portions to the Museum of Zoology for comparison with reference collections there. Several members of the staff helped with the more difficult identifications, especially Drs. Pierce Brodkorb, George M. Sutton, Josselyn Van Tyne, William H. Burt, and Emmet T. Hooper. We found additional evidence of what the hawks were eating in such debris as bones and feathers, and in items of prey which had not been eaten. Most of the nest-trees were easy to climb, but one (Nest 2) required a little engineering since we did not want to scuff the bark by daily use of climb-

FIG. 1. Young Cooper's Hawk tethered on ground near nest. Photographed at the Edwin S. George Reserve, near Pinckney, Michigan, on July 15, 1946, by Alfred E. Brandt and George M. Sutton.

ing irons. When the four nestlings were about two weeks old we fastened a shallow basket, about 18 inches in diameter, to a rope which passed through a pulley high in the tree. The pulley was hung from a coil spring to keep the rope from breaking when the trees swayed in the wind, and to keep enough tension on the rope to prevent the basket from swinging. We transferred the nestlings to the basket, which was suspended about 10 feet below the nest, and knocked the nest from the tree. The adults accepted the new "nest" immediately and even decorated it with a few juniper twigs. With this apparatus we could bring the young to the ground whenever we wished.

When the young were about ready to become "branchers"—i.e., to climb about the nest-tree—we tethered them on the ground until the adults began to lose interest in feeding them. When the young received so little from the parents that further study was not worth-while, we turned them loose. One free-flying brood we helped to feed for several days while they became accustomed to their new way of life.

We were unable to identify most of the food items which we took from the gullets of the nestlings during the first 10 days or so of their lives, as the material consisted for the most part of small scraps of meat with little or no fur, feathers, or bone attached. After they began to eat larger pieces of prey it became progressively easier to identify the food. Over the three seasons we examined the broods of young hawks a total of 189 times. We found no newly-brought-in items of prey on 25 of these visits. The food recovered from the young (gullet contents, debris, and uneaten prey) was as follows:

Nest 1, *June 10–July 24, 1941.* Birds: Ruffed Grouse (*Bonasa umbellus*), 1 ad.; Bob-white (*Colinus virginianus*) (?), 1 imm.; Ring-necked Pheasant (*Phasianus colchicus*), 8 imm.; Killdeer (*Charadrius vociferus*), 1 age ?; Mourning Dove (*Zenaidura macroura*), 3 ad., 2 imm., 3 nestl.; Yellow-billed Cuckoo (*Coccyzus americanus*), 1 ad.; Flicker (*Colaptes auratus*), 2 imm., 1 age ?; Hairy Woodpecker (*Dendrocopos villosus*), 1 ad.; Downy Woodpecker (*Dendrocopos pubescens*), 2 imm.; Phoebe (*Sayornis phoebe*) (?), 1 age ?; Bank Swallow (*Riparia riparia*), 1 imm.; Blue Jay (*Cyanocitta cristata*), 2 ad., 3 imm., 2 nestl., 1 age ?; White-breasted Nuthatch (*Sitta carolinensis*), 1 age ?; White-breasted Nuthatch (?), 1 age ?; Robin (*Turdus migratorius*), 8 imm.; Cedar Waxwing (*Bombycilla cedrorum*), 1 imm., 1 age ?; Starling (*Sturnus vulgaris*), 1 ad., 6 imm., 1 age ?; Starling (?), 2 age ?; English Sparrow (*Passer domesticus*), 4 ad., 4 imm., 4 age ?; English Sparrow (?), 1 imm., 1 age ?; Red-wing (*Agelaius phoeniceus*), 1 ad., 2 imm., 3 age ?; Baltimore Oriole (*Icterus galbula*), 2 ad., 1 age ?; Grackle (*Quiscalus quiscula*), 1 imm.; Cowbird (*Molothrus ater*), 2 imm.; Vesper Sparrow (*Pooecetes gramineus*), 2 age ?; Vesper Sparrow (?), 1 age ?; unidentified birds, 3 imm., 2 nestl., 4 age ?. Total Birds: 16 ad., 47 imm., 7 nestl., 26 age ?.

Mammals: Eastern Chipmunk (*Tamias striatus*), 2 ad., 2 imm., 4 age ?; Red Squirrel (*Tamiasciurus hudsonicus*), 1 age ?; Gray Squirrel (*Sciurus carolinensis*), 1 imm., 1 age ?. Total Mammals: 2 ad., 3 imm., 6 age ?.

Nest 2, *June 8–24, 1941.* Birds: Ruffed Grouse, 2 imm.; Ring-necked Pheasant, 3 imm.; Mourning Dove (?), 1 nestl.; Yellow-billed Cuckoo, 1 ad.; Screech Owl (*Otus asio*), 1 ad.; Flicker, 3 ad., 2 imm., 2 age ?; Purple Martin (*Progne subis*), 1 ad.; Blue Jay, 1 ad., 2 imm., 3 nestl., 1 age ?; Catbird (*Dumetella carolinensis*), 1 imm., 1 age ?; Robin, 1 imm.; Robin (?), 1 age ?; Cedar Waxwing, 1 imm.; Cedar Waxwing (?), 1 imm., 1 nestl.; Starling, 2 imm.; English Sparrow, 1 ad., 3 imm., 4 age ?; Red-wing, 2 ad., 2 imm., 1 age ?; Baltimore Oriole, 1 imm., 1 age ?; Cowbird, 1 imm.; Scarlet Tanager (*Piranga olivacea*), 2 age ?; Cardinal

(*Richmondena cardinalis*), 1 imm.; Towhee (*Pipilo erythrophthalmus*), 1 ad.; unidentified birds, 2 ad., 2 imm., 6 age ?. Total Birds: 13 ad., 25 imm., 5 nestl., 19 age ?.

Mammals: Striped Ground Squirrel (*Citellus tridecemlineatus*), 1 imm.; Eastern Chipmunk, 9 age ?; Red Squirrel, 1 imm.; Fox Squirrel (*Sciurus niger*), 1 imm.; Southern Flying Squirrel (*Glaucomys volans*), 1 imm.; Cottontail (*Sylvilagus floridanus*), 1 imm.; unidentified sciurid, 1 imm. Total Mammals: 6 imm., 9 age ?.

Nest 3, *June 23–July 2, 1942.* Birds: Ruffed Grouse, 1 ad.; Ring-necked Pheasant, 1 ad.; Mourning Dove, 1 ad., 2 imm.; Flicker, 1 imm.; Hairy Woodpecker, 1 ad.; Eastern Kingbird (*Tyrannus tyrannus*), 1 imm.; Cedar Waxwing, 1 imm.; Starling, 1 ad., 1 imm.; English Sparrow, 1 imm., 3 age ?; Red-wing, 2 imm., 1 age ?; Baltimore Oriole, 2 age ?; unidentified birds, 2 age ?. Total Birds: 5 ad., 9 imm., 8 age ?.

Mammals: Striped Ground Squirrel, 1 age ?; Eastern Chipmunk, 2 age ?; Bog Lemming (*Synaptomys cooperi*), 1 age ?; Meadow Jumping Mouse (*Zapus hudsonius*), 1 age ?. Total Mammals: 5 age ?.

Nest 4, *June 14–July 19, 1946.* Birds: Flicker, 3 imm., 1 age ?; Hairy Woodpecker, 1 age ?; Blue Jay, 1 imm.; Catbird, 1 imm.; Robin, 1 age ?; Robin (?), 1 imm.; Wood Thrush (*Hylocichla mustelina*) (?), 1 nestl.; Cedar Waxwing, 1 age ?; Starling, 4 imm.; Yellow-throated Vireo (*Vireo flavifrons*), 1 ad.; English Sparrow, 1 ad.; English Sparrow (?), 1 age ?; Meadowlark (*Sturnella magna*), 1 ad., 2 imm., 1 age ?; Red-wing, 1 ad., 2 imm., 2 age ?; Red-wing (?), 1 imm.; Baltimore Oriole, 2 imm.; Cowbird, 1 imm.; Scarlet Tanager, 1 ad.; Cardinal, 1 imm.; Vesper Sparrow (?), 1 imm.; Song Sparrow (*Melospiza melodia*), 1 imm.; unidentified birds, 1 imm., 5 age ?. Total Birds: 5 ad., 22 imm., 1 nestl., 13 age ?.

Mammals: Prairie Mole (*Scalopus aquaticus*), 1 age ?; Eastern Chipmunk, 1 ad., 2 imm., 2 age ?; unidentified sciurids, 3 age ?; unidentified mouse, 1 age ?. Total Mammals: 1 ad., 2 imm., 7 age ?.

Near three of the nests there were one or two "plucking trees" in which the adult hawks repeatedly dressed out their kills. Since we do not know how much of this prey they ate themselves and how much they fed to the young, we have not included any of it in the food list above. Many prey species occurred both in the food recovered from the young hawks and in the debris under plucking trees. In some cases we could be sure that these represented different individuals because they appeared at different times. There were three bird species that we found only among the plucking tree debris, never among the foods of the young hawks. Altogether, there were at least 21 plucking tree items representing kills not listed above. These items were (where age is not stated, it is not known): Ruffed Grouse, 1; Mourning Dove, 2 ad.; Flicker, 1 ad.; Purple Martin, 1; Tufted Titmouse (*Parus bicolor*), 1; Catbird, 1; Brown Thrasher (*Toxostoma rufum*), 1; Starling, 2 imm.; English Sparrow, 1 imm. and 1 age ?; Baltimore Oriole, 1; Cowbird, 2 ad.; Scarlet Tanager, 1 ad. male; Rose-breasted Grosbeak (*Pheucticus ludovicianus*), 2 imm.; Towhee, 1 ad. male; and Cottontail, 2 imm.

Of the 262 individual prey items among the foods of the young hawks, 84.4 per cent were small to medium-sized birds, and 15.6 per cent were small mammals. The largest items of prey were these: Ring-necked Pheasant, 1 ad. female; Ruffed Grouse, 2 ad.; Fox Squirrel, 1 imm.; and Cottontail, 1 imm. (and 2 more among the plucking tree debris).

In general, the food list is much the same as that which has been found in other studies elsewhere (see, for example, Fisher, 1893; Hausman, 1928; Snyder, 1932; Errington, 1933; McAtee, 1935; May, 1935; Edge and Lumley, 1940; and McDowell, 1941). A conspicuous difference between our study and those of others is that we found no domestic poultry or pigeons. Insects, amphibians, and reptiles in small numbers have been reported in other studies, and in one unusual instance (Fitch *et al.*, 1946) lizards formed the greater part of the diet. We found only birds and mammals. It is possible that certain kinds of prey, or certain size classes, were not brought to the nestlings. This is another reason for listing the plucking tree material separately. Segregating the data in this way should make possible a more precise comparison of different studies.

Although predation often falls heavily upon the immature, our food list does not show such a trend. Of 155 birds whose age we could determine, 25.1 per cent were adults, while 74.9 per cent were immatures. At least 8.4 per cent were nestlings. On the basis of 14 of the mammals, a similar age ratio occurred: adults, 21.4 per cent; immatures, 78.6 per cent. These immature:adult ratios are about what one would expect to find in prey populations at this time of year.

Nine bird species and one mammal species make up 73.7 per cent of the 213 completely identified items in the food list, although the total list is composed of 30 to 33 species of birds and 10 of mammals. In order of their occurrence as prey, the 10 species fed most often to the young hawks were: English Sparrow, Chipmunk, Red-wing, Starling, Blue Jay, Flicker, Ring-necked Pheasant, Mourning Dove, Robin, and Baltimore Oriole. Six of these were found at all four nests: English Sparrow, Chipmunk, Red-wing, Starling, Flicker, and oriole. Probably others would have been added to these six if Nest 3 had been under observation for a longer time.

At the three nests with the longest span of data (1, 2, and 4), most of the 10 major prey species were taken essentially throughout the period of most intensive study, i.e., the last half of June through all but the last week of July. Up to July 1, the species which were taken in greatest numbers at these three nests were the Chipmunk (12), Red-wing (7 + 1?), English Sparrow (7), Starling (5), Blue Jay (5), and Flicker (5). These were the most abundant species in the totals for the whole period. All of them except the Chipmunk were taken in even greater numbers in July, although no Blue Jays were found after July 14, no Flickers after July 18, and only one Red-wing after July 15. Two species, however, were distinctly more characteristic of July than of the whole period: (a) the 11 immature Pheasants were all taken between July 7 and 22 (the one adult hen, at Nest 3, on June 26); and (b) all of the Mourning Doves except one (plus 1?) were taken in July. Robins were taken somewhat more often in July than in June (7 + 1? vs. 3 + 1?), but this difference is not necessarily significant. Orioles, at the bottom of the list of the 10 most commonly eaten species, were scattered about equally through June and July.

The order of abundance of the prey species poses something of a problem, especially in the case of the birds. With the exception of the Red-wing, not one of the nine bird species most heavily preyed upon was among the most common breeders on the Reserve proper. The English Sparrow, Starling, and Pheasant were actually among the least common, while the Blue Jay, Flicker, dove, Robin, and oriole were no more than moderately common.

Conversely, the most abundant breeding species were not represented among the food items in numbers at all proportional to their occurrence. Dr. George Miksch Sutton, who has been studying the nesting birds of the Reserve for many years, has been kind enough to list for us the ten breeding species which he found to be commonest in the 1941–46 period. The first four are arranged in descending order, with the most common listed first; the rest are, he believes, certainly among the first ten, although they may not be listed in precisely their order of abundance: Field Sparrow (*Spizella pusilla*), Wood Pewee (*Contopus virens*), Goldfinch (*Spinus tristis*), Song Sparrow (*Melospiza melodia*), Red-wing, Yellow-throat (*Geothlypis trichas*), Oven-bird (*Seiurus aurocapillus*), Yellow-throated Vireo, Indigo Bunting (*Passerina cyanea*), and Least Flycatcher (*Empidonax minimus*). Of these, only the Red-wing was among the first ten food-species of the young hawks, and although it held second place among birds on the food list, it ranked no higher than fifth in order of abundance in the summer bird population. Only one other of the commonest summer residents—a single Yellow-throated Vireo—occurs on the food list at all. Most of the commonest summer birds were rather small, perhaps too small to be worth while to a Cooper's Hawk at all, or too small to be worth taking back to the nest—but a few were at least as large as the English Sparrow. All of them occurred in the kinds of habitat in which one or another of the major prey items were found.

The very fact that English Sparrows and Starlings were so large a part of the food total is plain evidence that these hawks did not confine their hunting to the Reserve. Both species lived in numbers around the farm buildings and cultivated lands *outside the boundary fence.* The closest places at which English Sparrows could be found in numbers were: from Nests 1 and 3, slightly over a half mile—immediately outside the fence; from Nests 2 and 4, about three quarters of a mile—a half mile beyond the fence, across pasture and cultivated land. Starlings were abundant at the English Sparrow concentrations nearest to Nests 1 and 3. In the case of Nests 2 and 4, Starlings were closer than the English Sparrows by almost half a mile. Only at Nest 4, however, does the Starling figure more prominently than the English Sparrow as an item of prey. At this nest only one English Sparrow was recorded (2.4 per cent of all birds recovered).

Both Uttendörfer (1939) and Tinbergen (1946) have commented upon a similar disproportionate occurrence of certain kinds of prey in the food of the closely related European Sparrow Hawk (*Accipiter nisus*). Both of these authors emphasize the fact that *Accipiter nisus* hunts certain types of habitat more often than others, rather than all types at random. Uttendörfer points out that in Germany the Sparrow Hawk seldom hunts in the vicinity of its nest, but flies out some little distance instead. Tinbergen says that it hunts especially often those places in which prey species are most abundant. In Holland these places are most often around villages and cultivated fields, but when—as seldom happens—a woodland has a high population of small birds, the Sparrow Hawk hunts there more often than is usual in that type. Both authors make clear that this habit of hunting certain habitats or localities plays a large part in determining what species are caught. Uttendörfer further believes that some Sparrow Hawks show a preference for certain species of prey. Tinbergen (1946: 194), however, says: "But it is not necessary that there is a preference for the species as such. On the contrary, it is probable that a comparison of the food with the faunae of those places that are hunted over (so not of the whole domain) would show that the different species are represented proportionally." He points out that captures are not *strictly* proportional to abundance, for some species are more easily caught than others. He cites the House Sparrow (*Passer domesticus*) as one of the more vulnerable species. It is not only especially abundant in the habitat in which the Sparrow Hawk does most of its hunting, but it is also especially liable to be caught "as it often leaves cover, as it is always busily moving about and probably as it lives socially throughout the year" (p. 203). Birds which are especially conspicuous (brightly colored, noisy, singing or feeding in exposed places), which are slow flying, which often leave cover, and which occur in groups rather than singly, are apt to be caught in disproportionately large numbers. Those whose habits are the opposite—secretive, quick, etc.—are apt to be caught in disproportionately small numbers.

Tinbergen's analysis would seem to explain the apparent contradiction in our data. Even though our Cooper's Hawks did not prey most extensively on the birds that were most abundant on the Reserve itself (with the exception of the Red-wing), there were concentrations of English Sparrows and Starlings within easy reach of all four nests. Blue Jays, Flickers, Mourning Doves, Robins, and orioles did not live in great concentrations anywhere in the neighborhood, but they were all moderately common. All of these species characteristically leave cover and fly out into open stretches for considerable distances; they are perhaps more vulnerable for that reason than some other species which out-rank them in abundance. It seems significant that all the Pheasants were taken in 1941 and 1942, a time of relative abundance in the country surrounding the Reserve. Southern Michigan experienced the almost nation-wide Pheasant decline of the mid-forties, and we found no Pheasants among the Cooper's Hawk's foods in 1946.

Red-tailed Hawk and Barred Owl

Six pairs of raptors attempted to nest on the Reserve in 1946—two pairs of Cooper's Hawks, two of Red-tails, one of Great Horned Owls, and one of Barred Owls. We hoped to make a comparative study of the food habits of all four species. However, the eggs in one Cooper's Hawk nest were destroyed during incubation, and if there was a second nest we did not find it. The Horned Owl nest had but one young, not yet able to fly, when it was found by Drs. Samuel Graham and E. C. O'Roke on April 22. Two days later the young owl was gone from the nest, and the adults abandoned the nesting woods shortly thereafter. We think the nestling was killed. The two Red-tail nests had but one young each. We obtained some food habits data from each of these broods, but one of the young was killed by a Horned Owl about three weeks after we had tethered it on the ground. The Barred Owl nest held two small young when we found it June 3, but one was gone by the next day. The young owl which disappeared was far too small to have left the nest in a normal manner. We tethered the remaining one; it was killed in late August, presumably by a Red-tail.

It is worth emphasizing that in this year of high nesting density—six pairs of raptors on 1300 acres—the success ratio was very low, quite apart from the disturbance caused by our studies. Both Red-tail broods numbered only one young each, and we did not climb to these nests until after the eggs had hatched. The Horned Owls were apparently wholly unsuccessful, and we did not climb that tree at all. The Barred Owls had only two young, one of which disappeared just after we had visited the nest once. The successful Cooper's Hawk nest had three young and one egg which failed to hatch, while all the eggs in the other nest were destroyed before we climbed to it.

As a matter of fact, it was fighting between the Barred Owls and the successful Cooper's Hawks that led us to that particular hawk nest (Nest 4). On the afternoon of May 14 we heard two adult Barred Owls calling, in rapid cadence, at a spot in the woods about a quarter of a mile away. Their calls were followed at once by the chatter of a Cooper's Hawk, apparently at the same place. Within a matter of seconds another Cooper's Hawk appeared over the tree-tops, flying rapidly toward the commotion. The flying hawk dove vertically, and was lost to view behind the crest of a ridge. Following the bearing given us by the stooping hawk, we walked directly to the nest. The commotion had died away before we got there, and the owls were gone, but there was still a very much excited Cooper's Hawk scolding near the nest. The Barred Owl nest, which we found about two weeks later, was only 200 yards away.

We have very little comparative material. We got 59 pellets and one uneaten prey item from the tethered young Barred Owl, over the period June 4 through August 28. A few pellets were probably broken and scattered before we found them, but as we gathered the pellets generally every three to five days, we probably got most of them. One young Red-tail was tethered from May 17 to June 6, the other from June 4 to July 12. We visited these hawks much less regularly than we did the Cooper's Hawks, and got from them only 27 items of prey.

The Barred Owl had eaten mainly mice (110), but 15 insectivores, 13 small birds, and 12 amphibians were represented. There were 18 beetles in the pellets. As the two genera of bettles which we could identify are known to be attracted to carrion, it is possible that the young owl caught them rather than receiving them from the adults. There were no crayfish (*Cambarus* sp.), although Barred Owls commonly eat them. Among the foods of the Red-tails, members of the Sciuridae made up almost half (13) of the total number of items. It is of interest that of the four birds recovered, three (Red-wing, Blue Jay, and Flicker) were among the most important foods of the young Cooper's Hawks. There was one weasel (*Mustela* sp.).

The Barred Owl and Red-tail data are as follows:

Barred Owl Nest, *June 4–August 28, 1946.* Birds: Hairy Woodpecker (?), 1 imm.; Crested Flycatcher (*Myiarchus crinitus*), 1 ad.; White-breasted Nuthatch, 1 age ?; unidentified birds, 2 ad., 4 imm., 4 age ?. Mammals: Prairie Mole, 1; Star-nosed Mole (*Condylura cristata*), 2; Shrew (*Sorex*, probably *S. cinereus*), 2; Short-tailed Shrew (*Blarina brevicauda*), 10; Eastern Chipmunk, 1; Southern Flying Squirrel, 3; White-footed Mouse (*Peromyscus* sp.), 66; Bog Lemming, 33; Meadow Vole (*Microtus pennsylvanicus*), 10; Meadow Jumping Mouse, 1; unidentified mammals, 1. Amphibians: 12 unidentified frogs and/or toads. Snakes: 1 unidentified. Insects: *Geotrupes* sp., 10; *Necrophorus* sp., 2; unidentified beetles, 6.

Red-tail Nests, *May 17–June 6 and June 4–July 12, 1946.* Birds: Sora (*Porzana carolina*), 1 age ?; Flicker, 1 ad.; Blue Jay, 1 age ?; Red-wing, 1 imm. Mammals: Prairie Mole, 1; Weasel (*Mustela*, probably *M. frenata*), 1; Striped Ground Squirrel, 1; Eastern Chipmunk, 3; Gray Squirrel, 3; Fox Squirrel, 6; Meadow Vole, 2; Pine Vole (*Pitymys pinetorum*), 1. Toad (*Bufo americanus*), 2. Snakes: Blue Racer (*Coluber constrictor*), 2; unidentified snake (probably Blue Racer), 1.

Summary

During three nesting seasons we identified the food brought by the parent birds to four broods of young Cooper's Hawks, to two young Red-tailed Hawks (two broods of one each), and to one young Barred Owl on the Edwin S. George Reserve, in southeastern Michigan. We used Errington's (1932) tethering technique.

Of a total of 262 Cooper's Hawk food items recovered from the gullets of the young hawks, as not yet eaten prey, or as residual debris in the nests or at the tethered young, 84.4 per cent were small to medium-sized birds and 15.6 per cent were small mammals. Of 155 birds whose age we could determine, 25.1 per cent were adult and 74.9 per cent immature. At least 8.4 per cent were nestlings. Of 14 comparable mammals, 21.4 per cent were adult and 78.6 per cent immature.

Nine bird and one mammal species constituted 73.7 per cent of the 213 completely identified food items brought to the young Cooper's Hawks, although the total list included 30 to 33 species of birds and 10 of mammals. The Chipmunk was the second most abundant item of prey. Three of the nine birds

(English Sparrow, Starling, and Red-wing) occurred locally in concentrations, although the first two were decidedly scarce on the Reserve itself. Five characteristically leave cover and fly out across the open (Blue Jay, Flicker, Mourning Dove, Robin, and Baltimore Oriole). All of these eight species were moderately common in the neighborhood, although only one (Red-wing) was among the most abundant of the Reserve's nesting birds. The ninth (Ring-necked Pheasant) was represented only in 1941 and 1942, a time of relative abundance in the farmlands surrounding the Reserve, and not at all in 1946, a time of scarcity.

The food brought the two young Red-tailed Hawks and one young Barred Owl was largely small mammals plus a few birds, amphibians, snakes and insects.

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THE COWBIRD AND CERTAIN HOST SPECIES IN MICHIGAN

BY ANDREW J. BERGER

ALTHOUGH attention has been directed recently to the problem of clutch size in the genus *Molothrus* (Davis, 1942; Preston, 1948; Nice, 1949), little has been written on the length of the breeding season of the best known species of the group, the Cowbird (*Molothrus ater*). Hann (1937: 206) tabulated dates on which he found Cowbird eggs in Oven-bird (*Seiurus aurocapillus*) nests over a three-year period in southern Michigan. His earliest date for a Cowbird egg was May 20, his latest July 6. Walkinshaw (1949: 83) presented data on 25 Cowbird eggs apparently laid by one female between May 15 and July 20 in southern Michigan. Norris (1947: 86) tabulated dates for Cowbird laying over a two-year period near Butler, Pennsylvania. The first eggs were laid on April 27 and April 10, the last on June 25 and July 12 in 1944 and 1945 respectively. In her study of the Song Sparrow (*Melospiza melodia*) in Ohio, Nice (1937: 155) found that the average date for the first Cowbird egg was April 25.

From April 1, 1946 through September 30, 1949 (except for the periods June 20 to September 1, 1946, and June 22 to August 15, 1947) I studied the Cowbird in Washtenaw County, Michigan. During these four breeding seasons I observed the nests[1] of 72 species of birds. Twenty of these were Cowbird-parasitized, and evidence pointed strongly toward parasitization of two additional species.

I knew to the exact one- or two-day period the laying date of 34 Cowbird eggs. Sufficient data were available on 119 additional eggs to permit my estimating the date of laying. Table 1 presents the laying dates of these 153 eggs.

Table 2, which follows the treatment of Norris (1947), indicates the degree of parasitism of the several host species and the success of the Cowbird eggs laid in these nests.

One obvious factor determining the degree of parasitism is the relationship of the Cowbird's breeding season to that of the host species. Pertinent data concerning the breeding season of certain host species and the relative success of parasitized and non-parasitized nests are given below. These data supplement those presented in Table 2.

[1]Several colleagues showed me nests they had found: David Delzell, three of the Phoebe (*Sayornis phoebe*); Charles C. Carpenter, three of the Song Sparrow and one of the Goldfinch (*Spinus tristis*); P. B. Hofslund, two (parasitized) of the Red-wing (*Agelaius phoeniceus*) and one each of the Song Sparrow and Yellow-breasted Chat (*Icteria virens*); N. S. Potter III, one of the chat; and H. B. Tordoff, one of the Field Sparrow (*Spizella pusilla*).

TABLE 1

COWBIRD EGG-LAYING DATES IN SOUTHERN MICHIGAN

	1946	1947	1948	1949		1946	1947	1948	1949
April 21	1				June 9				
22					10				
23					11				
24					12		1		
25				1	13				
26			1	2	14				2
27	2			2	15			1	2
28	1			4	16			1	1
29				4	17				1
30				3	18				
May 1	1		1	2	19				
2			1	2	20				
3			2	1	21				
4			2	1	22				
5	1		2	4	23				
6				4	24				
7				2	25				
8				2	26				
9					27				
10	1				28			1	1
11	1				29				
12			1	1	30				
13				2	July 1				
14			1	1	2			1	
15	1		1	3	3				
16		2	1	2	4				
17		4	2	2	5				
18	1	1		3	6				
19	1	3		1	7				
20	2	1	1	2	8				
21	2	1	1	2	9				
22	3	3	2		10				
23	1		1		11				
24			1		12				
25	1		3		13				
26	1	1	1		14				
27		1		1	15				
28					16				
29					17				
30		2	1		18				
31				1	19				
June 1			1		20				
2		1	4	2	21				
3		1	1	1	22				
4					23				
5					24				
6	1	1			25		1		
7	2	1			26				1
8		1		1	27				

TABLE 2

DEGREE OF PARASITISM AND COWBIRD SUCCESS

Species	Total nests	Parasitized nests	Nests with 1 Cowbird eggs	2	3	4	5	Cow-bird eggs laid	Cowbird eggs hatched	Cowbird young fledged
Phoebe	15	5 (33.3%)	3	1	1	—	—	8	5	5
Alder Flycatcher	37	3 (8.1%)	2	1	—	—	—	4	1	1
Catbird	71	1 (1.4%)	—	1	—	—	—	2	0	0
Wood Thrush	7	1 (14.3%)	—	1	—	—	—	2	0	0
Red-eyed Vireo	1	1 (100%)	—	—	—	1	—	4*	0	0
Oven-bird	2	2 (100%)	—	1	1	—	—	5	0	0
Yellow Warbler	44	18 (40.9%)	9	3	6	—	—	33	3	2
Yellow-throat	1	1 (100%)	1	—	—	—	—	1	0	0
Yellow-breasted Chat	3	1 (33.3%)	1	—	—	—	—	1	0	0
Red-wing	99	5 (5.0%)	5	—	—	—	—	5	1	0
Cardinal	22	10 (45.4%)	3	5	2	—	—	19	4	4
Rose breasted Grosbeak	2	1 (50.0%)	1	—	—	—	—	1	0	0
Indigo Bunting	9	5 (55.5%)	3	1	—	1	—	9	4	4
Goldfinch	70	2 (2.8%)	1	—	1	—	—	4	0	0
Red-eyed Towhee	6	2 (33.3%)	1	1	—	—	—	3	1	0
Vesper Sparrow	6	2 (33.3%)	2	—	—	—	—	2	2	0
Chipping Sparrow	8	5 (62.5%)	3	2	—	—	—	7	1	1
Field Sparrow	33	6 (18.1%)	5	1	—	—	—	7	2	1
Swamp Sparrow	5	4 (80.0%)	3	1	—	—	—	5†	?	?
Song Sparrow	59	37 (62.7%)	10	17	4	4	2	82	36	25
Totals	500	112 (22.4%)	53	36	15	6	2	204	60 (30.6%)	43 (21.9%)

* Three eggs removed from nest by author; not used in computing percent hatched and fledged.

† None of the Swamp Sparrow nests was re-visited; these five eggs not used in computing percent hatched and fledged.

Sayornis phoebe. All but two of the 15 Phoebe nests were found between April 14 and May 31; with one exception (a re-nesting), nests found after May 15 contained young. The latest nest, found July 4, contained six young Phoebes which would not remain in the nest after being banded. Nine non-parasitized nests containing 38 eggs fledged 34 young. Four parasitized nests, known to contain at least 18 host and seven Cowbird eggs, fledged three Phoebes and five Cowbirds. Cowbird interference caused the desertion of one nest.

Empidonax traillii. The nesting of the Alder Flycatcher at Ann Arbor has been reported on by Berger and Hofslund (1950). Of 37 nests found in a two-year period, three were parasitized, and one Cowbird was fledged from the four eggs laid.

Eremophila alpestris. In southern Michigan, first nests of the Horned Lark are built before the beginning of the Cowbird's breeding season. Nine nests found between March 19 and April 24 were not parasitized. Ten young larks were fledged from 24 eggs (eight nests).

I offer this evidence of Cowbird parasitism: On June 20, 1948, I heard a fledgling Cowbird giving its food call from the remains of a 1947 Robin (*Turdus migratorius*) nest near the University Hospital. This Cowbird was being attended by a male lark. I tethered the Cowbird on the ground, and the lark fed it for the next five days. The Cowbird got loose on June 26, but I caught it two days later, and placed it in a Potter trap; within five minutes the lark entered the trap. The Cowbird was kept in captivity until May 27, 1949, at which time it (a male) was released. Moore (1947: 39) reported a "horned lark feeding an almost independent Cowbird" at the Chicago airport on June 20, 1946.

Dumetella carolinensis. Only one of 71 Catbird nests was known to be parasitized: a nest containing four host and two Cowbird eggs, found May 28, 1949. A Catbird was incubating. On May 30 the two Cowbird eggs were gone, but the four host eggs were still there. The nest contained two recently hatched young and two pipped Catbird eggs on June 8.

On May 29, 1948, I placed a Cowbird egg in a Catbird nest containing two Catbird eggs. The Cowbird egg was gone when I visited the nest two days later and there were three Catbird eggs. Three Catbirds were fledged from this nest.

On May 17, 1949, I placed a Cowbird egg in a nest containing five Catbird eggs and with binoculars retreated to cover 40 paces off. Within three minutes, both Catbirds returned to the nest. One Catbird hopped to the ground below the nest with the Cowbird egg in its bill, then flew to a low branch about 30 feet from the nest. I was unable to find any trace of this egg.

Friedmann and others have mentioned the removal by Catbirds of foreign eggs from their nests. I believe that the Catbird is a more common host to the Cowbird in southern Michigan than is generally assumed, and that the reason so few cases of parasitism have been observed is that Cowbirds lay very early in the morning (Hann, 1939: 201) and Catbirds usually remove the eggs immediately on discovering them.

Hylocichla mustelina. Six Wood Thrush nests were found between May 26 and June 10, the seventh nest (under construction) on July 11. From seven nests containing a total of 24 host and two Cowbird eggs, ten thrushes and no Cowbirds were fledged. The six non-parasitized nests were in the University Arboretum, where the Cowbird population was high.

Vireo olivaceus. I found only one Red-eyed Vireo nest because I spent very little time in that species' habitat. A nest found under construction on May 25, 1948, contained a Cowbird egg the following day. This egg I removed. On May 27 I removed another Cowbird egg. I saw the vireo on the nest for the first time on May 28; the nest contained one egg that day, a Cowbird's. On May 29 the nest still held one Cowbird egg, which I removed. On May 31 the nest contained two vireo eggs, and I saw the vireo on the nest (with the two host eggs) daily until June 7. On that date, one Cowbird and one vireo egg were in the nest. The vireo incubated these two eggs until June 14. On June 15 only the Cowbird egg was in the nest and the vireo deserted the following day.

Dendroica petechia. I found Yellow Warbler nests under construction from May 11 to June 4. Although 13 of the 44 nests were observed only once, I saw Cowbird eggs or young in 40.9 percent of the total. Eleven parasitized nests (containing 21 Cowbird eggs) were deserted. Nine additional Cowbird eggs were buried under lining but the nests were not deserted. Hicks (1934: 386) found 42 percent (62 nests) of 146 nests parasitized in Ohio.

Icterus galbula. I did not inspect the contents of any Baltimore Oriole nest. On June 22, 1948, however, I observed a female oriole feeding a recently fledged Cowbird about 40 feet from the oriole's nest. The female oriole was the only bird to give alarm notes when I picked up the Cowbird, although a pair of Song Sparrows had a nest 15 yards away. I tethered the Cowbird and for three days the female oriole fed it and at least two orioles still in the nest. The orioles left the nest on June 25.

Richmondena cardinalis. My earliest date for a Cardinal nest was May 1 (three Cardinal eggs), my latest August 6 (three fresh Cardinal eggs). Seven parasitized nests containing at least 11 host and 13 Cowbird eggs fledged no Cardinals and only two Cowbirds. This high mortality appears to be due to the tendency of the Cardinal to desert when Cowbird eggs are laid in its nest. Mortality of non-parasitized nests, also, was high: nine such nests, containing a minimum of 21 eggs, fledged only four young.

Passerina cyanea. My earliest date for an Indigo Bunting nest was May 26 (two eggs), my latest August 24 (two young). From eight eggs in four non-parasitized nests, six buntings were fledged. Five parasitized nests containing seven host and ten Cowbird eggs fledged two buntings and four Cowbirds.

Spinus tristis. Goldfinch nests with fresh eggs were found from June 12 to August 31. Of 70 nests observed only two were parasitized. I have reported on these in detail (Berger, 1948).

Spizella pusilla. The breeding season of the Field Sparrow extended from the first week of May through August. First nests were found on May 5, 6, and 7 in 1946, 1948, and 1949 respectively. Late nests (each with three sparrow eggs) were found August 7 and 20, 1949. Thirteen non-parasitized nests containing 47 eggs fledged 31 (65.9%) young. Five parasitized nests containing six Cowbird and 16 hest eggs fledged one Cowbird and three sparrows. I also observed Field Sparrows feeding young Cowbirds out of the nest on June 15 and August 8, 1948.

Melospiza melodia. I found four nests [3, 4, 4 (one Cowbird), 5 eggs] of the Song Sparrow on April 21, 1946. This was my earliest date for a Song Sparrow nest and also my earliest date for a Cowbird egg. During the four years, 13 nests were found between April 21 and 30; 33 nests in May; six in June; five in July; two in August. In 18 non-parasitized nests, 69 eggs were laid, 31 eggs hatched, and 28 (40.5%) young fledged. Twenty-eight parasitized nests (92 host and 68 Cowbird eggs) fledged 18 (19.5%) Song Sparrows and 16 (23.5%) Cowbirds. I observed Song Sparrows feeding young Cowbirds out of the nest on the following dates: May 24 and 31 and June 10, 1948, and May 22 and 31, 1949.

Hicks (1934: 386) found 34 percent (135) of 398 Song Sparrow nests parasitized in Ohio. Nice (1937: 159) reported parasitization of 43.9 percent of 223 Ohio nests observed by her over a seven-year period, although the yearly percentage varied from 24.6 to 77.7. Norris (1947: 90) found 11 (40.7%) of 27 Pennsylvania nests parasitized.

Hann (1937: 202) reported that Cowbird eggs usually were laid in Oven-bird nests during the laying period of that host: "Extreme cases, however, were three days before the first Oven-bird's egg was laid, and three days after incubation began." Friedmann (1929: 186) stressed the coincidence of Cowbird-host laying periods when he said that "a Cowbird has been known to lay an egg in a nest of an Indigo Bunting, containing young. This was a very exceptional case and was doubtless a last resort in an emergency." Norris (1947: 100) called attention to the fact, however, that some Cowbird eggs are laid so long after host incubation has begun that they do not hatch.

A Cowbird egg was laid before the first host egg in five nests which I observed (Phoebe, Red-eyed Vireo, Cardinal and two Song Sparrow). None of these nests was deserted as a result of this early parasitization. Two Alder Flycatcher, one Red-wing, two Oven-bird, and three Yellow Warbler nests, however, were deserted apparently as a result of early parasitization.

A Cowbird egg was laid in a Red-eyed Towhee (*Pipilo erythrophthalmus*) nest after the four host eggs had been incubated at least one full day. On July 1, 1948, I found a Song Sparrow nest which contained one addled Song Sparrow egg, two Cowbird nestlings about 24 hours old, and one Song Sparrow nestling which left as I exposed the nest. The Song Sparrow was feathered and would not remain in the nest. One of the young Cowbirds disappeared on July 5, but the other fledged July 9. A Chipping Sparrow (*Spizella passerina*) nest which I found June 10, 1947, contained three host young and a fresh Cowbird egg. In a Field Sparrow nest I was observing, a Cowbird egg was laid after one Cowbird and three host eggs had hatched. Walkinshaw (1949: 84) cited two cases in which Cowbird eggs were laid in nests (Field Sparrow) after the host eggs had hatched.

My data also show that the Cowbird tends to lay in deserted nests. I found Cowbird eggs in five Song Sparrow nests after they had been deserted. The interval between desertion of the nest and deposition of the Cowbird egg varied from one to 26 days, and averaged 10.2 days. One nest is of special interest. I found this nest on May 10, 1947, at which time it contained two Song Sparrow eggs; a third sparrow egg and a Cowbird egg lay on the ground a few inches from the nest. It had been deserted by May 15, on which date I placed all the eggs in the nest. On May 19 it contained three Cowbird eggs only. A Vesper Sparrow (*Pooecetes gramineus*) nest deserted on April 24 or 25 held two sparrow eggs on the latter date; on May 20 I removed two *Cowbird* eggs from the nest. One Cowbird egg was laid in a deserted Phoebe nest containing two Phoebe eggs. Nice (1937: 162) noted that three out of 113 Cowbird eggs were laid in deserted Song Sparrow nests. We may infer from this tendency either that the Cowbird is unable to distinguish between active and inactive nests or that, being ready for oviposition, it lays in whatever nest is available to it at the time.

Ornithologists have known for a long time that Cowbird eggs usually hatch before those of the host species. Audubon (1831: 487) said: "In every case the Cow Bird's egg is the first hatched." Bendire (1895: 595) reported that Cowbird eggs hatch "generally in advance of those of the foster parent." Baird *et al.* (1905: 155) noted that "the eggs of the Cowbird are the first hatched, usually two days before the others." More recently, Friedmann (1929: 188) stated that "in the majority of cases, irrespective of the species of bird victimized, the cowbirds' eggs hatch first." Many, perhaps all, of these authors believed that the shortness of the Cowbird's incubation period (ten days, according to Friedmann, *loc. cit.*), accounted for this phenomenon; but Nice (*op. cit.*) and Hann (*op. cit.*) have ascertained that the incubation period is actually at least one day longer than ten. Obviously if the incubation period of the host is considerably longer than that of the Cowbird, the Cowbird eggs will hatch first if they are laid *during* the laying period of the host. On the other hand, Cowbird eggs laid in nests of species having only a slightly longer incubation period than the Cowbird's will hatch first only if deposited on or before the day on which incubation commences. Cowbird eggs usually hatch first, then, because they usually are laid during, or slightly in advance of, the host's laying period. The Cowbird's custom of removing a host egg increases the chances that its own egg will hatch first.

That 'getting a head start' through hatching first is closely correlated with fledging success seems to be clearly indicated by some of my observations. In six parasitized nests (Wood Thrush, Yellow Warbler, Towhee, Field Sparrow and two Song Sparrow) one or more host eggs hatched first. Every one of these nests fledged one or more host young. Three of them fledged Cowbirds also (one Cowbird and one Yellow Warbler; one Cowbird and three Song Sparrows; one Cowbird and four Song Sparrows). In the following nine nests, on the other hand, Cowbird eggs hatched first: three Phoebe, one Alder Flycatcher, five Song Sparrow. In *only two* of these nests were host young fledged. A Phoebe nest fledged three Phoebes and one Cowbird. A Song Sparrow nest fledged one Song Sparrow and one Cowbird (which, ten days after hatching, was lying dead two feet from the nest the day before the Song Sparrow fledged). Two of the other five Song Sparrow nests fledged no sparrows but three and four Cowbirds respectively. Two Song Sparrow nests, in each of which a Cowbird egg and at least one host egg hatched on the same day, each fledged two Song Sparrows and one Cowbird.

Norris (1947: 100) stated that "No more than two Cowbirds were fledged in a single nest, and this occurred only five times." Table 3, which indicates the relationship between number of host young and number of young Cowbirds fledged in 19 nests, makes clear that three or even four Cowbirds may be fledged from one nest.

On two occasions I found a Song Sparrow nest by watching a female Cowbird. On May 12, 1948, I watched a female Cowbird alight on a weed and peer downward as though looking at or for a nest. I went to the place and flushed a Song Sparrow from a nest containing five eggs (one a Cowbird's). The Cowbird had perched less than a foot from the nest but the Song Sparrow had continued to incubate. I neither saw nor heard the male Song Sparrow during this time, but he appeared and gave alarm notes after I flushed the female. This nest contained three host and two Cowbird eggs when I visited it next on May 14.

Hann (1937: 213) stated that female Cowbirds "discover the Oven-bird's nests by seeing the females building." Nice (1937: 163) believed that Cowbirds find nests both by watching the host build and by direct search. She said further (p. 165): "Cowbirds apparently do not find well concealed nests quite as readily as those poorly concealed, and the same is true of predators." This seems to be a logical conclusion, but at the same time it raises the question of whether or not a nest, well concealed from the human point of view, is also well concealed from Cowbirds and predators. Eight Song Sparrow nests which I thought to be well concealed were parasitized, whereas five nests which I considered exposed were not parasitized. Judging from what I have observed of field nests, I believe that there is a correlation between parasitism and proximity to higher vegetation. In general, parasitized nests in fields were near bordering woodlots or thickets, whereas non-parasitized nests were not near such vegetation. Thickets and trees apparently provide perches and cover for female Cowbirds on the alert for nest building activity.

TABLE 3

Survival of Host and Cowbird Young in 19 Parasitized Nests

Host Species	Host eggs	Host young fledged	Cowbird eggs	Cowbirds fledged
1-Phoebe	5	0	1	1
2- "	4	0	3	3
3- "	5	3	1	1
4-Alder Flycatcher	4	0	1	1
5-Yellow Warbler	4	1	3*	1
6-Cardinal	3	0	2	1
7- "	3	0	3	1
8-Chipping Sparrow	0†	0	1	1
9-Song Sparrow	4	0	4‡	1
10- " "	4	0	5	2
11- " "	3	0	4	3
12- " "	3	0	4	4
13- " "	4	1	2	0
14- " "	2	1§	2	1
15- " "	4	2	1	1
16- " "	4	2	3	1
17- " "	4	3	1	1
18- " "	4	4	1	1
19- " "	5	4	2	1
Totals	69	21	44	26

* Two Cowbird eggs laid after incubation began.

† One Cowbird only in nest when found.

‡ Two Cowbirds died nine days after hatching.

§ Song Sparrow left prematurely when nest was found; Cowbird fledged nine days later.

Summary

A study of Cowbird parasitism in Washtenaw County, Michigan, from 1946 through 1949 involved twenty host species and two additional species believed to be hosts.

The Cowbird laying season extended from April 21 to July 26. Of 112 parasitized nests observed, 53 contained one Cowbird egg, 36 contained two, 15 contained three, six contained four, and two contained five. Of 196 Cowbird eggs observed, 60 (30.6%) hatched. Forty-three of these 60 young Cowbirds (21.9% of the 196 eggs) fledged.

In each of four nests, a Cowbird egg was laid after incubation had begun: in two cases while eggs were still unhatched; in two cases after the young had hatched.

Cowbird eggs were laid in seven deserted nests. The interval between nest-desertion and deposition of the Cowbird egg in five Song Sparrow nests varied from one to 26 days and averaged 10.2 days.

The relative time of hatching of host and Cowbird eggs is important in the

fledging success of the respective species. Host young were fledged from each of six nests of five species in which the host eggs hatched first. In only two of nine nests in which Cowbird eggs hatched first were host young also fledged. Both host and Cowbird young were fledged from two Song Sparrow nests in which a Cowbird egg and at least one host egg hatched the same day. Host eggs hatched first in two Song Sparrow nests which fledged three host and one Cowbird and four host and one Cowbird respectively. Cowbird eggs hatched first in two Song Sparrow nests which fledged three and four Cowbirds respectively but no sparrows.

Parasitized nests of field-nesting species which I observed were in portions of fields bordered by a woodlot or thicket, whereas non-parasitized nests were not near such vegetation.

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NOTES ON THE BIRDS OF THE MIDWAY AND WAKE ISLANDS

BY ALFRED M. BAILEY

On March 14, 1913, George Willett and I spent the day on Sand and Eastern Islands of the Midway Group, observing birds and liberating a few Laysan Rails (*Porzanula palmeri*) and Laysan Finches (*Telespiza cantans*) which we had captured on Laysan Island. Previous plantings of these birds had been made. The two species thrived there for many years following our visit.

Fig. 1. Almost fully fledged young White-tailed Tropic-bird (*Phaëthon lepturus*) in nest in broad crotch of ironwood tree (*Casuarina* sp.) about ten feet above ground. Photographed on Sand Island, in the Midway Group, on November 22, 1949, by Alfred M. Bailey.

When R. J. Niedrach and I visited the Midways from May 4 to 11, 1949, however, we looked in vain for these rails and finches. They apparently had been exterminated by rats which had escaped from ships during the last war. We saw no unusual birds on that visit except a few flying White-tailed Tropic-birds (*Phaëthon lepturus*).

While returning to Honolulu from Australia later that year I again visited the Midways, arriving November 21. By that date both the Laysan Albatross (*Diomedea immutabilis*) and Black-footed Albatross (*D. nigripes*) had returned to Sand Island and many of the latter had eggs, but I did not see eggs of the former until I visited Eastern Island on November 23. Along the Sand Island plane runways I saw many Turnstones (*Arenaria interpres*) and American Golden Plovers (*Pluvialis dominica*), and on Eastern Island about a dozen Bristle-thighed Curlews (*Numenius tahitiensis*) and four Wandering Tattlers (*Heteroscelus incanus*).

In ironwoods (*Casuarina* sp.) near my headquarters on Sand Island many Hawaiian Terns (*Anous minutus*) were nesting. In an ironwood, about ten feet above ground, I found a nearly full grown young White-tailed Tropic-bird sitting in its nest. I made a point of noting that the bill of the young bird was yellowish; that of the young Red-tailed Tropic-bird (*P. rubricauda*) is black. The nest was a bare crotch about ten or twelve inches wide, more or less surrounded by upright stubs (see Fig. 1). The tree was about a foot and a half in diameter at its base.

In the harbor I tried to collect a loon (*Gavia*), but it was so wild that I could not even get close enough to tell what species it was.

Navy Photographer Harold Fawcett told me that several Short-eared Owls (*Asio flammeus*) had been seen repeatedly on the island the preceding mid-June and that he had photographed one of them after it had been captured. I inspected this photograph but could not be sure which of the several possible geographical races the bird represented.

I visited Wake from May 11 to 15, 1949. The main island was nearly devoid of bird-life at that time. The only birds I saw were a few American Golden Plovers. I searched for Wake Rails (*Rallus wakensis*) but did not find any, and was told that none had been seen since the reoccupation of the island by Americans. Rats, or possibly the starving Japanese troops themselves, may have exterminated them.

I was deeply interested in a Japanese military officer's diary found among the war ruins. When the diary was written some four thousand Japanese were being subjected to daily air attacks by the Americans, and they were cut off from all supplies. Almost every entry was on the subject of food, a typical one being: "The diet has been reduced again. I'm sick and tired of it. A formation of eight bombers hit the island."

Another entry was: "Pay day. What good is money? It all goes into savings. Private Ikeda was put in jail for eating 16 cans of meat. He was tortured by cutting down his diet until he died today. Exchanging life for only 16 cans of meat. O God! save our soul! He was one of the healthy fellows in our squad. Otori [Wake] is a dangerous island."

The entry for July 31 was: "Many enlisted men dying of starvation. One patrol plane."

Considering the terrible times the soldiers were having, I marvelled at the following entry: "August 22. Two night alarms and one day. The enemy seems to know how to harass us. What a life! An order has just come out forbidding us to catch gooney birds [albatrosses] lest they be wiped out."

The efforts of this officer to protect the 'gooney birds' must have been largely in vain. Most of the birds were destroyed by the starving soldiers, although a great colony of Sooty Terns (*Sterna fuscata*) was guarded so that the eggs could be gathered regularly. The Sooty Tern colony on Peale Island (of the Wake Group) was the largest I had ever seen. On May 14 I saw thousands of birds on their eggs. The downy young were beginning to hatch on that date.

A few Man-o'-war-birds (*Fregata magnificens*) were sitting about on the rusted iron skeletons of bombed naval buildings. Small groups of Noddy Terns (*Anous stolidus*) were nesting in the dwarfed trees known locally as bukas (*Pisonia grandis*). I saw two White-tailed Tropic-birds. It was apparent that the bird population had suffered from the Japanese occupation for, aside from what I have just mentioned, there were no birds. We did not see any boobies (*Sula*), Red-tailed Tropic-birds, or albatrosses. A search for such burrow-nesting birds as petrels and shearwaters was out of the question, for my time was so short. I saw nothing of either.

Denver Museum of Natural History, Denver, Colorado

NEW LIFE MEMBER

Olive Ruth Spencer grew up on a farm in Adams County, Illinois. All her life she has been interested in out-of-door things, especially birds and plants. She did her undergraduate work at Wheaton College and took her master's degree (in biology) at the University of Michigan. She spent five summers at the University of Michigan Biological Station, making, while there, a life history study of the Black-billed Cuckoo (*Coccyzus erythropthalmus*) on which she reported in *The Wilson Bulletin* in 1943. Miss Spencer has taught biology in the Moline (Illinois) High School for the past 23 years, having been head of the department since 1935. Preparing specimens found dead by her students and herself, she has built up a useful collection of birdskins. She is a member of the American Ornithologists' Union, the Illinois Audubon Society, and the Tri-City Bird Club.

A NEW SWAMP SPARROW FROM THE MARYLAND COASTAL PLAIN

BY GORMAN M. BOND AND ROBERT E. STEWART

The breeding of the Swamp Sparrow, *Melospiza georgiana* (Latham), on the Coastal Plain of Maryland was first suspected by Neil Hotchkiss, of the Patuxent Research Refuge, who believed that he heard the species singing in the Nanticoke River marshes during July, 1946, and again in May of 1947. Martin Karplus, Chandler S. Robbins, and Robert E. Stewart investigated this area on July 11, 1947. Of the thirteen adult Swamp Sparrows observed by them on that date, eight were singing males. One of these they collected, finding the testes enlarged. A statement published by Stewart (1947: 73) made clear the fact that the Maryland Coastal Plain was part of the breeding range of *Melospiza georgiana*.

That the one breeding example just referred to was much darker than breeding specimens of *M. g. georgiana* from New York, Pennsylvania, and West Virginia was readily apparent when it was first critically examined in 1947. Consequently, in the summer of 1950, the authors collected four more breeding adults in the same marshes from which the 1947 example was taken. The difference exhibited by this small series of five birds is so striking that we do not hesitate to describe them as new. They may be known as

Melospiza georgiana nigrescens, new subspecies
Coastal Plain Swamp Sparrow

TYPE.—Adult male, U. S. National Museum No. 418565 (Fish and Wildlife Service Collection); Wicomico County, Nanticoke River marshes, opposite Vienna, Maryland, June 24, 1950; collected by Gorman M. Bond and Robert E. Stewart (original number 120).

SUBSPECIFIC CHARACTERS: Similar to *Melospiza georgiana georgiana* (Latham) of the northeastern United States and southeastern Canada, but in breeding plumage the black streaking of the upper parts distinctly heavier, especially on the nape and dorsal region; feather edgings of the upper parts much grayer, less rufescent and buffy; tail and bill averaging darker; flanks noticeably less buffy. Seven specimens taken at Vienna, Maryland, in November resemble the new form in length of wing and tail, and we consider them representative of the breeding population of that area. These birds are similar to *M. g. georgiana* in comparable plumage but the brown of their upper parts is somewhat richer and darker, and the light edgings of their dorsal feathers are considerably less distinct. Similar also to the pale form, *M. g. ericrypta* Oberholser, of central western Canada and eastward, but in both breeding and winter plumage feather edgings of the upper parts considerably narrower, not so whitish. General coloration of dorsal region even darker than when compared with the preceding race.

Measurements in Millimeters: Adult male (three breeding specimens): wing (chord), 62.0–63.5 (63.0); tail, 59.0–61.0 (60.0). Adult male (four breeding specimens): exposed culmen, 11.0–11.5 (11.2); tarsus, 22.5–24.0 (23.2); middle toe without claw, 15.0–16.5 (15.6). Adult female (1 breeding specimen): wing (chord) 57.5; tail, 57.0; exposed culmen, 11.5; tarsus, 22.5; middle toe without claw, 15.0. Measurements of November birds are as follows: Male (four specimens): wing (chord), 62.5–63.5 (63.0); tail, 58.5–61.5 (60.5); exposed culmen, 10.0–10.5 (10.2); tarsus, 21.5–22.5 (22.0); middle toe without claw, 13.5–15.0 (14.3). Female (three specimens): wing (chord), 58.0–64.0 (60.3); tail, 54.0–57.0 (55.8); exposed culmen, 9.0–10.0 (9.3); tarsus, 20.0–21.5 (20.8); middle toe without claw, 14.0–15.0 (14.5).

Although the above measurements are based on a very small sample, they indicate that *nigrescens* may be slightly larger than the nominate race. Sixteen breeding *M. g. georgiana* from New York, Pennsylvania, and West Virginia measure: Male (eleven specimens): wing (chord), 60.0–64.0 (62.0); tail, 55.0–63.5 (59.0); exposed culmen, 10.0–12.0 (10.5); tarsus, 21.0–23.5 (22.1); middle toe without claw, 14.5–15.5 (15.2). Female (five specimens): wing (chord), 56.0–62.0 (59.1); tail, 52.5–56.5 (54.9); exposed culmen, 9.5–11.0 (10.1); tarsus, 21.5–22.5 (22.0); middle toe without claw, 14.0–15.5 (14.9).

Geographic Distribution: Breeds in the Nanticoke River marshes, Wicomico County, across the river from Vienna, Maryland, and possibly also in other brackish tidal marshes where vegetation is suitable along the east shore of Chesapeake Bay in Maryland and Delaware. Present indications lead us to believe that *M. g. nigrescens* is resident in the Nanticoke River marshes. Breeding birds from southeastern New York, northern New Jersey, and southeastern Pennsylvania are darker than specimens from farther inland but are not as dark as the new race, and we consider them intermediate in color between *nigrescens* and *georgiana*.

Breeding Specimens Examined: New York: Severance, 1♀. New Jersey: Overpeck Creek (near New York City), 10♂; Leonia, 2♂, 1♀; Newark, 1♂; Fort Lee, 1♂. Pennsylvania: Black Swamp, 1♂, 1♀; Somerset, 1♂, 1♀; Sugar Lake, 1♀; Sandy Lake, 1♂. West Virginia: Blister Run, 2♂; Cranberry Glades, 4♂, 1♀; Durbin, 1♂; Cranesville, 1♂.

Remarks: Latham's description (1790: 460) of '*Fringilla georgiana*' was based on a migrant bird taken in Georgia. A check of all specimens in the collections of the Fish and Wildlife Service and the U. S. National Museum reveals that there are, in all, thirty eight examples of *M. g. georgiana* and thirty three of *M. g. ericrypta* from Georgia. This evidence that the two forms are equally abundant in Georgia clearly indicates that Latham could have had a specimen of either when he described the species. The original description is too generalized for any conclusion as to which of these two races he was considering, but nothing about the description suggests that he was basing it on a specimen as dark as the Maryland Coastal Plain form. Of seventy-one Georgia specimens examined by us, none was representative of *nigrescens*.

Acknowledgements: For the loan of comparative material the writers wish to thank the authorities of the Academy of Natural Sciences of Philadelphia and the American Museum of Natural History. We would also like to thank Dr. John W. Aldrich, Mr. Thomas D. Burleigh, Mr. Herbert Deignan, Mr. Allen J. Duvall, and Dr. H. C. Oberholser for valuable assistance and advice in preparing the manuscript.

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Fish and Wildlife Service, U. S. Department of the Interior, Washington, D. C.

NEW LIFE MEMBER

Lawrence Irving Grinnell, a graduate of Harvard, retired from business in New York in 1938 to devote his time to ornithology. He received his Ph.D. from Cornell in 1947. He has studied and filmed birds widely throughout the United States, on the North Shore of the Gulf of St. Lawrence, on the west coast of Hudson Bay, and in Trinidad, Guatemala, Colombia, México (including Yucatán), and the West Indies. He has shown his films at numerous meetings ornithological and otherwise. His published papers include one on the bird life of Churchill, Manitoba, one on the nesting habits of the Redpoll (*Acanthis flammea*), and one on the nesting habits of the Lapland Longspur (*Calcarius lapponicus*). Always actively interested in outdoor pursuits, he has travelled over 7,000 miles on canoeing and high mountaineering expeditions. He has served as a vice president of the Appalachian Mountain Club.

GENERAL NOTES

Pacific Loon in Indiana.—On or about April 14, 1949, a farmer living near Newcastle, Henry Co., Indiana found a small loon alive, and apparently uninjured, in one of his cornfields. He gave the bird to Marjorie Tapscott, a senior at the Newcastle High School. Miss Tapscott, uncertain as to the bird's identity, showed it to Max Forsyth, her biology teacher. Mr. Forsyth kept the bird in captivity for some days, but fish for it were expensive, so on April 19 he liberated it on a pond in one of the municipal parks. A day or so later he described the bird to me and I was led to believe that it might be a Pacific Loon.

On April 24 the loon was found dead near the nest-site of a pair of Mute Swans (*Cygnus olor*) which bred regularly in the park. On skinning the specimen I found that it was a female with very small ovary. The neck was broken. The exposed culmen measured 51 mm., the wing (primaries not pressed flat) 266; the tarsus 67. The plumage appeared to be that of a fully adult bird in winter except that the wing coverts, which were dark medially, had rather noticeable ashy gray edgings. The upper parts in general were dark gray, darkest and most glossy on the lower hind neck, back, scapulars and rump. The scapulars were sparsely marked with small roundish, not squarish, spots. The under parts were white except for a faint interrupted dusky line across the lower throat, a few not very noticeable dusky streaks on the sides of the chest, the dusky median portion of the longer under tail coverts, and a dusky band (wide at each side but very thin in the middle) across the vent. Nowhere in the plumage —despite the lateness of the date—was there evidence of molt into the handsome breeding dress.

So far as I know this is the first specimen of *Gavia arctica* ever to be taken in Indiana, though Butler in his "Birds of Indiana" included the species hypothetically. For verification of my identification I sent the specimen to the U. S. National Museum, where Allen J. Duvall pronounced it an example of the small New World race, *G. a. pacifica*. It is now No. 18862 in the collection of the Joseph Moore Museum at Earlham College.—James B. Cope, *Earlham College, Richmond, Indiana.*

White Pelican on Ohio Shore of Lake Erie.—During the summer of 1950 the White Pelican, *Pelecanus erythrorhynchos*, was observed on two occasions along the south shore of the Marblehead Peninsula, near the west end of Lake Erie, in Ottawa County, Ohio. On July 19, Charles A. Triplehorn and his wife, Wanda, observed a solitary bird in flight over East Harbor State Park. On August 19, Fred Crates, R. S. Phillips, and James Bruce observed a single bird standing in the midst of a large mixed flock of Herring Gulls (*Larus argentatus*), Ring-billed Gulls (*Larus delawarensis*), Common Terns (*Sterna hirundo*), Black Terns (*Chlidonias nigra*), and Caspian Terns (*Hydroprogne caspia*) on a sandbar about a hundred yards offshore at Bayview Park. The three observers approached the pelican twice, once to within about fifty yards. They obtained excellent views of the bird.

According to Borror (1950. "A Check List of the Birds of Ohio," *Ohio Jour. Sci.* 50: 2) the White Pelican is 'rare' in Ohio. Along the Ohio shore of Lake Erie it has been recorded at least twice—on May 5, 1925, a group of five in the Maumee River, east of Walbridge Park, Toledo (Campbell, 1940. *Toledo Mus. Sci. Bull.* 1: 32), and a single bird May 28, 1944, near Toledo (Mayfield, 1944. *Aud. Mag.*, 46, Sec. 2, p. 6).—Charles A. Triplehorn, *Ohio State Museum, Columbus* and R. S. Phillips, *Biology Department, Findlay College, Findlay, Ohio.*

Marsh Hawk feeding on Black-billed Magpie.—On February 4, 1950, I flushed a male Marsh Hawk (*Circus cyaneus*) from a small patch of willows two miles south of Roosevelt, Duchesne County, Utah. It held in its claws a partly eaten, freshly killed Black-billed Magpie

(*Pica pica*) which it dropped after flying about a hundred feet. Most of the viscera and pectoral muscles had been eaten.

When I returned to the site three hours later the uneaten portion of the magpie still lay in the snow where the hawk had dropped it.

Bent (1946. *U. S. Natl. Mus. Bull.* 191: 151–152) indicates that magpies are seldom used for food by other birds. Starvation may have caused this Marsh Hawk to eat the magpie. Below-freezing weather continued from the middle of December, throughout January, and into February. At the time of my observation, an average of 16 inches of snow covered most of the ground.—MERLIN L. KILLPACK, *Biology Dept., Union High School, Roosevelt, Utah.*

Ruffed Grouse nest predation by blacksnakes.[1]—During the nesting seasons of 1949 and 1950 I observed two instances of Ruffed Grouse (*Bonasa umbellus*) nest predation by the Pilot Blacksnake (*Elaphe obsoleta*) on the Beaver Creek Wildlife Management Area in McCreary and Pulaski Counties, Kentucky. The instances were:

Blacksnake eating egg of Ruffed Grouse. Photographed on the Beaver Creek Wildlife Management Area in McCreary County, Kentucky, May 17, 1949, by Harold E. Alexander.

1. On May 17, 1949, as H. E. Wallace, H. E. Alexander, J. O. Moynahan and I were checking grouse nests under observation, we found a blacksnake in a nest about five miles northeast of Greenwood in McCreary County. In the nest were four eggs, one of which was also in the mouth of the snake (see photograph). When we had last visited that nest, three days before (May 14), we had flushed the hen from four eggs. Presumably the clutch had been complete at that time, since no more eggs had been added by May 17. Observations recorded in my field note-book on May 17 were as follows:

3:56 p.m. We approached nest on foot from the nearby jeep road. A blacksnake in the nest apparently is attempting to swallow an egg.

3:59 Snake has firm grasp on butt end of the egg with edges of mouth.

[1] This paper is a contribution from Federal Aid Project 18-R, Kentucky Division of Game and Fish.

4:01 Egg completely within snake's mouth.
4:02 Egg at a position just back of the head.
4:05 A cracking noise heard, apparently caused by breaking of the egg. Egg not crushed, however, since it still forms a bulge in the body.
4:06 Egg moving back much faster.
4:08 Egg has reached a position 6 inches behind the head and still moving fast. Snake attempting to take another egg.
4:12 Egg about 15 inches behind snake's head. Snake attempting to obtain grasp on second egg. It seems that pains are taken in selecting the large end of the egg. In approaching the egg, snake had turned its head in opposite direction from that in which first egg was consumed. In this operation the egg was shifted slightly. Snake shows no fear of us as we stand within a few feet of the nest.

We caught the snake before it had swallowed the second egg. On killing it and opening the alimentary tract, we found the shell of the first egg cracked and the yolk running out. The estimated total length of the snake was 54 inches. We did not see nor hear the hen grouse while making these observations.

At 8:30 a.m. on May 18 we visited the nest again, flushing the hen from her clutch of three eggs, all of which seemed to be in perfect condition. We continued to visit the nest almost daily until May 31, on which date we found it empty.

2. On May 14, 1950, at 7:25 a.m., I visited a nest four miles east of Alpine, Pulaski County, finding it empty. I had first visited this nest on April 14, on which date it had held three eggs. On April 26 the ninth and last egg of the clutch had been laid. The nine eggs had been incubated about 17 days when I last saw them on May 13. On the 14th the nest was warm and dry, in contrast to the surrounding leaves which were wet from a recent shower. I decided that it had been unoccupied only a short time. While I was critically examining the leaves of the nest's bowl a grouse flushed about 30 feet away. For half an hour I could hear the bird calling intermittently in the distance. It did not return to the nest. At 8:15 I found and captured a blacksnake 21 feet from the nest. On cutting open the intestinal tract, I found the entire clutch of nine grouse eggs, each cracked, and each containing a large embryo. The snake was $60\frac{1}{2}$ inches long.—Frederick C. Hardy, *133 North Central, Somerset, Kentucky.*

Abnormal throat-color in male Bob-white Quail.—In three male Bob-white Quail (*Colinus virginianus*) which I have had occasion to examine recently, the white throat-patch was boldly divided by a median black area or stripe. In one individual, a bird shot near Alva, Woods County, Oklahoma by Arnold Purviance of Mooreland, a black stripe about a quarter of an inch wide extended from the chin almost to the end of the throat-patch. The rest of the plumage of the head and body was, so far as I could see, normal. Wallace Hughes made a sketch of the head of this bird. A black and white reproduction of this sketch appeared on the back cover of the February, 1949, issue of *Oklahoma Game and Fish News*.

The two other abnormally colored specimens were among six male birds shot *from one covey* in eastern Cleveland County, Oklahoma, in December, 1949, by Earl Johnson of Norman. In these birds the black median area was a quarter of an inch wide, about as in the Woods County specimen discussed above. The heads of the two specimens were mounted and placed in the University of Oklahoma Museum in Norman.

Stoddard (1931. "The Bobwhite Quail. Its Habits, Preservation and Increase", p. 88 and plate 18) states that this color variation occurs very rarely. I have not found any other reference to Bob-whites with partly black throats.—Glenn Jones, *1115 W. Garver, Norman, Oklahoma.*

Egg-laying, incubation, and fledging periods of the Spotted Sandpiper.—Witherby *et al.* (1940. "Handbook of British Birds", 4: 303) stated that the period of incubation for the

Spotted Sandpiper (*Actitis macularia*) was 21 days, "not 15 as given in Bent's work." A more detailed account by Miller and Miller (1948. *Auk*, 65: 562) gave, for three nests at Belle Isle, near Detroit, Michigan, 20 to 22 days, and references showing periods from 19½ to 21 days. Nelson (1930. *Bird-Banding*, 1: 8) gave an incubation period of 21 days for one Michigan nest.

Miller and Miller (*op. cit.*, p. 561) stated that in seven nests observed by them one egg was laid daily, but that in two other nests one day was skipped between the laying of the second and third eggs. The latter part of this statement was, according to a personal letter from the authors, slightly in error: in one of the "two other nests" a day was skipped between the laying of the first and second eggs; in the other a day was skipped between the third and fourth eggs. These authors stated, in their paper (*op. cit.*, p. 566) that the chicks began to fly at 14–15 days of age.

At a nest which I found in May, 1950, the egg-laying pattern was distinctly different from anything suggested above. The nest was near the Carrie Dam in the Preston Frith, in Butler County, Pennsylvania, 30 miles due north of downtown Pittsburgh. A transcript of my record follows:

Sunday, May 14, 1950, shortly before noon E.D.S.T. the bird was flushed from one egg, presumably shortly after she had laid it.

May 15	5 p.m.	still only one egg
May 16	5 p.m.	two eggs
May 17	5 p.m.	two eggs
May 18	7 p.m.	three eggs
May 19	5 p.m.	four eggs, and bird sitting
June 11	noon	four eggs, none hatched
June 12	7 p.m.	one dead young in nest, other three gone.

The slow rate of egg-laying surprised me: it took five days (May 14–19) to increase the clutch from one to four eggs—almost two days per egg. The weather was favorable, but cool at night at the water's edge.

The incubation period was between 23 and 24 days (May 19–June 12), appreciably longer than anything recorded in the literature above mentioned.

So far as I could tell, the hatching was normal. The dead young one was dry and fluffy, apparently having been for some hours outside the shell.

From the time incubation started I noted only one adult sandpiper at the dam at any time, this despite the frequency of my observations. I do not know what the sex of the one bird was. After the eggs hatched I several times observed one adult and two young some two hundred feet from the nest in the spillway from the dam, and later along the shore close to the nest-site. Witherby *et al.* (*loc. cit.*) stated that the young were "tended by one parent." Nelson (*op. cit.*, p. 2) stated that incubation and brooding were done by the male bird only.

On June 26 and 27, when the young were 14–15 days old, they did not fly, even when my dog chased them, but on the 30th they flew without provocation. Their fledging period was a day or so longer than that reported by Miller and Miller.—F. W. Preston, *Butler, Pennnsylvania.*

Short-billed Marsh Wren breeding in Kansas.—On August 26, 1950, in a field south of and adjacent to U.S. Highway No. 40, and eight miles west of Lawrence, Douglas County, Kansas, we discovered at least six singing Short-billed Marsh Wrens (*Cistothorus platensis*). A specimen shot by Tordoff that day proved to be a male (UKMNH No. 29664) with much worn plumage, completely ossified skull, and considerably enlarged (about 6 x 4.5 mm.) testes.

A search of the literature revealed that, despite Gosse's calling the Short-billed Marsh Wren a rare summer resident in the state (1891. "History of the Birds of Kansas," p. 617), the A.O.U. Check-List's inclusion of eastern Kansas in the breeding range (1931, p. 249), and Bent's statement that the species breeds south "to . . . central Missouri (St. Louis and Kansas City)" and "west to western Missouri (Kansas City) . . ." (1948. *U. S. Natl. Mus. Bull.* 195: 274), there was no definite breeding record for Kansas.

This being the case, we returned to the same field four days later (August 30) and hunted until we found a nest. Two wrens obviously were in possession of it, for one sang frequently and the other scolded vigorously while we were in the immediate vicinity. The nest held four eggs. After watching the scolding bird enter, we waited about three minutes, then flushed and collected it, finding that it had a well defined brood-patch. On obtaining the singing bird, we noted that its plumage, like that of the first specimen, was much worn, but that it had no brood-patch. The birds proved to be a male and female (UKMNH Nos. 29665 and 29666). Neither was fat. In each the skull was completely ossified. In neither had the postnuptial molt started. The testes of the male measured about 7 x 5 mm., the ovary of the female about 4.5 x 3.5 mm., the largest ovum having a diameter of about 1 mm. The four eggs proved to be considerably dehydrated and without visible embryos.

The population of wrens from which the three adults and the nest and eggs were taken ranged over nearly ten acres of gently southward sloping hillside. The vegetation of the area was a mixture of rank weeds and grasses, approximately four feet high, interspersed with many clumps of smooth sumac (*Rhus glabra* L.). The nest itself was 12 inches above the ground in little blue stem (*Andropogon scoparius* Michx.) and was constructed of dried and green blades of the same and other species of grass. The hillside, although heavily overgrown with weeds and grasses, could not by any stretch of the imagination have been called a marsh or swamp. In years of normal spring and summer precipitation, it would doubtless be relatively dry. In 1950, however, approximately 23.6 inches of rain fell in the Lawrence area between June 1 and September 1, and this excessive moisture may have been responsible for the wrens' nesting. Many lowland meadows in eastern Kansas should, it seems to us, offer a suitable nesting environment for this species even in seasons with much less rainfall.

Bent (*op. cit.*, 276) gives August 20 (New Jersey) as the latest "egg date" for the Short-billed Marsh Wren. Although the condition of the eggs in the nest described above indicated that they had been incubated for some time, the date, as far as we can tell, is the latest on record for a clutch attended by a female.—HARRISON B. TORDOFF AND GEORGE P. YOUNG, *Museum of Natural History, University of Kansas, Lawrence.*

***Turdus migratorius achrusterus* and *Passerculus sandwichensis mediogriseus* in the Northern Panhandle of West Virginia.**—On April 2, 1949, at Beech Bottom, Brooke County, West Virginia, I collected from a flock of about 200 Robins two male specimens which appear to belong to the small 'southern' race, *achrusterus*. They measure respectively: wing, 122, 124 mm.; tail, 90, 90; exposed culmen, 19, 20; tarsus, 30, 32.

The Savannah Sparrow is a rather common summer resident in the open hilltop farmlands of the Northern Panhandle at elevations from 1000 to 1200 feet. To ascertain which subspecies nested in the region, I collected a breeding male on May 28, 1949, half a mile northeast of West Liberty, in Ohio County, finding that it represents the race *mediogriseus*, the breeding form of northern Ohio. It measures: wing, 70 mm., tail, 49, exposed culmen, 10.5, tarsus, 19.

Dr. Herbert Friedmann of the U. S. National Museum has handled the above discussed three specimens and concurs as to their identification.—LT. KARL W. HALLER, *Killeen Base, Killeen, Texas.*

Notes on *Icterus nigrogularis* and *I. chrysocephalus* in Surinam.—In his interesting and important paper, 'Convergent Evolution in the American Orioles,' Beecher (1950. *Wilson Bulletin*, 62: 70) states that the Yellow Oriole (*I. nigrogularis*) is an "arid zone" bird. This is wholly counter to my experience in Surinam, where the species is confined to swampy areas along the rivers and outer coasts. Conspicuous because of its melodious, flutelike notes, it is one of the most characteristic birds of the *parwa*, the broad strip of mangrove (*Avicennia nitida*) along the seashore. It is also found in the *brantimaka*, the thorny thicket of sickle-pod (*Drepanocarpus lunatus*) fringing the muddy banks of the rivers. I have never found it breeding in the savanna belt in sandy country in the interior. Its long pendent nest is built near the end of an outer branch of either an *Avicennia* or *Drepanocarpus* plant, in the former often at considerable distance above the ground.

Eggs of *I. nigrogularis* in the large Penard oölogical collection from Surinam were collected in February, June and August (Hellebrekers, 1942. *Zoologische Mededeelingen*, p. 268). I can give some additional data. On July 9, 1946, not far from the coast at Coronie, I observed a pair

Nest of *Icterus nigrogularis* in low-growing mangrove. The entrance, which is at the top, leads directly down into the nest. Photographed at Coronie, Surinam, on July 11, 1946, by F. Haverschmidt.

building a nest in a low *Avicennia* plant. The first egg was laid on July 11 (see photograph). I observed birds building nests in low-growing *Avicennia* also at Nieuw Nickerie on July 24 and December 19, 1946. Along the Surinam River, at the plantation 'La Liberté', on March 9 and June 29, 1947, I observed birds at nests built in *Drepanocarpus*. On the coast, near the mouth of the Surinam River, I saw occupied nests on August 1 and 5, 1946.

As for the so-called Moriche Oriole (*I. chrysocephalus*),[1] on the other hand, I have never

[1] Hellmayr (1937. Cat. Birds Amer., part 10, p. 114) gives this species the common name 'Moriche Oriole.' *Moriche*, *morichi*, *murichi* and *miriti* are listed as common names of the palm *Mauritia flexuosa* in H. L. Gerth van Wijk's "A Dictionary of Plant Names" (1916. 1: 821), but I find no statement there concerning the derivation of any of the words. *Moriche* is conceivably a barbarism—a mere mispronunciation or misspelling of *Mauritia*.—G.M.S.

found it in the above-mentioned swampy habitat. It is, according to my experience, a bird of dry areas—sand reefs on which the vegetation grows in long rows paralleling the coast, and forest-fringed savannas of the interior. In the large savanna near the airfield at Zanderij, on March 6, 1949, I observed a pair of the handsome birds building their nest in a *Mauritia flexuosa* palm tree. (For a photograph of a palm of this species see *The Auk*, 1948, plate 6.) The nest was neatly woven of dry leaves and sewn under a frond just too high for me to reach from a standing position on the ground. On March 20 it contained two eggs which broke as I was trying to collect them and the nest.—Fr. Haverschmidt, *P.O. Box 644, Paramaribo, Surinam, Dutch Guiana.*

Brewer's Blackbird in Indiana.—On May 18, 1950, I collected an adult male Brewer's Blackbird (*Euphagus cyanocephalus*) in Noble County, just north of Ligonier, Indiana. I observed the bird for about fifteen minutes before collecting it. During most of this time it perched on a fence along the highway at the edge of a large pasture. It sang several times. It was not part of a blackbird flock, but I saw and heard Cowbirds (*Molothrus ater*), Grackles (*Quiscalus quiscula*) and Red-wings (*Agelaius phoeniceus*) in the vicinity that day. So far as I know the Brewer's Blackbird has not actually been collected before in Indiana. Butler, in his "Birds of Indiana" (1897. Indiana Department of Geology and Natural Resources, 22nd Annual Report, p. 1178) listed it hypothetically on the basis of Ridgway's records from Mt. Carmel, Illinois. It has, I understand, been seen several times recently (in the early spring of 1950) in the vicinity of South Bend, Indiana. My specimen was collected about thirty miles east of South Bend. The skin is now in the Joseph Moore Museum at Earlham College, Richmond, Indiana.—Russell E. Mumford, *812 East Hendrix Street, Brazil, Indiana.*

Generic Placement of the Rufous-winged Sparrow.—Most recent authors have given the Rufous-winged Sparrow the scientific name *Aimophila carpalis*, a notable exception being van Rossem (1936. *Trans. San Diego Soc. Nat. Hist.*, 8: 144) who, without going into details, referred to it as "a typical *Spizella* in almost every respect," then, nine years later, unaccountably reversed his position (1945. "A Distributional Survey of the Birds of Sonora, México," *La. State Univ. Mus. Zool. Occ. Papers No.* 21: 274). The suspicion that *carpalis* may be a *Spizella* seems to me to be justified.

My field experience with the species has been confined to Sonora. In his work on the birds of Sonora, van Rossem (*op. cit.*, p. 275, footnote) expressed doubt that *carpalis* bred in the southern part of that state. Reporting a lack of records for the period from June 22 to November 5, he stated that specimens taken in May and early June "showed only the beginning of sexual activity, none were paired, and all were in various stages of the complete prenuptial . . . moult." In 1946, Moore (*Condor*, 48: 117–123) reported evidence that *carpalis* bred in southern Sonora, and extended the species' known range southward into south-central Sinaloa. My observations at Pitahaya, 40 kilometers southeast of Empalme, Sonora, from October 29 to November 1, 1946, confirm earlier observations that *carpalis* breeds commonly in that part of the state.

At that time Rufous-wings were found in pairs or individually, spaced about as they would be in the breeding season. When one member of a pair was collected, the other remained nearby. Association with small, wandering flocks of non-resident Brewer's Sparrows (*Spizella breweri*) and Clay-colored Sparrows (*S. pallida*) occurred, but such association was loose and only brief. The Rufous-wings sang intermittently, a few of them regularly (for varying periods) from prominent perches. They were most common in open mesquite groves throughout which the trees were ten to fourteen feet high and the interspaces largely grassy.

On November 1, I discovered a pair of adults with three bob-tailed juveniles at most two or three days out of the nest. I collected the young birds and the male parent, finding the latter to be in an early stage of the postnuptial molt. One testis was 5.5 mm. long. The male of another pair collected had just started to molt (one testis measured 3.5 mm.) but the female had not begun to molt. In two additional male specimens, both in early stages of the molt, the testis length was 3.0 and 1.5 mm., respectively. These records, with those of Moore (*loc. cit.*) indicate that in southern Sonora the Rufous-winged Sparrow breeds in the fall. Eggs may be laid as late as early October. Whether the species breeds also in the spring and summer, or only in the spring and summer when the season is wet, remains to be ascertained.

Now for available behavioristic evidence as to generic affinities. *Carpalis* moves about through the grass and brush like a *Spizella*. Its posture and manner of perching conspicuously on high twigs in shrubbery distinctly suggest the Field Sparrow, *Spizella pusilla*. The alarm note is a *Spizella*-like *tzeep* or *tsip*. The song suggests that of *Spizella pusilla*, *S. pallida*, *S. passerina* and *S. breweri* in that it is weak, monotonous, and not very noticeable. After opening with several broken, rather clearly enunciated notes, it becomes a series of seven or eight less loud, quickly repeated notes all at the same pitch. One male repeatedly sang a steadily accelerating series of five to nine notes—a song-pattern similar to that of *S. pusilla*. In these features of behavior *carpalis* appears to be far removed from *ruficeps* and *rufescens*, the species of *Aimophila* best known to me in the field. On the other hand, as mentioned above, whenever I saw *carpalis* in flocks of *Spizella breweri* or *S. pallida* I was impressed with the similarity in behavior of the three species.

Some evidence along these lines is available in the writings of early observers of Arizona birds. Henshaw (1875. Zool. Exp. W. 100th Merid., p. 291) stated that *carpalis*, "unlike the other *Peucaea* [*botterii*, *cassini*, and *ruficeps*], never attempted concealment by hiding in the grass, but immediately took wing . . . In habits and actions, it greatly resembles the Chipping Sparrow." Bendire (1882. *Orn. and Ool.*, 7: 121–122), from experience with 43 nests of *carpalis*, wrote that the "nest is usually . . . in low bushes . . . from six inches to five feet from the ground . . . firmly fixed into a fork or crotch . . . . The eggs . . . are of a very delicate pale green color and unspotted. . . ." Bendire's observations on nest structure and nest placement again suggest the genus *Spizella*. Absence of spots on the eggs suggests *Aimophila* rather than *Spizella*, but I place no weight on this character. Both Henshaw and Bendire comment on the marked gregariousness and sociability of *carpalis*, in which respect it resembles members of the genus *Spizella*. Moore (*op. cit.*, pp. 119–120) confirms Bendire's observations on nest-site and reports that his field experience with *carpalis* agrees with that of early observers.

Ridgway (1901. Birds of North and Middle America, part 1, p. 231), though admitting difficulty in setting limits for the genus *Aimophila*, nonetheless put the Rufous-wing in that genus without comment other than that the bird was closely related to *Aimophila sumichrasti* of Oaxaca. Hellmayr (1938. Cat. Birds Amer., part 11, p. 522) suggested that *carpalis* and *sumichrasti* might be conspecific. *A. sumichrasti* must therefore be observed closely by anyone wishing to decide the generic placement of *carpalis*. This I have not been able to do, but I report my field experience with *carpalis* in the hope that the information will be useful in future study of the problem.—FRANK A. PITELKA, *Museum of Vertebrate Zoology, University of California, Berkeley.*

EDITORIAL

Friends and admirers of Louis Agassiz Fuertes will rejoice to learn that the great bird artist's biography, now being written by his daughter Mary, will be finished by spring or early summer. There is not a person among us—not one—who has not been affected in one way or another by Louis Fuertes or his work. Some of us knew him well and treasure the memory of the hours we had with him. Many of us have heard stories about him—stories that lift the spirit and spread the smiles wider. All of us have seen his bird drawings and, having seen them, have wondered which was the more beautiful, a bird or a Fuertes drawing of a bird. Mary Fuertes Boynton wants this book about her father to be a full, faithful account. If, among our letters, or among our memories, there are facts or anecdotes which would help to give the world of the future a more complete picture of Louis Agassiz Fuertes, let us turn these over to Mary Boynton immediately. Her address is: Mrs. Damon Boynton, R. F. D. 3, Trumansburg, New York.

Applications for the 1951 Louis Agassiz Fuertes Research Grant are now being received by the chairman of the Club's Research Committee, Dr. Charles G. Sibley, Department of Natural Sciences, San Jose State College, San Jose, California.

The Louis Agassiz Fuertes Research Fund was established to encourage ornithological research. The grant is designed to help students and amateur ornithologists in defraying the expenses of their research programs, particularly such items as travel, materials, and equipment.

One hundred dollars is given each year to the applicant selected by the Research Committee on the basis of (1) merits of the applicant's project; (2) prospects of successful completion of the project; (3) ability of the applicant; and (4) financial need of the applicant. All members of The Wilson Ornithological Club are eligible for the grant. Dr. Sibley will supply application forms on request, or the applicant may furnish the following information in a letter: Name, address, and age, ornithological training and experience (no formal training is required as a basis for eligibility); subject of investigation (title, objective, and scope of project; plan of procedure; progress to date); supervisor or consultant, if any; ways in which the money would be used; financial need. A letter of endorsement by some well-known ornithologist or zoologist is desirable but not required. Applications which fail to win the grant in any given year may be re-submitted in following years if desired.

To perpetuate the memory of Frank M. Chapman, and to continue his influence, a memorial fund under control of the American Museum of Natural History was established after his death in 1945 by Mrs. Elsie M. B. Naumburg and her husband, Walter W. Naumburg. Many of Dr. Chapman's friends and admirers have since contributed to this fund, which has grown sufficiently to permit a grant or grants to be made from the income. The Frank M. Chapman Memorial Committee is happy to announce that the first awards may be allotted in the year 1951.

Applications for fellowships should be addressed to the Chapman Memorial Fund, in care of the Department of Birds of the American Museum of Natural History, New York 24, New York. Applicants should state their training and experience and describe the nature and scope of the proposed project as well as the plan of procedure, previous work on the project (if any), and amount of financial aid required. They should also name one or more sponsors.

Projects eligible under the provisions of the Chapman Memorial Fund include field expeditions, intensive studies of behavior of species of birds or of bird colonies, laboratory or museum studies—in fact, almost any kind of sound ornithological research. A sum of approximately $2000.00 will be available for the first grants.

The American Museum of Natural History will be responsible for judging the qualifications of the applicants. Any necessary collections made during the tenure of a Chapman Fellowship will be deposited in the American Museum. Applications must be received before June 1, 1951.

Applications for the Edward L. Chalif Grant for Bird-work in México are now being received by Dr. Sibley. The grant is $200. Applicants should state their plans briefly, making clear the parts of México they intend to visit. Mr. Chalif's desire is to bring to light as rapidly as possible the salient facts of bird distribution in México, for he is working on a field guide covering all the birds of that country. He plans to be in México himself for about five months this coming summer and would like to join a party working there during that same time. Roger Tory Peterson and George Miksch Sutton are to make the drawings for this useful work and to collaborate in any way they can.

Two W. K. Kellogg Bird Sanctuary Fellowships have been announced by Michigan State College. Each of these pays $1200 to a Ph.D. candidate who carries out his research project at the W. K. Kellogg Bird Sanctuary. Persons who do satisfactory work may have their fellowships renewed for one or more years. One fellowship is now available. Inquiries should be addressed to Dr. Arthur E. Staebler, Director of the W. K. Kellogg Bird Sanctuary, Hickory Corners, Michigan.

Your editor, with Ralph M. Edeburn, Robert W. Storer, Philip S. Humphrey, David Parmalee and Peter Stettenheim, all members of the Club, visited the Kellogg Sanctuary late last November and witnessed, with great interest and satisfaction, the capture and banding of 19 Canada Geese (*Branta canadensis*). Cannons-of-a-sort set in a line on the lake-shore *shot* a great net out over the feeding birds, which were promptly put into big crates and taken to a building not far away for banding. Dr. Staebler, who has been active in banding geese since becoming Director of the Sanctuary, keeps a record of each bird handled, carefully determining the sex through anal examination and noting conditions of plumage, irregularities of color pattern, and such details as missing toes. The geese which we 'helped' to band on November 25 were surprisingly tractable, though they beat their wings mightily when not held properly and occasionally bit hard when a hand lingered within tempting distance. Their beauty, as they sprang into the strong wind bearing away their new bands, was thrilling. That was the day of the 'big blow'—a day we shall never forget.

At the meeting of the American Ornithologists' Union in St. Paul and Minneapolis last October many Wilson Club members were honored. Josselyn Van Tyne, for many years editor of *The Wilson Bulletin*, was elected President. Alden H. Miller was elected First Vice-President, Ludlow Griscom, Second Vice-President, Olin Sewall Pettingill, Jr., Secretary, R. Allyn Moser, Treasurer, and Harvey I. Fisher, Editor. W. J. Breckenridge, George H. Lowery, Jr., Frank A. Pitelka, and L. L. Snyder were elected to Council. Maurice Brooks, our President, and Dr. Breckenridge, our First Vice-President, were elected Fellows. F. Haverschmidt of Paramaribo, Surinam, and Helmuth O. Wagner, of Bremen, both members of the Club and contributors to *The Bulletin*, were elected Corresponding Fellows. Harold F. Mayfield, our Secretary, was elected to full Membership. Others elected Fellows were: Harvey I. Fisher, William Rowan, A. A. Saunders, Alexander Sprunt, Jr., and Winsor M. Tyler. Others elected Members were: Anders H. Anderson, Rollin H. Baker, William J. Beecher, Charles H. Blake, Ben B. Coffey, Jr., J. Fred Denton, Alexander D. DuBois, Mary M. Erickson, E. Thomas Gilliard, Horace Groskin, William H. Marshall, Gale W. Monson, Fred J. Pierce, Karl Plath, Hustace H. Poor, Kenneth Racey, William F. Rapp, Jr., W. Austin Squires, Walter P. Taylor, Ruth Harris Thomas, Melvin A. Traylor, Jr., Arthur B. Williams, C. Sloan Williams, and Angus M. Woodbury. In 1951 the Union will meet in Montreal.

During the summer of 1950 the Arctic Institute of North America sponsored two ornithological investigations—a general one dealing with the birds of St. Lawrence Island and the Nome region of Alaska, carried on by T. J. Cade, of the University of Alaska; and a more detailed one dealing with the breeding populations of the Upland Plover (*Bartramia longicauda*) in the vicinity of Burwash Landing, Yukon, carried on by Irven O. Buss of the State College of Washington. An expedition to Baffin Island, led by P. D. Baird, Director of the Montreal office of the Arctic Institute, centered its activities on the east coast. An initial report on this expedition, including a discussion of the birds encountered, is to be published presently in the journal *Arctic*.

Dr. Ira L. Wiggins, of the staff of the Natural History Museum at Stanford University, has recently been appointed Scientific Director of the Arctic Research Laboratory at Point Barrow. This laboratory should furnish an excellent base for anyone interested in studying birds in the arctic. For particulars write the Scientific Director, Arctic Research Laboratory, Point Barrow, Alaska.

We are especially grateful to William C. Dilger, now a graduate student at Cornell University, for making the fine color-plate we are using as a frontispiece for this issue and volume. Mr. Dilger's extra time recently has been used in making a series of canary paintings for the French bird seed people. These we are eager to see in published form.

Jane S. (Mrs. Robert M.) Mengel has consented to serve as a member of our Illustrations Committee. This is good news for all of us—especially for her husband, who happens to be Chairman of the Committee.

A Science Annual, serving as a supplement to the Smithsonian Series, is now being prepared by the Series Publishers, Inc., of New York City. Webster P. True, Editor, who has written us of his plan to "reprint in the Annual some twenty-five or more of the year's outstanding articles appearing in scientific and technical journals," has asked permission to use "Barometric Pressure-Patterns and Spring Bird Migration," by Aaron M. Bagg, W. W. H. Gunn, D. S. Miller, J. T. Nichols, Winnifred Smith and F. P. Woolfarth, a paper which appeared in the March, 1950, issue of *The Wilson Bulletin*.

The Minnesota Ornithologists' Union and Editor Dwain W. Warner are to be commended for their recent publication in *The Flicker* of Arnold B. Erickson's "Bibliography of the Wilson's Snipe." It is to be hoped that other state organizations will exhibit from time to time a scholarly breadth of interest of this sort.

By invitation The Wilson Ornithological Club was officially represented at the inauguration of Dr. Louis Linden Madsen as President of Utah State Agricultural College at Logan on November 3, 1950. Maurice Brooks asked George H. Kelker, a sustaining member of the Club since 1938, to serve us in this capacity.

L. E. Richdale, Honorary Lecturer in Zoology at the University of Otago, New Zealand, and a member of The Wilson Ornithological Club since 1945, arrived in the United States last December. He visited at the University of California and the State College of Washington, stopped for several days in Chicago on his way east, and is now at Cornell University. His book, "The Sexual Behavior of Penguins," is being published by the University of Kansas soon. He plans to attend our annual meeting in Davenport. We hope that he will present a paper on albatrosses, petrels, or penguins—or all three.

Through an unfortunate oversight the name of Betty (Mrs. Herbert E.) Carnes was omitted from the list, published in the last issue of *The Bulletin*, of Americans attending the Tenth International Ornithological Congress in Sweden. Mrs. Carnes is President of the New Jersey Audubon Society. She has been a member of The Wilson Ornithological Club since 1944.

James P. Chapin, who is noted especially for his work on African birds, is now the President of the Explorers Club of New York. He was 'Distant Guest of Honor' at the recent twenty-seventh anniversary meeting of the Cleveland Bird Club.

We regret to announce that several defective copies of the December *Bulletin* were mailed to subscribers. If your copy of the issue had no colored frontispiece please write the Editor at once. A copy complete with color plate will be sent you if you will return the defective copy; or a separate color plate, which can be tipped in, will be sent. Please mail defective copies direct to the Editor.

Just as we go to press, Samuel A. Grimes, of Jacksonville, Florida, offers to have made "at no cost to the W.O.C." the color plates of the Wilson's Warbler kodachrome referred to editorially in our last *Bulletin*. Several other members already have made donations to the color plate fund. This money will be used in printing the plates Mr. Grimes so generously offers to have made.

Mrs. Marjorie Rine Olsen, of Elm Grove, West Virginia, has recently been helping her busy son Jim, our Treasurer, with some of the detail of his exacting job. For one thing she has been keeping straight all records pertaining to names and addresses of members. Mrs. Olsen deserves, and is hereby tendered, our thanks.

University and college students desiring free or inexpensive rooms during the April meeting of the Club should write at once to the Housing Committee, Davenport Public Museum, Davenport, Iowa.

The editors are grateful to the following for assistance in preparing for publication the material appearing in this issue: Aaron M. Bagg, Donald J. Borror, William L. Brudon, James B. Cope, William A. Lunk, Harold F. Mayfield, Ernst Mayr, Rogers McVaugh, Oscar T. Owre, Olin Sewall Pettingill, Jr., Elizabeth Reeder Schwartz, and Milton B. Trautman. Elsa Hertz, long a friend of the Club, has assisted through daily typing of letters and parts of manuscripts.

LETTER TO THE EDITOR

My admiration for the learning and stimulating hypotheses contained in W. J. Beecher's recent article "Convergent Evolution in the American Orioles" (1950. *Wilson Bulletin*, 62: 50–86) is unbounded. I feel, however, that the article ignores certain pertinent facts that, had they been included, might have led to conclusions very different from those presented.

Beecher separates the genus *Icterus* into two genera, *Icterus* and *Bananivorus*, on the strength of what he considers their independent origin from two ancestral South American genera. He thinks that evolutionary modifications have brought about color convergence in several modern species. These modifications have resulted, primarily, from "dietary" changes associated with climatic changes caused by geological events.

This interpretation of color evolution completely ignores a fundamental ornithological concept—namely, that the most striking color patterns in a very large number of species (males particularly) result from the needs of sex advertising, territorial advertising, warning, courtship display, and intraspecific recognition.

Similarly, the interpretation virtually ignores the colors of female orioles. Beecher does not explain why the diet and the climate that he believes have affected the males so remarkably has not similarly affected the females. Females are mentioned only casually and in only two sentences of the 36-page article. The statement, in one of these sentences, that "all orioles reaching the United States are sexually dimorphic" (p. 80) is not essentially true of either *I. graduacauda* or *I. gularis*. The interpretation likewise ignores the colors of immature birds. It is axiomatic that any attempt to trace phylogenetic relationships among birds must take account of immature and female plumages.

Beecher argues that all the American orioles are derived, ultimately, from a quite black ancestor, and that the general trend of evolution has been for black birds in one branch of descent to acquire yellow, and in another branch to acquire yellow, then black again. But, except for two South American species, *cayanensis* and *chrysocephalus*, *none of the 25 to 30 species of* Icterus *has anything approaching a quite black immature plumage*, and in no species does the female have more black in her plumage than the male. Furthermore (still excluding *cayanensis* and *chrysocephalus*), of the 60-odd forms of *Icterus* in which immature and female plumages are known, the immatures of all but one form (*bonana*) are predominantly yellow (i.e., yellowish, grayish yellow, or olive, etc.); and the females of all but 17 are predominantly yellow. In other words, it seems inescapable that the ancestry of practically all orioles but *cayanensis* and *chrysocephalus* contains a powerful yellow strain. Apparently, black figures little in their ancestry.

Instead of Beecher's two genera (which are weakly differentiated at best, and which contain many species whose inclusion in one genus or the other must be justified by only the most elaborate hypotheses and unverified assumptions) the scheme outlined below seems much more consistent with all the facts.

Icterus may be separated into three very distinct groups that might almost be regarded as subgenera:

1. *Black* birds with yellow shoulder patches. These are confined to South America. The females and young are quite dusky, or black like the males. One widespread species is involved: *I. cayanensis*.

2. *Black-throated* birds whose foreparts and underparts otherwise are yellow—though the black patch may sometimes extend over the face and across the forehead, and down to the breast. Their center of distribution is Central America, where they are numerous and variable. Of the 36 forms usually recognized, only one reaches North America (the region north of the Mexican border), three (of a single species) reach Jamaica and the Cayman Islands, and nine reach South America—though of the latter, three are conspecific with Central American forms, three have developed as isolated forms on small islands, and all are confined to the northernmost fringes of South America. Females of all forms are predominantly yellow, and nearly all immatures are quite yellow.

3. *Black-headed* birds with yellow (or reddish) rump. These are scattered over North, Central, and South America and the West Indies. In some species the sexes are alike; in some the females are yellow; and in most the young are yellow, or yellow with black throat. The troupials of South America (*I. icterus* and *I. jamacaii*) form a special subgroup in which the young are approximately like the adults.

This arrangement takes care of all the nearly 70 forms except *I. bullockii*, *I. jamacaii croconotus*, and *I. j. strictifrons*, all of which are obviously intermediate between black-throated and black-headed forms; *I. bonana*, an isolated insular "black-headed" form in which the head is "very dark chestnut or bay"; and the strange *I. chrysocephalus*. This last species is almost entirely black; the sexes are alike; the immatures are dusky; it is confined to a relatively small area in South America adjoining the range of *I. cayanensis*; and (as Beecher says) it is probably derived directly from *I. cayanensis*. It should be grouped with the black orioles.

Considering all these facts—well-defined differences among the three groups of males, great similarity of the young and of the females within each group, great difference of young and females in the black group from those of other groups, peculiarities of distribution, well-marked predominance of certain forms in certain areas—I do not see how we can escape the following conclusions:

1. The *black* South American orioles (*I. cayanensis* and *I. chrysocephalus*) probably stem from a black ancestor (as Beecher says), are indigenous to South America, and have not spread away from there.

2. The *black-throated* orioles show no evidence of having stemmed from a black ancestor; they almost certainly stemmed from a yellow ancestor; probably they originated in Central America, and from there invaded southwestern North America and northern South America.

3. The *black-headed* orioles show no evidence (in immature and female plumages) of having stemmed from a black ancestor; many of them must have stemmed from a yellow ancestor; and some of them seem to have stemmed from a black-throated ancestor. Perhaps *I. jamacaii croconotus* and *I. j. strictifrons*, with only the throat and the front half of the head black, and with ranges remote from the black-throated forms, may be only relicts of the ancestral black-throated form; or perhaps they represent a reversion toward the ancestral black-throated form.

In summary, the black South American orioles represent a distinct branch of *Icterus*; and the black-throated and the black-headed orioles represent another branch—with a strong probability that at least some of the black-headed forms descended from black-throated forms.

A hypothesis that might account for the development of black-headed orioles from black-throated ones follows:

Though immatures and females of the family Icteridae may be black, brown, tan, buffy, or yellow indifferently, mature males of the family have developed (or retained) black color characters to an extraordinary degree. Apparently black has great significance (sexual, defensive, aggressive, or attractive) in the family. If black is thus at a premium, it seems likely that black would be especially desirable at the periphery of range, where breeding or survival conditions would be comparatively difficult. If, then, black-throated orioles of Central America have spread from their ancestral optimum range to become a peripheral population, we might expect them to have developed larger and larger areas of black plumage, and thus to have become black-headed.

Admittedly, this is hypothetical. But it would explain the very marked preponderance (also noted by Beecher) of black-headed forms at the periphery of the range of the black-throated forms—in the West Indies, North America, and South America.

George G. Williams

The Rice Institute, Houston, Texas

ORNITHOLOGICAL LITERATURE

Grønlands Fugle. The Birds of Greenland. Part 1. By Finn Salomonsen. Ejnar Munksgaard, Copenhagen, 1950: 9 × 13 in., 158 pp., 17 color-plates and numerous decorative sketches by Gitz-Johansen. Paper. To be published in three parts, each at 60 Dan. kr. ($8.72), but parts cannot be supplied separately.

This handsome work, which promises to bring us up to date on the birdlife of the world's largest island, possesses to a remarkable degree the charm and rugged beauty of that island. At the beginning of each species writeup the Danish, English and Eskimo bird names are given in large type, together with a little drawing of the bird itself in black and white. The text is presented in two columns, Danish at the left, English at the right. The roughness of the color plates reminds us instantly of wind, cold sea water, and hard ice and rocks. The distributional paragraphs are a kind of symphony of place-names. Some of these all-but-unpronounceable agglutinated words (e.g., Seqineqarajugtoq and Tingmiakulugssuit, the names for certain mountains) will not bewilder students of the Eskimo language, for their etymology is clear enough; but even the initiated—those who recall that Angmagssalik is on the east coast and Upernavik on the west—will long for that "small scale map" which is, according to a statement in the introduction, to appear "at the back of the present book" (i.e., presumably, at the end of Part 3).

The distributional material of Part 1 might well have been shortened, simplified, or summarized. Users of the book will welcome detailed discussion of the areas throughout which a given species is known to breed. They cannot object to what at first seems to be over-use of long local names for cliffs, islands, fjords and tide-rips so long as certain general statements remain perfectly clear. But when, in order to ascertain just how far north and how far south a species breeds they have to resort to underlining they may well object to the obfuscating detail. A few statements are regrettably unclear or unidiomatic—e.g., that pertaining to *Branta bernicla*, a species which "has been recorded a few times as breeding south of its actual nesting-range" (p. 82). Some of the general summaries of species-distribution are not wholly satisfactory either. I know from personal observation that *Branta bernicla hrota* breeds southward as far as Lat. 64°N. on Southampton Island, and Gavin (1948. *Wilson Bulletin*, 59: 198) has reported its breeding in the Perry River district just south of Queen Maud Gulf, yet Salomonsen flatly states that the "pale breasted form (*B. b. hrota*) [is] restricted to Spitzbergen, N. Greenland, N. Ellesmere Island and Axel Heiberg Land" (p. 84).

The distributional data on the whole are excellent and exceedingly timely in view of the fact that the forthcoming Fifth Edition of the A.O.U. Check-List will cover Greenland as well as the Arctic Archipelago. The author makes clear that Leach's Petrel (*Oceanodroma leucorhoa*) is not actually known to nest in Greenland; that the nest of the Barrow's Goldeneye (*Bucephala islandica*) has yet to be found anywhere on the island; that the Pintail (*Dafila acuta*) breeds in some numbers on the west coast; that the Green-winged Teal (*Anas crecca*) has not actually been found breeding though it occurs with astonishing regularity in spring (adults) and from mid-September to mid-November (young birds); that the Greenland White-fronted Goose (*Anser albifrons flavirostris*) breeds "only in the low-arctic region of the West-coast, from 64° to 72° 30′ n. lat." (p. 59) and winters "in the British Isles, chiefly in Ireland" (p. 63). Definite statements of this sort have been made possible through banding. One banded Greenland White-fronted Goose has been recovered in December in North America—at Metis Beach along the St. Lawrence River.

Most of the 22 species written up in Part 1 are treated quite fully. The author has had wide experience in the north, but in discussing nesting habits, courtship, molts migration and the like he has, fortunately, drawn extensively on the experiences and writings of others. His repeated reference to the failure of certain species to breed during adverse summers, notably on the east coast, causes us to wish that this whole subject, as well as the irregularities of the mild periods he has written about elsewhere (1948. *Dansk Orn. Foren. Tidss.*, 42: 85–99), might have been discussed at greater length in the introduction. In many of the life history discussions use of the word 'nocturnal' is unfortunate in that it is almost certain to connote *darkness* to many readers. Students who have observed birds during the breeding season in the far north know full well how little actual darkness there is. The birds come and go, sing, court and feed almost literally at all hours, for the sky is light even in the middle of the night.

Of very special interest are the author's graphic discussion of the cliff-nesting of the Barnacle Goose (*Branta leucopsis*); the striking difference between the colonial nesting of the Eider (*Somateria mollissima*) on islets in salt water and the strictly non-colonial nesting of the King Eider (*S. spectabilis*) inland; the remarkable dependence of the Harlequin Duck (*H. histrionicus*) upon swiftly moving water; the migration of Brant across the notorious ice-cap; and the presence of the beaks of certain cephalopods in the stomachs of virtually all specimens of Fulmar (*Fulmarus glacialis*) examined. Hagerup's guess was that the Fulmars ingested these cephalopod beaks when eating "the faeces of the smaller whales, which feed on cuttlefish."

The Gitz-Johansen drawings are bold and sketchy to say the least. Their technique is exciting. They are not, primarily, bird illustrations at all, but Greenland landscapes or seascapes in which birds happen to figure. Crude as they are, their plant life, rocks, horizons, and skies are authentic. The most successful of them, possibly, is that of the Fulmar—a brisk study chilly enough to make one reach for one's overcoat. Among the least successful is the flying Oldsquaw (*Clangula hyemalis*), which is too small headed, too small footed, too dark in eye-color, and utterly motionless despite its spread wings.—George Miksch Sutton.

Distributional Check-List of the Birds of Mexico. Part 1. By Herbert Friedmann, Ludlow Griscom and Robert T. Moore. Cooper Ornithological Club, Pacific Coast Avifauna, Number 29, Berkeley, California, June 30, 1950: 202 pp., 2 colored plates (used also in *The Condor*). $4.00.

The authors of this first published list of Mexican birds make it quite clear in their introduction that they expect the work to be out of date just as soon as interested readers have had time to point out overlooked data in the literature and to correct the ranges of various species with which they may be individually familiar. Although a few published records have been overlooked, the big gaps in the ranges of many species are no doubt due to lack of published data. For example, the eastern range of the Rufescent Tinamou (*Crypturellus cinnamomeus*) is given as "southern Tamaulipas south through Central America," whereas the bird ranges northward through western Tamaulipas and eastern Nuevo León at least as far as the hills south of Linares. The Western Grebe (*Aechmophorus occidentalis*) is said to be "locally common to June 11" in Baja California, and to occur in certain other Mexican states in winter, whereas actually it is fairly common in several states throughout the summer. Adult and young birds may be observed on prairie lakes in Zacatecas and from the paved highway along the west shore of Lake Chapala, in Jalisco, in June and July. Such large and easily observed birds as the Wood Ibis (*Mycteria americana*) and Roseate Spoonbill (*Ajaia ajaja*) are not listed for the big state of Oaxaca, although both species are quite common in the marshes around Salina Cruz. Since it is probable that anyone using the book will consider the stated ranges as merely suggestive, these faults may be taken lightly. The thing of importance is that we do now have a published list and that some definite points in the range of each species have been set down. The Check-List is welcome and well worthwhile.

The family arrangement is that of Wetmore's "A Systematic Classification for the Birds of the World." The family name is given first, followed by the scientific and common name of the species. The general distribution of the species is given next. This is followed by the scientific name of each subspecies and the detailed range of each. The Mexican common name (usually Spanish, sometimes Mayan, etc.) of each subspecies is also given. Finally there is an excellent index of all the common and scientific names. The subspecies included are largely those recognized by Peters in his "Check-List of Birds of the World" but the authors have exercised "independent judgment" when that has been deemed advisable. In the Accipitridae they do not accept *Accipiter cooperii mexicanus* on the grounds that it seems doubtfully distinct; on the other hand they do accept *Cathartes aura teter* which would seem to be equally doubtful. No two taxonomists will ever agree on such points as these and until there is a definite rule adopted for the acceptance of subspecies on a statistical basis, such arguments will continue. On the whole, the subspecific treatment is sound and conservative.

In an attempt to make the list as useful as possible to field students and to visitors to México who do not collect, each subspecies which the authors believe can be identified in the field has been marked by an asterisk. Such thoughtfulness is certainly commendable. The inclusion of Mexican common names possibly was intended to serve somewhat the same purpose. However, if amateur field students attempt to use these names they will soon find that many of them are not the ones used locally. This is not a criticism of the distinguished Mexicans who supplied the names. We still have somewhat the same trouble in this country with common names supplied by the A.O.U. committee even after four editions of the Check-List.

There is, in the museum at Tuxtla Gutiérrez, Chiapas, a mounted Jabiru (*Jabiru mycteria*) specimen said to have been taken on the river near the city. Other Jabirus are reported to have been seen at the same locality. Since Miguel Alvarez del Toro, who is curator of the museum, is the only Mexican who has been contributing regularly to our ornithological magazines (several short papers or notes from him have appeared in *The Condor* and *The Auk*) it seems strange that he was not consulted. The Check-List indicates that the inclusion of the Jabiru was based on one lone record from Cosamaloapam, Veracruz.

In comparing the various groups in the list, the reviewer received the impression that the hummingbirds were more carefully covered than most other families. If true, this might suggest that the authors became more thorough as they progressed, for this is the last family in the book.—L. Irby Davis.

CANADA GEESE OF THE MISSISSIPPI FLYWAY WITH SPECIAL REFERENCE TO AN ILLINOIS FLOCK. By Harold C. Hanson and Robert H. Smith. Bulletin of the Illinois Natural History Survey, Urbana, Illinois, Vol. 25, Article 3, March, 1950: $6\frac{3}{4} \times 10$ in., pp. 67–210, frontispiece, 92 figs., 47 tables, bibliography. Paper, 1 copy free; cost of more than one copy to be determined by correspondence.

The authors have been far afield in gathering the material for this informative and detailed report. Hanson, as Game Specialist, spent several years at the Horseshoe Lake Refuge in Illinois where approximately 50% of the Mississippi River Valley Canada Geese wintered during the time of this study. He also spent parts of two summers in the James-Hudson Bay goose nesting area. Smith, as Flyway Biologist for the United States Fish and Wildlife Service, observed this and other Canada Goose populations in various areas of Canada and the United States.

Starting in the north, the authors discuss goose breeding grounds from the standpoint of geography, geology, vegetation, and nesting sites preferred by the geese. Information on the last point should be of great value to those attempting to rebuild Canada Goose breeding populations throughout areas in which the birds once nested commonly.

From this James-Hudson Bay production area the geese are followed south over their fall migration routes to various wintering concentration points in the United States. One of the more important stopping places in the fall is the famed Jack Miner Bird Sanctuary at Kingsville, Ontario. Here approximately 31,000 Canada Geese were banded between 1915 and the spring of 1944. A discussion of certain outstanding banding records is given.

The various wintering areas of the Canada Geese are taken up, with special emphasis on the Horseshoe Lake Refuge. In the discussion of this particular refuge, the annual hunting losses, the behavior of the geese, and the hunting methods are given primary importance. These points should also be of great importance to states such as Michigan and Wisconsin which each have a number of goose refuges.

The annual bag of the Mississippi Valley geese is separated into three main parts: that taken by Canadians, that taken by Indians on the goose breeding grounds, and that taken by people in the United States. Crippling losses and additional mortality factors are also included in this discussion. A summary of the material on productivity follows.

Having information on productivity, as well as trapping and banding data of the Jack Miner Bird Sanctuary and the Horseshoe Lake Refuge, the authors went further and tried to determine population survival; they found the data inadequate and biased however, so felt that their findings were only approximate.

One of the most important results of the study of the Jack Miner banding data was the discovery of a distinct and heretofore unrecognized group of Canada Geese that winter in the inland areas of Virginia, North Carolina, South Carolina, Georgia, Alabama, and the Gulf Coast of Florida. Because management of the Mississippi Valley goose population should be guided to some extent by a knowledge of neighboring goose populations a brief summary of the breeding and wintering ranges, as well as the migration paths of this newly defined group of Canada Geese, named the 'Southeast population', is given. Other flyway populations are also described.

To meet the problems of the Mississippi River Valley goose population, created by the geese of the Horseshoe Lake Refuge, proper management techniques were applied. At present the population has responded and recovered from its low point of 1945–46.

In summary, this bulletin with its numerous illustrations and well-founded and detailed information should certainly be studied by all concerned with game management and related subjects. The authors have done a very commendable job in bringing together data from widely separated areas on this species.—Laurence R. Jahn.

THE WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been recently received. From:

Edgar P. Chance—5 pamphlets
Karl W. Haller—4 books
Fr. Haverschmidt—2 reprints
David W. Johnston—5 reprints
Leon Kelso—2 pamphlets
Charles M. Kirkpatrick—1 reprint
Margaret R. Knox—3 magazines
Rosario Mazzeo—16 magazines
James Nessle—2 books
Margaret M. Nice—3 books, 8 reprints, 1 magazine
Allan R. Phillips—10 reprints
Frank A. Pitelka—4 books
Hustace H. Poor—62 volumes of magazines, 8 books
L. L. Snyder—1 pamphlet
O. A. Stevens—1 reprint
Robert E. Stewart—1 reprint
Robert W. Storer—1 reprint
R. M. Strong—29 magazines
University of Wisconsin Department of Wildlife Management—7 reprints
Josselyn Van Tyne—5 reprints
George J. Wallace—1 reprint
F. A. Ward—2 magazines
Harriet Woolfenden—1 book

HORMONES AND CYCLES: A REVIEW

BY DEAN AMADON

The basic causes of cycles in the abundance of hares, voles, grouse and other northern animals are still but little understood. Disease, predators, and parasites have all been suspected, but these are now generally believed to be, if involved at all, no more than contributing factors. Starvation is not likely to be a cause of cycles, except in the case of certain predators which may have secondary cycles reflecting fluctuations in the numbers of their prey. Efforts to show that cycles are caused by sun spot fluctuations have not met with success.

Some years ago Green and Larson (1938) found that at the time of cyclic die-off in the Varying Hare, *Lepus americanus*, in Minnesota, large numbers of these animals perished suddenly of hypoglycemic shock. This "shock disease" involves no pathogenic organism, but has as its immediate organic cause a failure of the liver to store glycogen. Any mild stress, e.g., exercise or capture, may induce convulsions and death in hares at such periods. The significance of these facts became more evident in the light of Selye's (1950) later research on the effects of stresses upon laboratory animals. His findings have been summarized by White (1950: 394) as follows: " . . . all living organisms can respond to stress as such, and . . . in this respect, the basic reaction pattern is always the same, irrespective of the agent used to produce stress. He (Selye) has called this response the General-Adaptation-Syndrome, and its derailments the Diseases of Adaptation." Physiologically, this adaptive response involves the secretion of the adrenocorticotrophic hormone (ACTH) by the pituitary and of the cortisone hormone by the adrenal cortex. Probably other hormones are involved as well, for example, one of the spleen now being investigated at the marine biological station at Naples, a hormone which, it is thought, may be responsible for the phenomenon of "second wind" in man (Crammer, 1950: 361).

Selye pointed out that the shock disease of hares resembled what he called the "diseases of adaptation", but it remained for Christian (1950) to emphasize that Selye had provided what would seem to be a satisfactory explanation of the sudden decimations that occur in cyclic species. Christian visualizes the process as follows (p. 253): "Exhaustion of the adreno-pituitary system resulting from increased stresses inherent in a high population, especially in winter, plus the late winter demands of the reproductive system, due to increased light or other factors, precipitates population-wide death with the symptoms of adrenal insufficiency and hypoglycemic convulsions."

Are birds subject to shock disease? So far as I know, it has not been reported, though the "autumn madness" of Ruffed Grouse, *Bonasa umbellus*, might be correlated with such disturbances. Most investigations of the cycles of this bird have tended to show that the periodic decreases result from heavy mortality of chicks (Bump, Darrow, *et al.*, 1947). This might mean only that in grouse, apparently unlike hares or voles, shock disease occurs among immatures rather than adults. A recent experiment conducted by the New York State Conservation Department (Anon., 1950) did precipitate a "population crash" in Ruffed Grouse and Varying Hares during the winter. The experiment was conducted on Valcour Island (area about 1000 acres) in Lake Champlain. Predators were intensively controlled on this island for a period of five years. Both grouse and hares increased rapidly, but in the winter following the third year there was a drastic decrease in both species. This was attributed, though apparently without much evidence, to disease. Populations on a control area on the mainland remained almost stable. It seems entirely possible that the crash in the two species followed collapse of hormonal defense against multiple stresses following over-population. Most investigators have found that cyclic decreases in grouse populations are correlated with population density.

In the paper mentioned above, Christian assumes that in species not known to be cyclic, e.g., the Beaver, *Castor canadensis*, the population is held below the critical level by other factors, such as predation by man. It seems possible, however, that collapse of the adreno-pituitary system, with resulting shock disease, in voles and hares is in itself an adaptation to reduce the population of these prolific, short-lived species drastically at times of over-abundance, so that the stresses on the remaining nucleus of breeding stock are quickly alleviated. Wolves and other carnivores, on the other hand, are so very resistant to cold, semi-starvation and other privations that they may never be subject to sudden hormonal deficiencies caused by stress. In man himself, adreno-pituitary exhaustion is often a physiological symptom of schizophrenia resulting from stress—a condition not necessarily fatal (White, *op. cit.*). An even more gradual impairment of the hormonal defense mechanism is implied in the suggestion that the greater average longevity of women as compared with men reflects a "better-damped reaction to stress" (Comfort, 1950).

Investigation of the role played by hormonal deficiencies in population fluctuations among birds will require both field and laboratory studies. The hormones involved in the physiological adjustment of the mammal to stress are proving of great significance in medicine and biology. Does a similar physiological mechanism exist in birds?

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THE DINGELL-JOHNSON ACT: WILL IT BENEFIT BIRD-LIFE?

An eleven-year fight was won on August 9, 1950, with the passage of the Dingell-Johnson Bill (Public Law 681, 81st Congress, 2nd Session). This Act, which will become effective July 1, 1951, will do for fisheries conservation what the Pittman-Robertson Act has done for wild game. Together, these two pieces of legislation will advance all fields of conservation, benefiting bird-life indirectly.

The Dingell-Johnson Act authorizes the appropriation of such moneys as may be collected from a 10 percent Federal tax on " . . . fishing rods, creels, reels, and artificial lures, baits, and flies . . . " for the preceding fiscal year. The bill *authorizes* the appropriation, but the appropriation proper must be made annually by the Congress. In this respect it differs from the Pittman-Robertson Act which, as now amended, sanctions use of the taxes collected from sporting arms and ammunition during the preceding fiscal year without further action by Congress. The money is proportioned to the States, after they have met qualifications similar to those of the Pittman-Robertson Act. The proportionment is thus: 40 percent in the ratio which the area of each State, including coastal and Great Lakes water, bears to the total area of all the States; and 60 percent in the ratio which the number of persons holding paid licenses to fish for sport or recreation in the State bears to the number of such persons in all the States. No State shall receive less than 1 percent nor more than 5 percent of the total amount appropriated; Alaska, Hawaii, Puerto Rico and the Virgin Islands are provided for. No more than 8 percent of the annual appropriation may be used for administration.

Any money which is appropriated to any State and not expended in the two years' time limit may be used in carrying out the research program of the Fish and Wildlife Service in respect to fish of material value for sport and recreation. This provision should make available to the Service money badly needed for research on migratory fish which, like migratory birds, do not lend themselves well to individual State research or management.

The enabling legislation has defined "fish restoration and management projects" to mean projects designed for the restoration and management of all species of fish which have material value for sport or recreation in the marine and/or fresh waters of the United States. Types of projects acceptable under the law include (1) research projects; (2) management investigations; (3) stocking of waters with food and game fishes including an investigation of the efficacy of such projects; and (4) selection, restoration, rehabilitation and improvement of areas of water or land adaptable as hatching, feeding, resting or breeding places for fish. After 1953, not more than 25 percent of the money allotted to each State may be spent for the maintenance of water areas acquired and developed under the provisions of this Act.

Twenty-five percent of the money required for any of the types of projects listed above must be supplied by the individual State, and the remaining 75 percent is provided by the Federal government under the Dingell-Johnson Act, as with the Pittman-Robertson Act. It is estimated that the Federal tax on sport fishing gear will produce an income of about \$3,000,000. If this amount is appropriated by the Congress, and assuming that some 15,000,000 fishing licenses are sold annually, the individual States would receive amounts varying between \$26,000 and \$132,000 from the Federal government for fisheries work. These figures would be increased by the 25 percent matching funds from the several States.

It has recently been announced that the Dingell-Johnson Act, like the Pittman-Robertson Act, will be administered for the Federal government by the Branch of Federal Aid of the Fish and Wildlife Service, Department of the Interior. Most conservationists agree that this is a wise decision, as this Branch has had more than a decade of experience in administering the Pittman-Robertson funds and has already established a high reputation with the wildlife agencies in each of the 48 States and possessions.

It is obvious that the advancement made possible by this Act will benefit the entire conservation field, especially as provisions are made for employing professionally trained personnel for work in every section of the United States and its possessions. The addition of this relatively large number of full-time wildlife biologists to the existing conservation force is certain to elevate many spheres of natural history other than fisheries. Further, the acquisition and management of land and water areas, as made possible by Dingell-Johnson money, should benefit other forms of animal life as well as fish. For example, it has been demonstrated repeatedly that the acquiring and developing of federal migratory waterfowl areas have been of substantial benefit to many forms of birdlife other than waterfowl. Likewise, it is entirely possible that the acquisition and development of water areas, and certain adjoining land areas, for fisheries purposes will be beneficial in its effect upon many forms of our birds. As a result of the acquisition and developmental program of the Dingell-Johnson Act, ornithologists may expect to have at their disposal many additional outdoor laboratories, with sympathetic and cooperative fellow workers in charge of these areas.

The passage of the Dingell-Johnson Act, notwithstanding the fact that it has been presented annually to the Congress for many years, poses one rather serious problem, namely, that of immediately securing adequately trained personnel. Where will the trained personnel come from, as of July 1, 1951, to carry out the provisions of this legislation in each of the 48 States? This problem has given the State fisheries people much concern as they know only too well that they require personnel trained to secure biological facts, work with sportsmen, and *get practical results on the ground or in the water.* Perhaps the best type of training for state conservation work is that of serving an apprenticeship in the field, working on a typical project, while taking academic training. It is obvious that adequately prepared personnel, with both academic and "practical" experience, cannot be trained in a hurry. Most states will have their projects up for consideration well in advance of July 1, 1951. Where will the personnel be secured to make the best use of the funds then available? Will the fisheries people repeat some of the mistakes made by certain early Pittman-Robertson project-leaders in undertaking general life history studies with inexperienced personnel and thus throw the stigma of "impractical" on all fisheries research under the Dingell-Johnson Act? Will they, in the rush to secure the needed men, settle for individuals whose qualifications do not justify their assuming leadership responsibilities in the States fisheries field but who will assume such leadership merely because they were the first employed and thus have greater seniority? The inroads which will be made upon conservation personnel by the present military preparedness program may further complicate fisheries personnel problems.

There is little question that the Dingell-Johnson Act will go down in history as one of the most important steps forward in the entire field of conservation. We all have cause to rejoice in its passage.—H. S. Mosby and W. W. H. Gunn.

GRADUATE RESEARCH IN ORNITHOLOGY

Several readers of *The Wilson Bulletin* have expressed interest in learning the extent to which graduate students in American universities were conducting ornithological research in fulfillment of their thesis requirements for advanced degrees. It would be even more interesting to learn of *all* current bird research in the country, but a compilation of that scope we do not have the temerity to tackle, and the present preliminary summary is limited strictly to research being conducted by graduate students. Editor Sutton requested us to assemble what information we could, and as a start we wrote each of the institutions known by us to encourage theses on ornithological topics.

Some workers object to having current research mentioned in print until it has been completed and published in full and final form. They may feel that publishing the titles below will be interpreted as "staking out claims," a procedure which could, possibly, in some cases, hinder research. Outweighing such hazards, we think, are several benefits. Readers of *The Bulletin* undoubtedly have a lively interest in current ornithological research throughout the country. Some graduate investigations might be of such nature that Wilson Club members, once informed of them, could offer cooperation. In some instances unnecessary duplication of effort might be forestalled. Members planning future graduate work might be aided in their choice of a school. At any rate, your reaction as readers may determine whether the compilation will be attempted in future years.

It is recognized that such an initial effort as this cannot but be incomplete for a variety of reasons. In several cases the response indicated that some students would be selecting thesis topics later. Some reported no ornithological theses in progress just now, but made clear that this type of work was encouraged when possible. Many institutions doing such work we doubtless overlooked, for which we apologize, but we hope that the publication of this preliminary list will stimulate communication from them. Finally, several institutions have not yet responded, probably for perfectly legitimate reasons. Ornithologists are well known to be far-flung travelers, and some of the persons to whom our inquiries were directed have likely been engaged in field work of their own at points not easily accessible to the U. S. mails. One response we received was from Saudi Arabia: for this one we were especially grateful. We hope that those institutions whose ornithological graduate work is not adequately represented in this preliminary list will send us additional information promptly, so that a further report may be more complete.

The degree toward which a student is working is stated in some cases, not in others: we are giving here only such information as has been passed on to us. Theses in the general field of game management, even if concerned with avian species, we have not included. A classified list of graduate theses submitted in American universities between 1934 and 1949 on "subjects related to the ecology and management of wildlife" appeared in *The Wildlife Review* for February, 1950, and its editor, Neil Hotchkiss, of the U. S. Fish and Wildlife Service, has indicated his desire to continue issuing this occasionally to keep it up to date. He has another list in preparation now.

The list which follows is limited to theses which were in progress at the time of writing (July to December, 1950). Some of these may have been completed since that time:

California, University of

Bailey, Robert E.—The incubation patch of birds.

Childs, Henry E.—Population studies of the Brown Towhee (*Pipilo fuscus*).

Cogswell, Howard L.—Size of territory in chaparral birds in relation to vegetation.

Dixon, Keith L.—Comparative ecology and behavior of sympatric and hybridizing species of titmice.

Howell, Thomas R.—Natural history and differentiation in *Sphyrapicus varius*.

Norris, Robert A.—A comparative study of the biology of the nuthatches *Sitta pygmaea* and *Sitta pusilla*.

Richards, Lawrence P.—Morphologic adaptations in the drepaniids of Hawaii.

Salt, G. W.—Metabolic characteristics of three species of finches (*Carpodacus*) in relation to zonal distribution.

Cornell University

Dilger, William C. (M.S.)—A bibliography of the ornithology of India.

Fischer, Richard B. (Ph.D.)—Life history of the Chimney Swift (*Chaetura pelagica*).

Hawksley, Oscar (Ph.D.)—Life history of the Arctic Tern (*Sterna paradisaea*).

Hensley, Marvin M. (Ph.D.)—The ecology of the birdlife in Organ Pipe Cactus National Monument.

Kessel, Brina (Ph.D.)—The life history and management of the Starling (*Sturnus vulgaris*) in New York State.

Meng, Heinz (Ph.D.)—Life history and management of the Cooper's Hawk (*Accipiter cooperii*).

Owen, Oliver S. (Ph.D.)—The ecology of birdlife in a black ash swamp.

Parkes, Kenneth C. (Ph.D.)—Speciation in the breeding birds of New York State.

Reilly, Edgar M. (Ph.D.)—The origin of North American birds, based on studies for the new A.O.U. Check-List.

Florida, University of

Adams, Claude T.—Osteology of the Ardeidae.

Baumel, Julian J.—Comparative osteology of the Fish Crow (*Corvus ossifragus*) and the Common Crow (*Corvus brachyrhynchos*).

Burns, Bartley J.—Ecology of the birds of Newnans Lake, Florida.

Dennis, John V.—Ecology of Florida woodpeckers.

Dickinson, Joshua C., Jr.—Variation in the Towhee (*Pipilo erythrophthalmus*).

Fehon, Jack H.—Comparative osteology of rails.

Glatfelter, Alfred E.—Comparative osteology of jays of the genera *Cyanocitta* and *Aphelocoma*.

Hicks, Thomas W.—Geographical variation of the Bluebird (*Sialia sialis*).

Nelson, Gideon E., Jr.—Ecology of the birds of Welaka, Florida.

Kansas, University of

Baker, M. F.—Natural history of the Prairie Chicken (*Tympanuchus cupido*) in Kansas.

Harder, R. C.—Ecology of the Cardinal (*Richmondena cardinalis*) in eastern Kansas.

Louisiana State University

Arney, S. A. (Ph.D.)—A telescopic study of day-time migration. (Several other Master's and Ph.D. candidates, with specific topics not yet selected, will be working on problems concerned with geographic variation, speciation, life-history, and the mechanics of day-time and nocturnal migration).

Michigan, University of

Batts, H. Lewis, Jr. (Ph.D.)—An ecological study of a 60-acre portion of the Newcomb Tract, near Ann Arbor, Michigan, with special reference to the nesting birds.

Hofslund, Pershing B. (Ph.D.)—A life-history study of the Yellow-throat (*Geothlypis trichas*).

Humphrey, Philip S. (Ph.D.)—Analysis of the Mergini.

Lunk, William A. (Ph.D.)—Life history of the Rough-winged Swallow (*Stelgidopteryx ruficollis*).

Mengel, Robert M. (Ph.D.)—Birds of Kentucky.

Tordoff, Harrison B. (Ph.D.)—Osteology and phylogeny of the Fringillidae.

Texas, University of

Thompson, William L.—Survey of the ecological distribution of the summer birds in the "Canadian Breaks" in Hutchinson County, Texas.

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Caskey, Jesse—Melanophores in silky fowl.

Gehrman, Kenneth—Life history of the Lesser Scaup Duck (*Aythya affinis*).

Mewaldt, Leonard—The reproductive cycle of Clark's Nutcracker (*Nucifraga columbiana*).

Schottelius, Byron—Blue Grouse (*Dendragapus obscurus*) populations in Washington.

Trivette, Edward—Leg muscles of charadriiform birds.

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Greeley, Frederick (Ph.D.)—Endocrine factors in adaptation to environmental stress in birds.

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Huntington, Charles E.—A survey of the Icteridae.

Paynter, Raymond A., Jr.—Avifauna and speciation in the Territory of Quintana Roo in México.

—Aaron M. Bagg and Gustav A. Swanson

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. Use figures for all definite weights, measurements, percentages and degrees of temperature (for example: 2 kgm., 1 inch, 20.5 cc., 300°C.). Spell out indefinite and approximate periods of time and numerals used in a general manner (for example: one hundred years ago; about two and one-half hours; seven times). 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. Follow carefully the style used in this issue in listing, after the paper, 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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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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DAVENPORT, IOWA, APRIL 27–28, 1951

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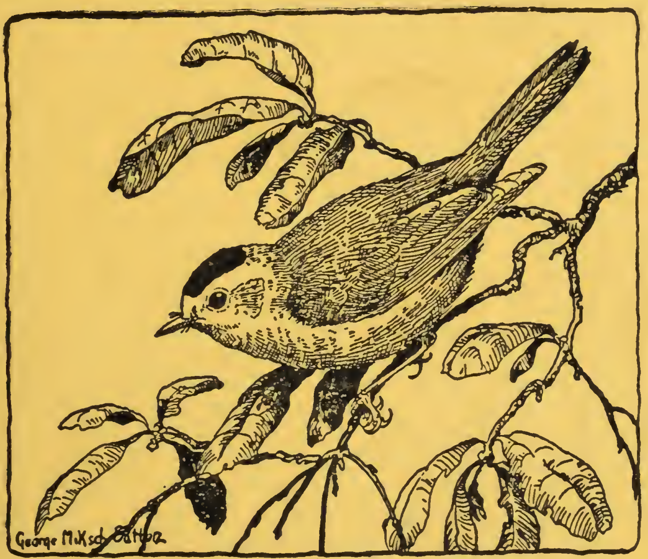

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The Wilson Ornithological Club

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Named after Alexander Wilson, the first American ornithologist.

President—Maurice Brooks, West Virginia University, Morgantown.

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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 2 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 of 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 85 periodicals, as gifts, and in exchange for *The Wilson Bulletin.* With the usual exception of rare books in the collection, 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 preliminary index of the Library's holdings was printed in the September 1943 issue of *The Wilson Bulletin*, and each September number lists the book titles in the accessions of the current year. A brief report on the recent gifts to the Library is published in every issue of the *Bulletin.*

The Wilson Bulletin

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THE PRESIDENT'S PAGE

This letter is devoted to the memory of Dr. Lynds Jones, whose recent death may fairly be said to mark the end of an era in Wilson Club affairs. During the early and formative years of the organization, Lynds Jones, in a very real sense, *was* the Club. With his passing, we have with us only one remaining founding member, Dr. R. M. Strong, of Chicago.

When the Wilson Club was organized in 1888, Lynds Jones became its first Secretary and its first Editor. He served as President of the organization from 1890 to 1893, from 1902 to 1908, and from 1927 to 1929. As Editor of *The Wilson Bulletin*, his tenure included the years 1888–1900, and 1902–1924, a total of thirty-four years of the Club's existence.

Long associated with Oberlin College, an institution which dared depart from accepted academic traditions, Dr. Jones was himself a pioneer and an innovator in bird study. He saw the field of ornithology as embracing more than taxonomy and physiology. Early issues of the *Bulletin* carried at their masthead "A Quarterly Magazine Devoted to the Study of Living Birds." In its pages vernacular names were used, since the Editor wished to appeal to a wider audience than the small coterie of scientists who were at ease in scientific nomenclature. Almost every early issue carried life history studies, and there were constant editorial urgings that bird students apply some quantitative methods to their observations.

Scientific bird study, around the turn of the century, was, to a remarkable degree, restricted to the Eastern Seaboard and the Pacific Coast. Students from eastern centers visited and collected in the midlands of the United States, but resident observers in the Mississippi Valley were few and far between. Along with such pioneers as Thomas S. Roberts, Francis Hobart Herrick, and Norman A. Wood, Lynds Jones did much to make the Midwest *terra cognita* in ornithology. With these men and such others as S. Prentiss Baldwin and V. E. Shelford, Dr. Jones led students into the pathways of ecology. As a result of this wise guidance, the mid-continent region has become a center for sound and productive ecological work.

I shall not forget my first Wilson Club meeting. Like many another neophyte, I went to Cleveland not knowing a single person at the meeting. Through a process of mental agonizing, I had screwed up my courage to present a paper, a superficial (and generally worthless) study of Bachman's Sparrow. It set no rivers ablaze, but Lynds Jones was President, and, with innate courtesy, he spoke kindly to me. Had that word of encouragement not been given, I should probably not have attended another meeting. In this kindly attitude toward the beginner a pattern was established, and the Club is still striving to follow it.

When the Club's membership roll was published in 1902, fourteen years after organization, it contained the names of sixty active members, four honorary members, and fourteen associates. Nevertheless, the foundation was sound. The Club has grown through its devotion to accurate and painstaking study of living birds under natural conditions. May we as present members recall the debt we owe to Dr. Lynds Jones, who charted so wise a course for us!

MAURICE BROOKS

MEXICAN RUFESCENT TINAMOU

(*Crypturellus cinnamomeus mexicanus*)

Adult female, life-size, sketched March 4, 1938, along the Río Sabinas, near the hill village of Gomez Farias in southwestern Tamaulipas, México, by George Miksch Sutton. This is the first of a series of eight color plates honoring the memory of Dr. David Clark Hilton.

THE RUFESCENT TINAMOU

BY GEORGE MIKSCH SUTTON

THE Rufescent Tinamou (*Crypturellus cinnamomeus*) is the most northern of the tinamous. Friedmann, Griscom and Moore, in their useful 'Distributional Check-List of the Birds of México,' inform us that in western México it ranges northward to central Sinaloa, "breeding up to 3000 feet." In the east it is common locally northward to the Río Sabinas, in southwestern Tamaulipas. I have heard it also in the valley below the Mesa de Llera, not far south of Victoria; and Irby Davis has recorded it in eastern Nuevo León, in the hills south of Linares.

In southern Tamaulipas it is especially common in the all but impenetrable, waist-high thicket of wild pineapple (*Bromelia pinguin*). Here its whistle, a mellow, slightly quavering *who-ee-you*, is to be heard all day in spring. Here it passes its whole life, hidden from the outer world, rarely flying, rarely even having occasion, it would seem, to cross a trail. I wonder if there is a more strictly sedentary bird anywhere. Only twice, during the course of several expeditions to México, have I seen a Rufescent Tinamou in full flight. On each occasion the bird acted as if it had never flown before.

I saw my first Rufescent Tinamou in the early spring of 1938. That year Thomas D. Burleigh, the late John B. Semple and I spent several days along the Río Sabinas, seeing for the first time many tropical birds with which we were to become familiar later. I recall how puzzled we were when the Mexicans told us that these whistling birds we were hearing in the flood-plain about us were *perdiz*. Translating the word as *partridges*, we were at a loss to figure out what sort of galliform birds they might be. Semple finally secured a specimen —a badly mutilated one with only a little of the bill left. Our mingled joy and regret can be imagined—joy at examining in the flesh our first crypturiform bird, regret at realizing how useless it would be as a model for the portrait I wanted so much to draw!

Finally, after devoting virtually a full day to the project, I got a tinamou. I never shall forget the peculiar thrill I had in seeing that beautiful specimen lying beside the trail. The sun had disappeared back of the mountain long since, so evening was descending, but I could see, even in the dim light, how pale the large eyes were; and I was much impressed by the coral-redness and peculiar, almost waxy smoothness of the feet. My watercolor drawing I made the following morning, several hours after the bird's death.

We did not find the nest of the *perdiz* in 1938; but on May 2, 1939, in dry, scrubby woods a few miles north of Valles, San Luis Potosí, I stumbled upon a nest and two eggs under a dead palmetto fan in a tangle of shrubbery and cat's claw smilax. The bird scuttled off, running this way and that with wings spread and drooping, head lowered, and bill parted. It gave low, breathy squeals, which at first I did not recognize as coming from the bird. On preparing the specimen later I was surprised to find it a male, with greatly enlarged testes. The eggs were lustrous but not highly glossed, and of a faintly purplish pale tan color. A nest found by a Mexican friend along the Sabinas about April 20, 1941, held three eggs. We were told that the clutch was never larger than that. I have never seen a downy chick.

The Rufescent Tinamou's whistle can be imitated easily, and it is possible to station one's self in the thicket and whistle the bird up. In the spring of 1941 Dwain W. Warner whistled one up to within a few feet, struck a fence wire with his gun to see what the bird would do, and was surprised to see it crouch with wings spread. When he struck the wire again it whirred noisily up and straight off (1942. *Auk*, 59: 7). Straight flight may not be intentional; it may be the only flight of which the bird is capable. The tail is so very short that it probably does not serve as a rudder.

In 1947 Ernest P. Edwards whistled a bird up and took wonderful motion pictures of it as it ran through the tangle.

It is hard to believe, as one drives southward along the main Laredo to Mexico City highway that there are tinamous within hearing distance of kilometer mark 619—but there they are; and there they will continue to be as long as the thicket remains. If the thickets go, the tinamous will go with them.

University of Michigan Museum of Zoology, Ann Arbor

THE NORTHERN ELEMENT IN THE SUMMER BIRD LIFE OF SOUTH-CENTRAL NEW ENGLAND

BY WENDELL TABER

FROM the White Mountains in New Hampshire a broad, high plateau extends southerly through that state, then across Massachusetts and Connecticut toward Long Island Sound. On a line extended southerly from Mt. Moosilauke (a peak of 4810 feet elevation some 31 miles southwest by west of Mt. Washington) 15 or more peaks in New Hampshire attain altitudes of between 2000 and 3300 feet. Other peaks lie to the east. On this same line in Massachusetts altitudes of 1200 to 1400 feet are numerous, and one peak to the east rises to over 2000 feet. Westerly of the line the plateau falls off sharply to the Connecticut River, which in northern Massachusetts has an elevation of 200 feet or less. On the line still farther, in Connecticut, altitudes of 900 to 1000 feet are frequent and two eminences near the town of Union reach almost 1300 feet. The formation changes, though, into one of high, flat, parallel ridges flanking broad river valleys, all taking a generally north and south direction and gradually losing altitude as they approach the coast.

On Mt. Washington, 6288 feet, the highest peak in northeastern North America, the tree-line is at about 5000 feet. Above this elevation the flora is arctic-alpine. In the Sandwich Range, 25 miles to the south, I have found breeding at about the 3000-foot level such birds as the Canada Jay (*Perisoreus canadensis*), Acadian Brown-capped Chickadee (*Parus hudsonicus littoralis*), Bicknell's Gray-cheeked Thrush (*Hylocichla m. minima*), and, once, the American Three-toed Woodpecker (*Picoïdes tridactylus bacatus*). My observations of the last-named species there are quoted by Bent (1939: 120).

Farther south in New Hampshire the flora and summer avifauna of the plateau continue to conform to the altitude rather than the latitude in possessing a strong northerly tinge. Thus, near Fitzwilliam, New Hampshire (maximum altitude in the vicinity nearly 1900 feet), not far north of the towns of Royalston and Winchendon in Massachusetts, trees such as the balsam (*Abies balsamea*), red spruce (*Picea rubens*), and larch (*Larix laricina*) are common; hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*) and paper birch (*Betula papyrifera*) occur in moderate-sized stands; and the ground hemlock or yew (*Taxus canadensis*) is local. Over a period of 14 years I have found the following birds nesting in the region at 1000 to 1300 feet elevations: Alder Flycatcher (*Empidonax traillii*), Olive-sided Flycatcher (*Nuttallornis borealis*), Winter Wren (*Troglodytes troglodytes*), Magnolia Warbler (*Dendroica magnolia*), and Myrtle Warbler (*Dendroica coronata*). The White-throated Sparrow (*Zonotrichia albicollis*) is common. Near Royalston, Massachusetts, I saw a pair of Slate-colored Juncos (*Junco hyemalis*) on June 17, 1938. Their behavior indicated that they were nesting.

John H. Conkey, a conservative field ornithologist who was Secretary of the Nuttall Ornithological Club prior to his removal to Ware, Massachusetts, in 1934, informs me (*in litt.*) that in the Ware and Quabbin Reservoir region of Massachusetts, which traverses about half of the state (roughly the half lying between the northern quarter and the southern quarter), the hemlock and paper birch are common, the red spruce uncommon, and the beech and yellow birch (*Betula lutea*) local. He informs me, too, that he considers the following to be characteristic summer birds: Alder Flycatcher, Brown Creeper (*Certhia familiaris*), Blue-headed Vireo (*Vireo solitarius*), Nashville Warbler (*Vermivora ruficapilla*), Black-throated Blue Warbler (*Dendroica caerulescens*), Blackburnian Warbler (*Dendroica fusca*), Northern Water-Thrush (*Seiurus noveboracensis*), and Canada Warbler (*Wilsonia canadensis*). My own scattered records over a period of years are corroboratory. Additionally, I recorded a Winter Wren near Winchendon in the aforesaid northerly quarter in a suitable breeding site, and a Myrtle Warbler and a White-throated Sparrow in the adjoining township of Ashburnham, all on June 7, 1947. Aaron M. Bagg informs me (*in litt.*) that he heard an Olive-sided Flycatcher in a spruce swamp near the Winchendon Township line on June 27, 1950. Data presented by E. H. Forbush (1927) clearly indicate that most or all of the above-mentioned birds are summer residents of this plateau region in Massachusetts.

In the course of numerous trips between Boston and Hartford, Allen H. Morgan and I became intrigued by the sparsely inhabited, densely forested highlands we crossed in the northeastern corner of Connecticut. Two exploratory trips made by Aaron M. Bagg to the region heightened our interest. After many delays we finally visited this area in early July, 1950. Bagg, unfortunately, was unable to join us. Arriving at Bigelow Hollow State Park, near the town of Union, on the evening of July 1, we camped there.

A notable feature of the Park is an extremely narrow, densely timbered, mile-long gorge, through which flows Bigelow Brook, the outlet stream from Mashapaug Pond, elevation 706 feet. Hemlock is dominant in this gorge. Descending at a moderate rate, the ravine debouches suddenly into a large, irregularly shaped pond, Bigelow Pond, elevation 636 feet, tucked in among 900-foot hills covered with hardwoods. The shores of the pond are badly fouled with a tangled mass of long-dead trees, many of them still standing. From the pond the brook continues its descent at a greatly decelerated rate, through the Yale Forest, meandering down a fairly narrow valley filled with alders. Hills covered with hardwoods rise to over 1000 feet at either side.

So much attention has been paid to the *southern* element in the bird life of south-central New England that ornithologists are all but unaware of the boreal element there. The part of northeastern Connecticut which I have briefly described just above, together with northwestern Connecticut, contiguous parts of New York, and the New York-New Jersey-eastern Pennsylvania hills form a southward-projecting boreal 'finger' comparable to—though of course less pronounced and less southerly in extent than—that of the main Appalachian chain and that of the great Rocky Mountain system of the west. Merriam, in his "A Review of the Birds of Connecticut, with Remarks on their Habits" (1877: 1–2) and Sage and Bishop (1913: 8) mention, respectively, the 'Canadian Fauna' and 'Canadian elements in the avifauna' of Connecticut, but do not give much attention to them as such. The breeding status of several of the 'northern' birds of this area has not, to my way of thinking, been fully enough stressed anywhere.

This strong 'northerly tinge' of the bird life contrasts rather sharply with the 'Carolinian tinge' of the Connecticut River valley itself, an area which has been described by Bagg and Eliot (1937). The same may be said of the coastal plain region of northeastern Massachusetts, parts of which lie east of southern New Hampshire. This coastal area has been described in detail by Townsend (1905; 1920) and more briefly by Stubbs and Emilio (1931).

Worth repeating is the fact that one is never far from this southern element when doing field work in the plateau region. On July 1, in North Woodstock, Connecticut, some ten miles east of Bigelow Hollow State Park, Morgan and I saw a Turkey Vulture (*Cathartes aura*). We saw the same or another Turkey Vulture the following day near East Woodstock. Altitudes along the ridge tops in this area reach 700 to 900 feet. Aaron Bagg and Henry M. Parker, in their intensive study of the Turkey Vulture in Connecticut (MS) conclude that this 'southern' species has become a common migrant and summer resident in certain western and southern parts of the state, but believe that our Woodstock records are the first for the northeastern part of the state.

Of the 66 birds recorded (58 in Bigelow Hollow State Park proper) by Morgan and me on July 1 and 2, 1950, the following boreal species warrant comment. Unless otherwise stated, localities mentioned are within the Park.

Brown Creeper, *Certhia familiaris*. July 2, I watched a pair of these birds chasing each other around an islet in the pond below the gorge. E. Alexander Bergstrom, of West Hartford, informs Morgan (*in litt.*) of having seen the species on Talcott Mountain, outside West Hartford, on May 30 and June 6, 1943. Sage and Bishop (1913: 173) give no records for Connecticut between May 7 and September 19. Forbush (1929: 354) describes the species as "rare in summer in southeastern parts [of New England] and not yet reported as breeding in Rhode Island."

Hermit Thrush, *Hylocichla guttata*. At least three of these birds were singing the evening of July 1st, and the species was much in evidence the following day. Only one Wood Thrush, *Hylocichla mustelina*, was recorded in the immediate vicinity, although that species was exceedingly common elsewhere throughout the greater territory. Bagg recorded two Hermit Thrushes in a hemlock swamp in nearby Phoenixville on June 14, 1950. Bergstrom (*in litt.*) states that the species nests in some numbers in the yellow pine of the Farmington Valley west of Hartford and at times on Talcott Mountain. He adds that there are summer records for Mansfield Center and Tolland, towns not greatly distant from Bigelow Hollow State Park. Except for one Hartford County record, Sage and Bishop (1913: 178–179) restrict the species in summer to the northwestern part of the state. Forbush (1929: 402) considers the species a "common summer resident throughout . . . northwestern Connecticut" but rare and local elsewhere in southern New England in summer.

Blue headed Vireo. *Vireo solitarius.* We saw or heard this species at three places in the Park July 2. Sage and Bishop (1913: 146) consider it "very rare" in summer, but mention several breeding records for Eastford, less than 7 miles distant, air-line, from the Park. Forbush (1929: 191) considers the species a "rare local summer resident" in Connecticut.

Black-throated Blue Warbler, *Dendroica caerulescens.* We found this species twice within the Park on July 2 as well as at one place just outside on July 1. Bagg found "many" throughout the region in general on June 15, 1950. Sage and Bishop (1913: 154) mention breeding records for Eastford, but limit the summer distribution otherwise chiefly to western parts of the state, as does also Forbush (1929: 235).

Myrtle Warbler, *Dendroica coronata.* One of these birds was singing as we cooked supper on July 1, and we distinguished four territorial areas of the species the following day. By way of contrast, a Rough-winged Swallow (*Stelgidopteryx ruficollis*), rare in the days of Sage and Bishop but now well distributed even in Massachusetts, flew back and forth repeatedly not far from our fireplace. Sage and Bishop did not record the Myrtle Warbler in summer. Forbush (1929: 238) states that the species "summers and possibly breeds locally in the hills of northwestern Connecticut." J. A. Farley (1919) observed a female and found a nest just over the state line near Webster, Massachusetts, on May 17, 1919.

Blackburnian Warbler, *Dendroica fusca.* As might be expected in a large hemlock stand, this species proved to be almost common. (On June 14, 1950, Bagg had found it at four places in and near Phoenixville, Connecticut. The following day he had found it in numbers throughout the area in general.) Bergstrom informs me that there are June records for Tolland and Willington, towns which lie within the plateau region. Also, he has found the species on Talcott Mountain in summer. Sage and Bishop (1913: 157) limit the species' summer distribution to northwestern parts of Connecticut. Forbush (1929: 258) calls it a "rare summer resident, less rare in western parts."

Northern Water-Thrush, *Seiurus noveboracensis.* We heard this species singing the evening of July 1. On July 2 we heard two singing. Morgan succeeded in seeing both birds; I saw one. Bagg had seen one at the same spot on June 15. Sage and Bishop (1913: 160) give no records for the state between June 3 and August 3. Forbush (1929: 281), while stating that the species is not known to breed in Connecticut, comments that both this species and the Louisiana Water-Thrush (*Seiurus motacilla*) "are found in the same localities in western Massachusetts, across the entire state where their respective ranges overlap, and Mr. Harry S. Hathaway tells me that he has found both species breeding in the Kingston swamp in Rhode Island." At Bigelow Pond five Louisiana Water-Thrushes were in evidence. *Motacilla* and *noveboracensis* were practically together at times. The habitat was fairly typical of that in which I customarily find the Northern Water-Thrush in summer in northern New England, and both species were concentrated in a rather small strip of shore-line. No water was coming over the spillway out of Mashapaug Pond, and there was only a sluggish flow from underground seepage lower down in the outlet brook. Conceivably, drying up of the brook may have caused the Louisiana Water-Thrushes to vacate what, at times of good water conditions, would be their normal breeding territory. Also, they may have been occupying territory along another small but rapid stream flowing into the pond almost in the center of the jointly-shared shore. Both Forbush (1929: 284) and Peterson (1947: 205) point out, however, that the Louisiana Water-Thrush does, at times, inhabit wooded swamps. I have discovered this species three times recently in such swamps in eastern Massachusetts, a region where practically no streams maintain a head of swift water the summer through.

Canada Warbler, *Wilsonia canadensis.* We recorded this species at five places in the Park on July 2. With difficulty we succeeded in seeing two singing males. Bergstrom has recent summer records for Hadlyme and Barkhamsted (brood in 1941), in the coastal area and western highlands respectively. Bagg found the species near Phoenixville on June 14, 1950. Sage and Bishop (1913: 165) state that it "breeds more or less regularly in the northwestern part of the state, although few nests have been taken." Forbush (1929: 308) calls it "an uncommon to rare local summer resident" in Connecticut. J. A. Farley (1919: 582) observed a pair building a nest a short distance over the state line, near Webster, Massachusetts, on May 23, 1919.

Rusty Blackbird, *Euphagus carolinus*. Bagg saw one of these birds at Bigelow Pond in the Park on June 14, 1950, but was unable to relocate the bird the next day. On July 2, within a few yards of the same pond, Morgan had a fleeting glimpse of what he felt sure was a Rusty Blackbird as it disappeared into a conifer under which I was standing. The bird uttered one short note which both of us attributed to this species. The pond and its outlet bear a strong resemblance to sites at which I customarily find the species in summer in Maine, but positive proof of nesting is lacking and the bird should be considered a straggler. I know of no occurrence of the species in summer nearer than Moosilauke. Sage and Bishop (1913: 114) give no dates for the entire state between May 13 and September 15.

White-throated Sparrow, *Zonotrichia albicollis*. From one spot, July 2, we could hear three of these birds singing. Forming an incongruous background was the insistent and monotonous song of a Prairie Warbler (*Dendroica discolor*). Sage and Bishop (1913: 129) limit the summer range of the White-throated Sparrow to the northwestern portion of the state. Forbush (1929: 73) states that the species breeds casually in the western highlands.

Summary

The summer bird life of the hilly, sometimes mountainous, plateau which extends from the mountains of New Hampshire southerly across Massachusetts and Connecticut to the coast of Long Island Sound is definitely northern in its affinities. The maximum elevations of this plateau gradually decrease to the southward, but among the breeding birds of Bigelow Hollow State Park, in northeastern Connecticut, are the Brown Creeper, Hermit Thrush, Blue-headed Vireo, Myrtle Warbler, Blackburnian Warbler, Black-throated Blue Warbler, Canada Warbler, Northern Water-Thrush and White-throated Sparrow. The Rusty Blackbird has been seen in summer. The Louisiana Water-Thrush, a southern species, breeds locally side by side with the Northern Water-Thrush, possibly as a result of drying up of the streams normally preferred. Most of the northern birds just mentioned have been known to inhabit northwestern Connecticut in summer, but their *breeding* in northeastern Connecticut has heretofore received little or no mention in the literature.

Acknowledgements

I am deeply indebted to Allen H. Morgan, for several years a resident of Hartford, Connecticut, but now of Wayland, Massachusetts, for deferring the writing of this paper in my favor and for supplying valuable information and constructive criticism. I am grateful also to Aaron M. Bagg, of Holyoke, Massachusetts, to E. Alexander Bergstrom of West Hartford, Connecticut, and to John H. Conkey, of Ware, Massachusetts, for confirmatory data put at my disposal.

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NESTING OF THE PARULA WARBLER IN MICHIGAN

BY RICHARD AND JEAN GRABER[1]

WHILE making a distributional study of the birds of Wilderness State Park in Emmet County, northwestern Lower Michigan, from June 9 to August 5, 1949, we observed the nesting of four pairs of Parula Warblers (*Parula americana*). This species has long been known to summer in Michigan, but up to 1938 no actual nest had been reported (Van Tyne, 1938: 32). The May 12 "nesting" date published by Chapman (1932: 454) apparently was a migration date from Wood (1908. *Auk*, 25: 12). Wood's manuscript notes include no unpublished nesting data.

Wilderness Park occupies 7,800 acres, including Waugoshance Point—a narrow peninsula extending westward into Lake Michigan and forming the northern boundary of Sturgeon Bay. The sandy north shore of Waugoshance Point is bordered first by small dunes sparsely covered with *Juniperus horizontalis* and *Arctostaphylos uva-ursi*, then by a forest-edge of white pine (*Pinus Strobus*), red pine (*Pinus resinosa*), spruce (*Picea* sp.), balsam (*Abies balsamea*), white cedar (*Thuja occidentalis*), aspen (*Populus* sp.), and white birch (*Betula alba*). The south shore of the Point and the whole of Sturgeon Bay are rocky, with *Scirpus* marshes extending about 50 yards inland to the forest-edge of cedar and scattered spruce, aspen and birch.

The only Parula Warblers we encountered inhabited the forest-edge of the Point and Sturgeon Bay. We located 15 singing males—12 on the north shore of the Point, one on the south side of the Point, and two farther south on Sturgeon Bay. We found four occupied and two old nests all in a line along the north side of the Point.

The Nests

The four active nests (Nos. 1, 2, 3, 4) and the two old nests were very much alike in situation. Each was among 5- to 12-inch-long strands of *Usnea* on the east side of an unshaded, dead or nearly dead, middle-sized balsam, on a small, not very steady limb. The entrance generally used was on the side next to the main trunk, but at times the birds would force their way through the canopy of lichen in another place. The average height of the 6 nests was about 10 feet. Five of them were so hidden in the *Usnea* that to see them we had to stand directly underneath.

The nests were well-woven, compact, semi-pensile structures resembling those of the Orchard Oriole (*Icterus spurius*). They were made of *Usnea*, usually with a few fine pieces of grass two to three inches long. The lining material seemed to be no finer than the rest.

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

TABLE 1

Active Parula Warbler Nests

Nest	Height	Measurements in Centimeters				Distance between nests
		Inside diam.	Outside diam.	Inside depth	Outside depth	
1	about 10′	4.5	7.5	5.0	7.5	About 500 yards from Nest 2
2	10′ 8″	4.9	6.5	4.5	5.8	889 feet between Nests 2 and 3
3	8′ 10″	4.0	7.0	4.5	5.5	392 feet between Nests 3 and 4
4	9′ 3″	4.1	7.0	5.2	5.7	

Nest 1, found June 28, contained 2 young birds (which left in good order on July 3).

Nest 2 was just being built when we found it July 11. It was made entirely of *Usnea* and was the only nest so composed. We believe that only a single egg was laid in this nest. The egg was laid on the morning of July 15, and was incubated for 15 days before it was removed by some unknown predator. An old nest which had much grass in it was in the same tree about 3 feet away (height 13 feet). This nest almost certainly had been built earlier in the summer of 1949.

Nest 3 held 1 egg when we found it July 12. Two more were laid, respectively on July 13 and 14.

Nest 4 held 2 eggs when we found it July 12, and another egg was laid July 13.

These clutches were small. Wilde (1897: 293) found the average clutch to be 4 eggs. Barrows (1912: 591) stated that an average clutch numbered 3 to 5 eggs, and Chapman (1932: 455) gave 4 to 5 as the average number in a clutch. The lateness of the nesting observed by us may have had something to do with the smallness of the clutches. Wilde (1897: 291) gives the middle of May as the time nests are built. Mousley (1926: 184) reported a nest being built as early as May 25.

Redstarts (*Setophaga ruticilla*), Song Sparrows (*Melospiza melodia*), Myrtle Warblers (*Dendroica coronata*), and Oven-birds (*Seiurus aurocapillus*) were nesting near the Parula Warbler nests.

At the four nests the parent birds, both males and females, varied considerably in color. Two males were quite handsome, with wide red and blue throat-bands, while another male could scarcely be distinguished from its mate. Three females had clear yellow throats or showed only a trace of blue. One bird, whose mate we never saw, had a narrow throat-band of blue with a hint of red in it. We assumed that this bird was a female, for it was very faithful in

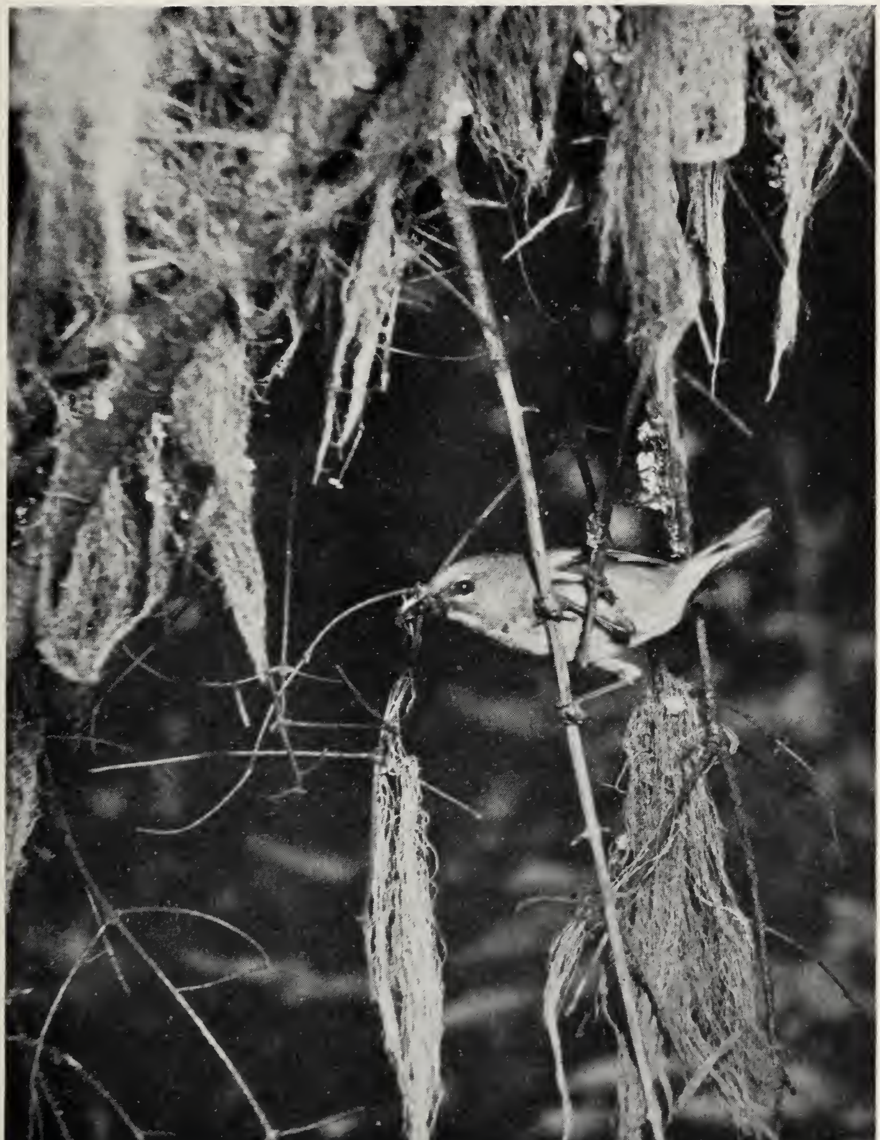

FIG. 1. Female Parula Warbler returning to nest (No. 1) with food for young. Photographed at Wilderness State Park, Emmet County, Michigan, on June 30, 1949, by Richard and Jean Graber.

incubating the eggs and caring for the young. Of 45 skins of female Parula Warblers examined at the University of Michigan Museum of Zoology, six had coloration similar to that of this bird.

We found Nest 2 at about 11 a.m. on July 11, through chancing to see the female fly to the site. We believe that she had started it earlier that day. We watched her working for an hour (until 12 m.). During much of this period she devoted her attention to making a cylindrical curtain of *Usnea* which was suspended above and about the nest. She pulled and wove the fibers together with an extremely rapid shuttling of her bill. When she had completed the curtain to her satisfaction, she began gathering *Usnea* for the nest itself. This she obtained not only in the nest-tree but also in trees close by.

A large white pine about 6 feet from the nest had tufts of *Usnea* growing on its trunk. Often she flew to this tree and, hopping down its trunk in the manner of a Black and White Warbler (*Mniotilta varia*), pulled a few fibers (2 to 3 inches long) from the bark and carried them to the nest. After weaving these in, she sometimes hopped out to the entrance and cocked her head from side to side as though appraising the effect. Occasionally when leaning over a limb, pulling at a fiber, she lost her balance, fell off, and fluttered in mid-air still hanging onto the fiber with her bill. Once we saw her swing upside-down, chickadee-fashion, while working at the bottom of the nest from the outside.

On one occasion the male came to a tree near the nest-tree and watched the female working. After a few minutes he flew to the nest, whereupon we heard a loud snapping of bills and saw both birds fly away. Presently they returned, alighted in a tree six feet from us, and chipped loudly. When the male flew off the female returned to her nest-building. Later the male came again and chipped at us but did not go to the nest—at which the female was busy working. She continued with her work, seemingly paying no attention to his *chip*. Throughout most of the hour the male sang at 20-second intervals in birches 20 to 30 yards from the nest. By the end of the day the nest had taken shape but was very thin-walled. We could see through the bottom.

The next day (July 12) we made continuous observations at the nest from 8:33 a.m. to 12:30 p.m. During this period the female thickened the walls and bottom with *Usnea* gathered nearby. The male was in the vicinity (we heard him sing 3 times), but he did not appear until another male flew into a tree about 10 feet from the nest. Both owners of the nest resented this intrusion. Flying to the tree in which the visitor perched, they gave angry *buzzing* notes. The visitor left, pursued by the male, and the female returned to the nest. Most of her time was spent strenuously gathering *Usnea*, making trips to the nest at 1- to $1\frac{1}{2}$-minute intervals, and spending only 10 to 15 seconds at the nest each time. When she paused to feed, she flew to small conifers near the nest.

Once the male visited the nest while the female was gone. He looked at it from several angles and even entered; then, with a few scarcely audible *chips*, he flew away. Later he came and coaxed the female to leave with him. She followed a short distance and then flew back to the nest. Again the male approached and this time succeeded in coaxing the female away. Both birds flew out of sight. On one occasion a wandering band of Black-capped Chickadees (*Parus atricapillus*) excited the male when they approached, but the female went on gathering *Usnea* as usual.

The female seemed to work more slowly before than after 10:30 a.m. It took her, without any help from her mate, four days to build the nest. On the fifth day she laid the one and only egg of the clutch. We observed that incubation began with the laying of this egg, and though we checked it several times each day between dawn and dark of the fifteen days the egg was incubated, we never saw a second egg.

Incubation

Nest 3 contained one egg (which had a tiny triangular hole in its side) July 12. A second egg was laid on the morning of the thirteenth. The female was sitting on the two eggs at 11:30 o'clock. The third and last egg was laid the following morning. We believe that incubation started just after the laying of the second egg. We did not see the female anywhere in the vicinity of the nest on July 12, but on July 13 we flushed her from the nest twice (11:30 a.m. and 4:30 p.m.). One egg hatched July 26, another the following day. (The egg with the hole in it did not hatch.)

Nest 4 contained two eggs when we visited it late in the day on July 12, and a third was in it at 11:35 a.m. the following day. On the morning of July 24 the three eggs were intact, but the female seemed unusually excited and reluctant to leave. On the following morning the nest held one young bird and two eggs (no eggshells). The two eggs did not hatch. Since we did not mark the eggs, we do not know which one hatched. The incubation period was at least 12 days, in any event, and possibly as long as 14 days.

Nest 3. On July 21 (the eighth day of incubation), at 7:30 a.m. we flushed the female from her clutch of three eggs. She feigned injury as she left the nest, spreading her tail and flying close to the ground, then rising to a perch 10 feet from the nest-tree where she chipped excitedly. She continued the alarm for 20 minutes, then left the area. In the next 2 hours and 20 minutes, the female came to the nest-tree repeatedly, but did not enter the nest, although once she flew directly to it. On one occasion, after an absence of 2 minutes, she returned with the male. He flew to the top of the nest-tree, then to a perch above us, chipped a few times, and left. This was the only time during the incubation period that we observed the male at the nest-tree.

The marked excitability of the female at this nest was evident from several characteristic actions, the commonest of which was wiping the sides of her bill on some branch. She did this even when she had eaten no food, and the mannerism seemed to be a sort of nervous reaction to the intruder. After the eggs had remained uncovered 2 hours and 40 minutes, we discontinued observation.

Nest 4. We began observations at 7:20 a.m., July 21 (ninth day of incubation). A bird was sitting on the nest at that time. The only bird we ever saw at this nest was almost certainly a female, though it was very handsomely colored. Only once did we hear a male singing near Nest 4, and then only for a few minutes at a time when the female was incubating.

The incubation rhythm was quite regular. During 7 hours of observation on July 21, the bird left the nest 12 times, the shortest inattentive period having been 2 minutes, the longest 37 (average 11). The 13 attentive periods averaged $21\frac{1}{2}$ minutes. Five of the seven hours were spent incubating.

The female behaved differently the following day. From 5:15 a.m. to 8:15 p.m. she left the nest 36 times for an average of only 4 minutes, and incubated the rest of the time. The longest period spent off the nest was 6 minutes, the shortest, 2. The attentive periods varied between 10 and 43 minutes (average 21 minutes).

The periods of incubation and of rest tended to be longer in the morning, though not markedly so. A marked variation occurred after 7:00 p.m., when both periods became increasingly shorter. At 8:15 we had to stop our observation. The sun was already below the horizon, and the nest a dark silhouette, yet only 10 minutes before our leaving the bird was away from the nest. It seems probable that this was close to the last trip of the day. Twelve and a half of the 15 hours the bird had spent on her eggs.

The activity of the bird during these periods of observation followed a very uniform pattern. She left and returned to the nest quickly and quietly. In leaving the nest she almost invariably flew inland in the same direction, and returned via the same route, usually flying to a favorite perch below the nest, from which she hopped to the side entrance. We frequently noted movement in the nest from 1 to 3 minutes before she actually departed.

We never followed the bird during her away-from-the-nest periods, though in these short intervals she could not have gone far. Very often upon returning she wiped her bill on a branch as if cleaning her mandibles before entering the nest.

Throughout the period of our study, numerous bands of Black-capped Chickadees, Golden-crowned Kinglets (*Regulus regulus*), and warblers wandered about the woods. Several times we saw one or more of these birds hopping about the nest-tree within 2 or 3 feet of the incubating Parula Warbler, yet neither did they show interest in the nest, nor were they driven away.

Nest Success

The June nest held two young birds when we found it, and these left in good order (as above stated). We do not know how many eggs had been laid in this nest.

The three July nests held a total of seven eggs, of which three hatched—two in one nest (three eggs), one in another (three eggs), none in another (one egg). Of the three young, one left the nest in good order. The two siblings in one nest were destroyed by some predator when they were about seven days old.

Grand total of eggs in the four nests: at least 9; of young hatched: 5; of young which lived to leave the nest: 3 (one of the latter we collected, July 3).

A less than one-day-old nestling (the second of Nest 3) which we critically examined on July 28 had a sparse patch of rather long silky white down on the head, and another along the mid-line on the dorsum. Otherwise it was naked, and the skin, bill, and legs were all of about the same shade of pinkish yellow. Tiny dark blood quills were visible through the skin of the wings. Late in the day on July 29 we examined this bird again, finding that the bill had become slightly more yellow, the incoming feather tracts more obvious, and the down of the head and back a trifle darker. On July 30 the down appeared to be even darker.

At Nest 1 (June) the male parent regularly brought food to the two young. The male and female at this nest were so similar in color that we would have entertained grave doubts concerning the male's coming to the nest at all had we not seen *both* birds there with food on several occasions. At Nests 2 and 3 the male parent did not bring food at all regularly. Not once did we recognize a male bird at Nest 4.

The behavior of the parent birds at Nests 3 and 4 merits special discussion. We spent 12 hours observing these nests on July 27 and two hours observing Nest 4 on August 4. The wildness of the female at Nest 3 has already been mentioned. This female brought food to her 2 nestlings only 14 times during a 5-hour period on July 27. The longest interval between feedings was 68 minutes, the shortest 5, the average 20. She brooded her young once for a period of 19 minutes. The male approached the nest with food only once. When he was within a few inches of the nest, the female flew swiftly at him driving him from the nest-tree. During the remaining two hours of our observations that day we did not see the male again. We were stationed fully fifty feet from the nest-tree, yet our presence obviously distressed the female. Occasionally she settled down into the nest as if to brood, then left hurriedly.

The females at Nests 3 and 4 gathered food within a few yards of the nest-trees, usually in conifers. Their behavior was kinglet-like as they hopped quickly about the branches. Occasionally they fluttered at the end of a twig. They found numerous green lepidopterous larvae among the pine needles. Frequently they caught a May fly (Ephemerida) or another of the winged insects that abounded along the shore.

At Nest 4 the female had only one nestling to tend, yet her feeding rate was almost as great as that of the female at Nest 3. During a six-hour observation period (July 27) she made 19 trips carrying food. The shortest interval between feedings was one minute, the longest 51, the average 19. She brooded the nestling immediately after 14 of the 19 feedings. The shortest brooding period was six minutes, the longest 27, the average 17 (total: almost four hours of brooding during that particular observation period).

At no time did we see a parent bird remove a fecal sac from a nest. Mousley (1924: 268) reported that he never saw a parent Parula Warbler carrying off a fecal sac. The adult probably swallows the fecal sac while its head is out of sight within the nest.

On the morning of August 4 we unintentionally so disturbed the young bird in Nest 4 that it left prematurely. Neither adult was in the immediate vicinity at the time. The young bird, which was 10 days old, was well feathered, and quite capable of hopping from branch to branch, but did not attempt to fly. It was in handsome juvenal plumage. It was, generally speaking, blue-gray above (with a greenish wash on the back) and white below, with distinct white wing-bars.

When the female parent returned, with a May fly in her bill, she gave sharp chips of alarm as she hopped toward the nest. The young bird, which was sitting quietly on a branch very near the nest, did not beg for food even when its parent was within a few inches. The adult looked at the nestling but peered into the nest three times before hopping to the young bird and poking food at its bill. This did not evoke a begging reaction and the parent swallowed the food and flew off. In about 10 minutes she returned with a large brown larva, went directly to the nest, looked in, then hopped over to the young bird, fed it and left. When the female returned with more food, she made an unsuccessful attempt to feed the young one, then moved toward and entered the nest. Settling down, she grew quiet, as if brooding the empty nest. After remaining in the nest for 8 minutes she began moving about restlessly, climbed out of the nest, and flew off. Presently she returned with more food. This time the young bird fluttered its wings, begged, jumped to the branch on which its mother had alighted, and was fed promptly.

The female continued to bring food at three- to five-minute intervals. Often, following what must have been a very powerful instinct, she went to the nest before going to the nestling, but this interest in the nest gradually waned. Once we saw her take a fecal sac as it was passed, and carry it away. At other feedings she looked for sacs, but this was the only instance in which she carried one away. The behavior of the young bird and also that of the adult clearly indicated that the juvenile had left the nest prematurely.

While the female was away, the young bird preened itself energetically and changed its position frequently, though it remained near the trunk of the nest-tree. Its colors matched those of its surroundings remarkably well. The lichens *Usnea cavernosa* and *Parmelia physoides*, which grew so abundantly on the branches of the nest-tree, were of almost the same shade of bluish gray as that of the upper parts of the young bird.

Acknowledgements

We hereby wish to thank the Michigan Conservation Department, especially Superintendent Grant Wykhuis of Wilderness State Park, for the kind treatment and many privileges extended to us. We are especially indebted to Dr. Olin S. Pettingill Jr., who advised us and guided our study.

Summary

The Parula Warblers which inhabited Wilderness State Park, Emmet Co., Michigan, in the summer of 1949 seemed to be nesting principally in the forest-edge along the shore of Lake Michigan. Four active and two old nests, situated in dense clumps of the lichen *Usnea cavernosa*, averaged 10 feet above ground. All six nests were in medium-sized, dead or nearly dead balsams (*Abies balsamea*). They were semi-pensile, and were made almost wholly of *Usnea*. Three of the four active nests were finished when found. The incomplete one was finished entirely by the female, while the male sang nearby and defended the territory. Complete clutches of 1, 3, and 3 eggs were observed. Grand total of eggs in the four nests: at least 9; of young hatched: 5; of young which lived to leave the nest: 3. At two nests the incubation period was not less than 12 nor more than 14 days. Incubation rhythm was regular. Incubation was performed exclusively by the female, who left the nest for a short period every 20 to 30 minutes. Both sexes fed the young, though the male was less active than the female in doing so. One young Parula Warbler left the nest prematurely at the age of 10 days.

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PATTERN AND RATE OF CRANIAL 'OSSIFICATION' IN THE HOUSE SPARROW

BY ROBERT W. NERO[1]

Determination of skull condition has been long accepted as a method of distinguishing immature from adult passerine birds. Chapin (1946: 35–37), for example, described this method, suggesting that various groups of birds should be studied in order to test its reliability. Davis (1947) attempted to correlate bursa and gonadal development with the ossification of the skull. Miller (1946) described a method of aging live birds, based on skull changes. Although commonly referred to as "ossification," the changes which occur involve the formation of a double layer of bone separated by small bony columns. In his description of this process of cranial development, Miller stated (*loc. cit.*, p. 33): "The skull of a passerine bird when it leaves the nest is made up of a single layer of bone in the area overlying the brain; at least, the covering appears single when viewed macroscopically. Later the brain case becomes double-layered, the outer layer being separated from the inner layer by an air space across which extend numerous small columns of bone. It is not necessary to section the bone to determine the condition. Externally the skull of the immature bird appears uniform and pinkish in live or freshly-killed specimens. The skull of the adult is whitish, due to the air space, and also it is finely speckled as a result of the dense white bony columns between the layers." Miller and others suggest that this condition is attained progressively, from posterior to anterior. Harrison and Harrison (1949), who have dealt with this subject in close detail, refer to the developmental process as "pneumatisation." The reader should consult their important paper for further aspects of this problem. The present paper describes the pattern and rate of cranial development in one species—the House Sparrow, *Passer domesticus*.

METHODS AND RESULTS

Specimens of known age were obtained through the recovery of banded young. A total of 346 nestling sparrows, aged according to wing and bill characters as described by Weaver (1942: 183–187), were banded at Madison, Dane County, Wisconsin, between May and August, 1949. Of these, 51, or nearly 15 percent, were recovered as fledged immatures of various ages during the period May,

[1] I wish to thank the many persons who have helped in the gathering of data on which this paper is based. Special thanks are due two members of the University of Wisconsin faculty—Dr. Robert A. McCabe, of the Department of Wildlife Management, for encouragement and advice in the beginning of the study, and Dr. John T. Emlen, Jr., of the Zoology Department, for careful reading and criticism of the manuscript.

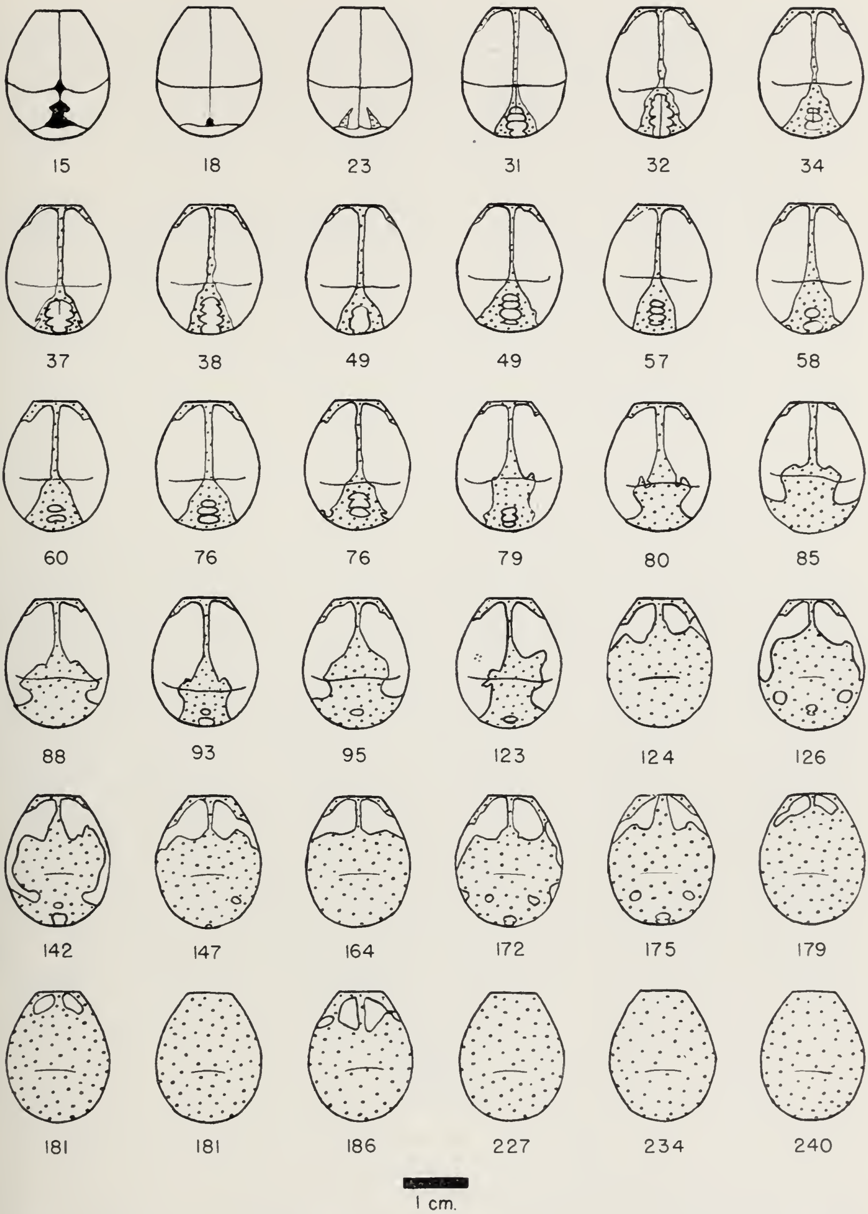

FIG. 1. Dorsal view, crania of 36 wild House Sparrows showing ossification pattern. Numbers under drawings indicate age in days.

1949, to March, 1950. Over 1600 sparrows were killed in recovering these banded birds. The methods of collecting included trapping, shooting into daytime flocks and night tree roosts, and capturing by hand and shooting in night barn roosts. The majority of recoveries were taken from night barn roosts at, or near, the point at which they had been banded. One bird, however, was recovered at a distance of four miles.

The skull-ossification patterns of 36 representative birds from this series are graphically represented in Figure 1. These drawings show a series of dorsal views of the cranium, the frontal border of each skull being toward the top of the figure. Frontal sections were obtained by cutting along a line extending from just dorsal to the foramen magnum to a point dorsal to the orbits. The drawings were projected from accurate linear measurements, giving a relative picture with some distortion towards the borders. The number beneath each drawing indicates the age in days of the particular specimen. The solid areas in the first two drawings in the top row indicate connective tissue; the clear areas, a single layer of bone; and the speckled areas, the double-layered bone. The fine lines indicate sutures.

These sections show that formation of the double layer of bone begins in the posterior parietal and exoccipital regions about 23 days after hatching, and appears in the median suture between the frontals shortly thereafter. Up to about 80 days it is confined largely to lateral extension of the area posterior to the frontoparietal suture. After this age, growth proceeds in a somewhat arm-like fashion from the posterior third of each frontal bone towards the antero-lateral corners, resulting in near-division of the frontals into four, and finally two, clear areas. These latter anterior areas are the last to become double-layered. When the cranial roof is completely double-layered, the bird is considered an adult, at least so far as cranial criteria are concerned. These clear areas may disappear as early as 181 days after hatching or may persist to 221 days, the latter figure being derived from a skull which is not illustrated here. Note that the pattern of ossification is generally symmetrical. In some cases where it is not, as in the skull of 123 days, there is a peculiar hardening (indicated as stippling outside of the circumscribed stippled area) of the single layer of bone, suggesting an injury, which seems to have interfered with the normal progress of development in the area. According to Harrison and Harrison (*loc. cit.*, p. 64) "the whole process is considerably slowed down and even stopped by any serious disease that the particular bird may be suffering from."

The area of double-layering of each of these skull sections has been measured from the drawings by means of a planimeter. The percentage of ossification as calculated on this basis yielded the data shown in Figure 2. In this graph the percentage of the opaque area (stippled) is computed against the age in days, each dot on the curve representing one of the drawings in Figure 1. This curve shows that the thickening of the cranium of the House Sparrow progresses at

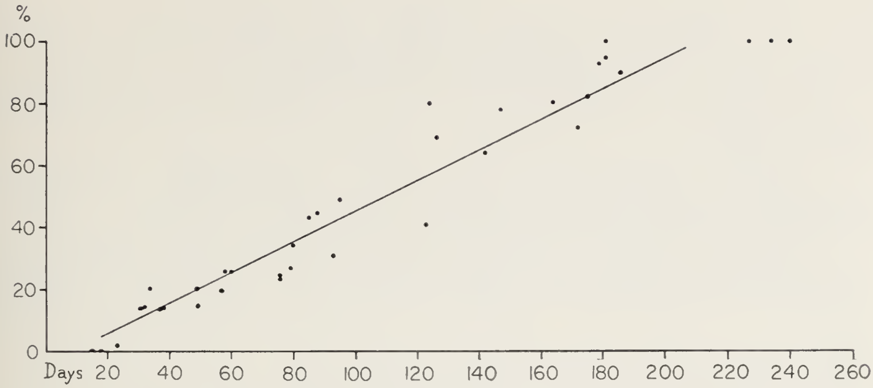

Fig. 2. Curve showing relationship of percentage of cranial ossification to age in days in the House Sparrow.

a fairly constant rate.

In the early stages of this study it was decided to raise young sparrows in cages, killing them at such times as to obtain a series of birds of known age, the supposition being that it would be difficult to recover sufficient banded nestlings. Figure 3 shows the skulls of 12 of these birds. These show consider-

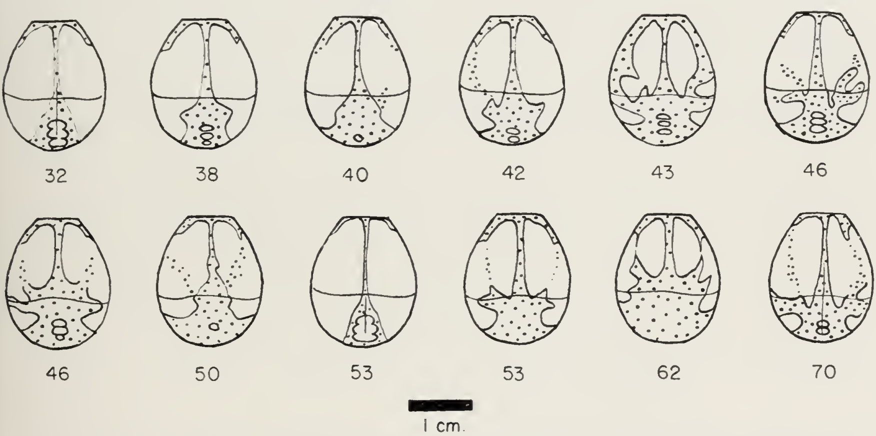

Fig. 3. Dorsal view, crania of 12 hand-reared House Sparrows showing ossification pattern. Numbers under drawings indicate age in days.

ably more variation in pattern and rate of development than those taken from the field. These irregularities may possibly be attributed to an abnormal diet, to an excess of head injuries as a result of caging, or to both. Irregular hardening of the single bone layer, as described above in the 123-day-old bird, is evident in seven specimens.

Summary

1. Fifty-one House Sparrows of known age were obtained through the recovery of banded nestlings. The ages of these birds ranged from 15 to 240 days.

2. The crania of these specimens showed a progressive and symmetrical growth pattern.

3. Complete ossification had been attained in one specimen 181 days old, but another specimen 221 days old still showed small clear areas.

4. Skull sections from 12 birds reared in captivity show more variability and a less symmetrical pattern than do those of wild birds. There is also more abnormal bone formation, due, perhaps, to injury from caging and to artificial diet.

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THE SONG AND SONG-FLIGHT OF THE ALDER FLYCATCHER

BY ROBERT A. MCCABE[1]

THE song of the Alder Flycatcher (*Empidonax t. traillii*) is well known but little understood—known in the sense that it is recognized, not understood in the sense that the meaning of song in relation to behavior and ecology is difficult to interpret. I cannot claim complete understanding, but the following is an attempt toward that end.

The main objective of this paper is to describe and discuss the song of the Alder Flycatcher from a physical point of view. A secondary objective is the describing of a hitherto unrecorded song-flight. The psychological aspects of the species' singing, particularly those relating the song to the breeding cycle, I hope to discuss in a later paper, when the entire ecology and nesting picture will also be given.

What is the song of the Alder Flycatcher? Peterson (1947: 152) describes it thus: "The regular song in New York and New England is a three-syllabled *wee-bé-o* with a hoarse burry quality, the accent on the middle syllable. The Ohio bird contracts this into a sneezy *fitz-bew* or '*witch-brew*' as distinctly different as that of any other two species of the genus. Possibly collecting would prove that subspecific differences existed." I came in recent years to associate the latter description with the song of the Alder Flycatcher in Wisconsin. This, however, may be more psychological than real. I have never heard the song *wee-bé-o*.

In the summer of 1943 I began a study of Alder Flycatcher ecology. The area used for study was a 40-acre plot of brushy marsh on the west shore of Lake Wingra in the University of Wisconsin Arboretum at Madison. The chief herbaceous cover was sedge (*Carex* sp.), aster (*Aster* sp.), goldenrod (*Solidago* sp.), sunflower (*Helianthus* sp.), joe-pye weed (*Eupatorium purpureum*), and nettle (*Urtica procera*). The woody cover was mainly elderberry (*Sambucus canadensis*), red osier dogwood (*Cornus stolonifera*), and willow (*Salix* sp.).

Allen W. Stokes and Arnold S. Jackson, Jr. worked with me in 1944. They

[1] This is Journal Paper No. 19 of the University of Wisconsin Arboretum. I gratefully acknowledge the field assistance rendered by Arnold S. Jackson, Jr., Allen W. Stokes, and James B. Hale. Appreciation is also extended to Roger T. Peterson for critical reading of the manuscript and to Margaret B. Hickey for editing it. Others to whom I am indebted for helpful suggestions are J. J. Hickey, Ernst Mayr, Klaus Patau, Marie S. McCabe and Patricia Murrish. This study was financed in part by a University of Wisconsin research fund established in memory of the late Charles W. Bunn.

spent part of the following nesting season in Maryland and California respectively, and both voluntarily sent word back to me that the *Empidonax traillii* songs they had been hearing sounded exactly like those they had heard in Wisconsin. On examining the phonetic descriptions of Alder Flycatcher song as presented in the literature, I was unable to detect any agreement on the song from the standpoint of geographic location. Table 1 presents a number of these

TABLE 1

PHONETIC EXPRESSIONS OF ALDER FLYCATCHER SONG

SONG	AUTHORITY	LOCALITY
Eastern: three syllables—*phe-bé-o* type		
Jee-je-ut	Hausman (1946)	Massachusetts
Ee-zee-e-ŭp	Chapman (1937)	Washington, D. C.
Che-beé-u	Minot, in Forbush (1927)	Massachusetts
Che-bêe-u	Nice (1931)	Oklahoma
Wee-bé-o	Peterson (1947)	New England-New York
Wit-ti-go	Widmann, in Butler (1897)	Indiana
Eaze-we-up	Howell (1932)	Florida-Alabama
Midwestern: two syllables—*fitz-bew* type		
Whip-whew	Breckenridge, in Roberts (1932)	Minnesota
Fitz-bew	Peterson (1947)	Ohio
Sweet-cheeuu	Trautman (1940)	Ohio
Pit-too	Gibbs, in Barrows (1912)	Michigan
Greadeal	Miller, in Forbush (1927)	Massachusetts
Grea-deal	Silloway (1897)	Massachusetts
Re-péal	Hyde (1939)	New York
Tick-weeah	Saunders (1935)	New York
Not classified		
Qui-deê	Hoffman (1904)	New York
Pree-pe-deer	Cooke, in Bailey (1908)	Western U. S.
Kee-wing	Coues (1903)	?
Raiz-wee	Bent (1942)	Massachusetts
Becky-weer	Sutton, in Todd (1940)	Pennsylvania

descriptions, some of which resemble each other, while others are singularly distinctive.

In discussing the question of subspecific differences with Roger T. Peterson in 1947 he told me that he had collected birds using the *fitz-bew* and others using the *wee-bé-o* song. Later when these skins were analyzed on a taxonomic basis by Dr. J. W. Aldrich, the birds were separated morphologically into two distinct groups. If the differences are so striking, perhaps the case for *Empidonax traillii alnorum* should be investigated more closely by the taxonomists. *Alnorum* was made synonymous with the nominate race in the last A.O.U. *Check-List* (1931, pp. 208 and 389).

As a further check on song differences, I sent a song-analysis questionnaire to a number of ornithologists in strategic geographical areas. Despite the courteous and generous response from this group, the results shed no light on whether or not there were two distinct song-areas within the range of the Alder Flycatcher. The questionnaire asked which of ten phonetic descriptions listed sounded most like the Alder Flycatcher song in the area with which the observer was most familiar. Space was also given for any new interpretations and attendant remarks. Twenty-nine ornithologists received the questionnaire. Twenty-seven answered it, but seven could offer no information. The remaining 20 indicated no clear-cut unanimity of opinion. For example, Robert Arbib circulated his questionnaire among members at a meeting of the Linnaean Society of New York City. The following interpretations resulted: *fitz-bew*, 11; *wee-bê-o*, 3; *greadeal*, 2; and *sweet-cheeuu*, 1. These data are from an eastern state in which *wee-bê-o* or *phe-bê-o* is said to be predominant (Peterson, *loc. cit.*). In seven instances the observer to whom a questionnaire was sent recorded two or more songs for the Alder Flycatcher, and in seven other cases an entirely new phonetic description was presented. These results, while not surprising, led me to think that the questionnaire measured the descriptive ability of the ornithologist rather than any regional difference in the song of the bird (a fault of the questionnaire).

In Wisconsin the Alder Flycatcher song is more than just *fitz-bew*. A prefix which sounds to me like *creet* precedes the *fitz-bew*. This note is sung just as loudly as the second part. When the birds are at the peak of their singing, the song is *creet* (pause) *fitz-bew*. Sometimes two *fitz-bews* are given in succession, following the *creet*. The only other author to suggest this *creet* as part of the full song is Trautman (1940: 296), who describes the song as *sweet-cheeuu*.

The song *re-pêal* (Hyde, 1939: 155) or *grea-deal* (Miller, in Forbush, 1927: 355; Silloway, 1897: 106) is also sung by Wisconsin birds. In my experience this song was usually heard at a distance but seldom heard as described when the observer was close by, except when the bird was greatly excited. This could be coincidence, but I am inclined to believe it is a matter of phonetic distortion caused by distance between the observer and the singing bird.

In general, I believe this species may have two songs or even three, but our knowledge of the song is so limited that we cannot with certainty classify it as to geographic region, season, age classes, social behavior, and other factors that might alter its pattern.

The call note of the Alder Flycatcher is a half-chirped, half-whistled *wheet* which, although given rather sharply, is a clear, melodious note. There is virtually no difference of opinion or interpretation among ornithologists as to the sound of this call. During this study, my co-workers and I referred to the calling as "whipping". When excited, the Alder Flycatcher contracts the call note so that it sounds like *whip!* It is described by Bendire (1895: 310) as *huip*, *hwip*. "Whipping" usually precedes the onset of song in both morning and evening, and is the note that is most apt to call one's attention to the bird when the observer is approaching the nest.

Quite by accident during the summer of 1943 an entirely new singing performance of the Alder Flycatcher was observed, which to my knowledge has not been reported in the literature. One evening in early June while checking the late-season Woodcock (*Philohela minor*) *peenting* in a section of marsh adjacent to the Alder Flycatcher study area, I stopped at a listening post on the east edge. It was about 8:30 p.m. (C.S.T.); the sun had set and it was almost dark. After a few minutes the last Song Sparrows (*Melospiza melodia*), Meadowlarks (*Sturnella magna*), Long-billed Marsh Wrens (*Telmatodytes palustris*), Henslow's Sparrows (*Passerherbulus henslowii*), and Yellow-throats (*Geothlypis trichas*) stopped singing and the marsh was momentarily quiet. Presently, as if by signal, several Alder Flycatchers nearby began to call, then broke into full song. Like a wave the singing spread to all sections of the 200-acre marsh, where a short while before no Alder Flycatcher was singing. This in itself was spectacular. As I listened I could hear the call note, the jumbled song used when chasing (*weet-weet-whee—fitz-bew*, given rapidly), and the familiar territory song (*creet*—pause—*fitz-bew*). There was also a variation of the last song which appeared to be coming from a considerable distance above the highest (6–8 feet) bushes used as singing perches. Upon a series of subsequent visits I found this to be a *flight-song*, part of the normal breeding behavior. During the nesting seasons of 1943 through 1947, I studied this song and its accompanying flight in some detail.

The song-flight is preceded by a series of loud calls (*wheet-wheet*, etc.) which become shorter and follow each other more and more rapidly until it seems as though they could be given no faster. Then in the same rapid tempo the bird calls *creeet, fitz-bew* over and over, in all about 8 to 12 times. At about the time the calling becomes accelerated, the bird takes off from its song-perch and spirals skyward in an erratic zig-zag flight. The bird appears to be fluttering rather than flying, and reaches a height of from 30 to 50 feet above the marsh floor. At this point the singing stops and the bird dives silently down to the original singing perch or to a nearby bush, from which point it may continue to sing. In many instances the bird proceeds from the nearby bush to its original perch by silently flying back just over the top of the vegetation.

In Silloway's (1897: 109) sketch of the Alder Flycatcher he says of this bird's flight habits, "Even out under the clear dome, with the blue bending over them so invitingly, they never seek to rise above their accustomed limits, and their sallies from the weed tops and low bush-heaps are never far or high." This, it seems to me, illustrates that the word "never" is usually ill-chosen in describing bird behavior, and that this exception (the song-flight) to what Silloway thought inflexible behavior is all the more interesting.

The song-flight seldom carries a bird beyond its territorial boundaries and usually covers less than 60 feet laterally. From a 25-foot tower placed in the center of the study area I made observations on the heights, distances covered, and song behavior of individual pairs. This tower facilitated complete coverage of the marsh, for at that height song-perch locations could not be confused. Also it made the estimation of heights of the song-flights more accurate and served as a blind for other behavior observations.

About 350 song-flights were heard by my co-workers and me during the study, but only 20% were actually seen. We found it impossible to tell which bird will go into a song-flight, or when it will occur, so one cannot always be in a position to see the flight. In many instances the evening song may begin or end with a song-flight. Song-flights on any one evening generally occur shortly after the birds begin their song period, although I have seen at least one song-flight by moonlight at the very end of an evening song period. A single bird may perform as many as six times during an evening, but two song-flights were more generally the rule. Also, not all birds perform song-flights on a given evening; in fact on certain evenings only the call is used by some birds. The reason for this interchange of expression is not known. In any one evening or morning less than 25% of the birds singing performed song-flights.

In southern Wisconsin, singing begins almost as soon as the birds arrive in spring, which is about May 10, and lasts until about August 10. The birds leave for the south shortly thereafter. Detailed studies of the song-flight in relation to certain environmental factors were made in 1944 and 1947. In general there was no correlation with any weather factor that was obvious in the field. The duration of song was used as the base datum for comparing with weather phenomena. There was no significant difference between the mean duration of song in the two years (1944, 37.0 ± 1.63 min.; 1947, 39.2 ± 2.76 min.). No correlation was found between duration of song and temperature at start of song, difference in barometric pressure between 12:30 and 6:30 p.m. on any one day, wind velocity and amount of available sunshine on any one day. However, when plotting the minimum temperature against duration of song, a statistically significant inverse correlation was realized (r value $= -0.538$). What ecological meaning this has, if any, is not clear, especially in view of the fact that minimum temperatures normally occur in the two hours before dawn of each day. This low point is then about 14 hours before evening song begins. The mean number of flight-songs which I heard per evening during the two years studied was 3.7 ± 2.3. The number of songs per day was not comparable because no consistent number of listening posts was used during the song periods. There was, however, a very definite correlation between the starting and stopping of song with the solstice (longest day), which will be discussed later.

I suspected that on cloudy evenings song might begin earlier and last longer, but the data did not support this suspicion. This much I can say: the two longest song periods in 1944 occurred on cloudy days. Purchon (1948: 149) found a similar situation in song frequency of the European Barn Swallow (*Hirundo r. rustica*) in relation to weather. He states "Above a certain threshold it appears that weather had no effect on song frequency—the best day for song was one of the 5 worst days for weather." Cloudy days are no better than clear days for daytime singing; actually the most voluble daytime singing I have ever heard occurred on a clear day in bright sunlight.

Both in 1944 and in 1947 the last song period of the season was very short. This appeared to be an abrupt tapering off.

It was evident, after listening to Alder Flycatcher singing for several weeks, that there was a certain daily regularity about it. At the suggestion of the late Aldo Leopold, who had done considerable work (unpublished) on the relation of bird song to light intensity, I kept records of the beginning and cessation of song. To test this regularity, I plotted the time of song beginning and cessation against the sunset curve (Fig. 1). It is obvious by simple inspection that beginning of song follows the sunset curve. It is probably controlled by a light-intensity factor. This observation is not new. A number of writers have observed the same phenomenon, particularly Craig (1943: 92–93) who worked on a closely related species, the Wood Pewee (*Contopus virens*). In 1944 and in 1947 the time of song beginning followed the slope of the sunset curve downward from late June to early August. In 1944 it followed the upswing toward the solstice.

Certain individuals may occasionally "jump the gun," so that beginning of song as here used is taken to be the time at which singing becomes continuous in all sections of marsh under observation. Actually I experienced little difficulty in assigning a time to the start of song since the birds usually started together.

Song cessation is probably *not* directly controlled by a light factor because evening song usually ends after it is completely dark to the human eye, and probably to the eyes of flycatchers as well.

Evening civil twilight,[2] which ends when the center of the sun is 6° below the horizon, was also plotted in the above mentioned figures. In no case was song cessation recorded before the end of civil twilight in either year. Interesting also is the fact that in both years song always started before the end of civil twilight, but in only two instances in 28 did song begin before the onset of civil twilight, namely sunset (see Fig. 1).

Cessation of song may be caused by fatigue, as was also postulated by Haecker (1924: 724), Wright (1912: 327), and Craig (1943: 96) for other species. I believe, however, that if we accept the hypothesis that a given light intensity stimulates song, then that same stimulation must fade, irrespective of whether the bird is physically able to respond or not. What I measured here was in effect the onset of the stimulation, its result, and the time at which the response

[2] "If the sun is much lower ordinary outdoor, civil operations are impracticable without artificial light" (Nautical Almanac, 1941).

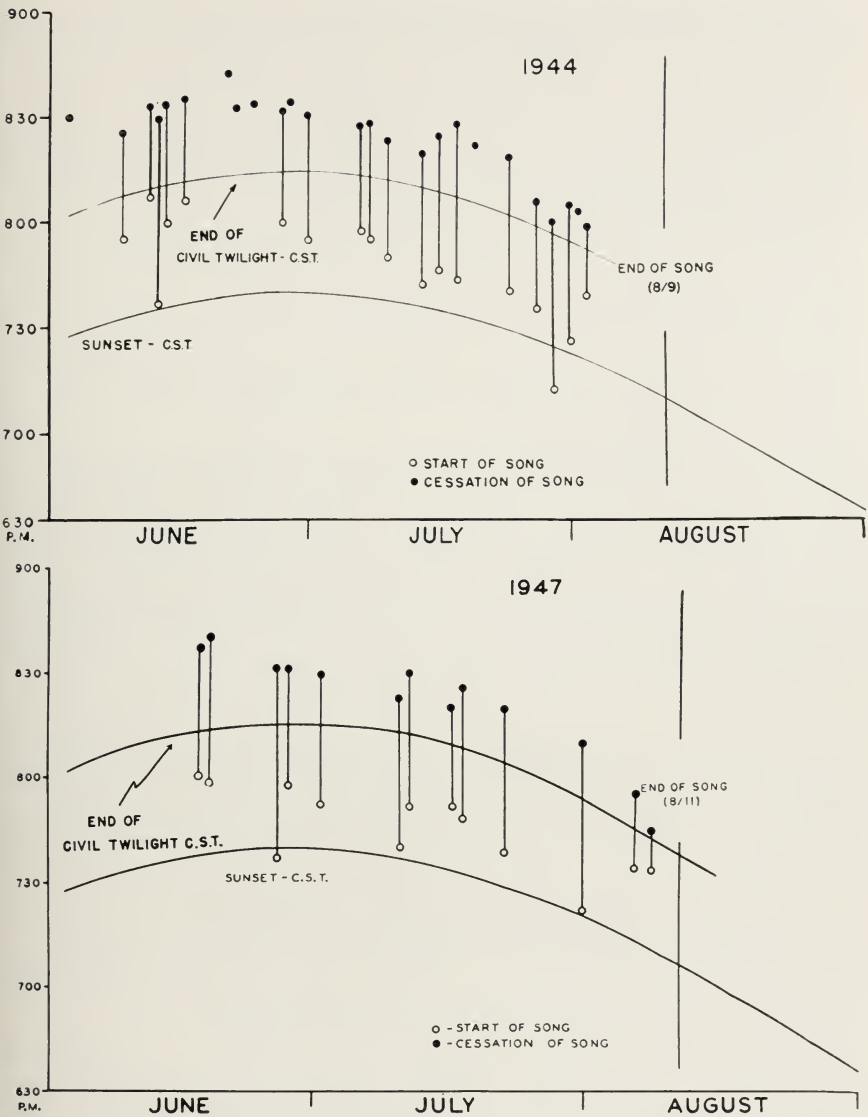

FIG. 1. Alder Flycatcher evening song in relation to sunset and the end of civil twilight in 1944 (above) and 1947.

was completely dissipated. Nothing in my observations suggested augmentation of the stimulus or acceleration of the response due to further changes in light intensity once the point of active response is reached. Craig (1943: 101) states of the Wood Pewee: "It may be that the ending of the song is influenced by a change in illumination." In the case of the Alder Flycatcher there is no visible change in illumination during the last third of the song period since it occurs in the darkness after civil twilight. Furthermore the evening song of the Alder Flycatcher in a marsh starts and reaches maximum intensity rather abruptly, and stops in the same fashion. This abrupt response would seem to indicate that a given light intensity rather than "changes of illumination" is the stimulating agent. What that light intensity is in foot-candles or how it is modified by environmental factors I am not prepared to say.

Craig (*op. cit.*) also infers that intraspecific stimulation to song may not occur (p. 101). I am of the opinion that an individual bird may cause others in adjoining territories to continue in song when they might normally have been quiet. This was particularly evident at the close of the song period on any one evening. In numerous cases the persistent bird "coaxed" its neighbors into song and the group continued their roundelay for three to five minutes after the bulk of the marsh was silent.

The song and song-flights also occurred during the crepuscular period in the morning, but a seven-day trial period of investigation showed that there was less activity at that time (i.e., fewer birds in song, fewer song-flights, etc.). There was no clear-cut cessation of song, as singles and groups of two and three birds would occasionally sing intermittently late into the morning. It is interesting, however, that seasonal song stopped within a two-day period both evening and morning in 1944 and 1947.

Summary

The existence of two distinct songs of the Alder Flycatcher, one eastern (*phe-bé-o*), and the other midwestern (*fitz-bew*), is beclouded by the fact that there is no unanimity of opinion among ornithologists on this geographic segregation of song. The disagreement may result from factors human rather than avian.

In Wisconsin the Alder Flycatcher appears to have added an extra syllable to the *fitz-bew* song, making it *creet* (pause) *fitz-bew*. Phonetic descriptions of Alder Flycatcher song by various writers are listed. The phonetic description of the call note, *wheet*, is generally accepted by ornithologists.

This bird performs a song-flight which carries it 30–50 feet above the marsh. During the performance the *creet*, *fitz-bew* is repeated in rapid succession 8–12 times. This song and flight take place late in the day and continue until after dark. Song generally starts after sunset, and the time of starting and stopping varies in direct relation to the time of sunset. The onset of daily song is probably controlled by a light-intensity factor; cessation probably is not, inasmuch as it is totally dark (after civil twilight) when the singing stops.

No correlation was found between measurable weather conditions and recorded aspects of song.

Morning song also occurs but it is less vigorous and less regular. In 1944 and

1947 seasonal song was ended both in the morning and in the evening within a two-day period (August 9, 1944 and August 11, 1947).

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FOUNDER

Reuben Myron Strong was born in West Allis, Wisconsin, in 1872. Graduated from Oberlin College in 1897, he later received A.M. and Ph.D. degrees from Harvard. He was a member of the Department of Zoology at the University of Chicago from 1903 to 1914 and served as Chairman of the Department of Anatomy at Loyola University Medical School from 1918 until his retirement in 1946. Since that time he has been Research Associate in Anatomy at the Chicago Natural History Museum.

Dr. Strong was the first Treasurer of The Wilson Ornithological Club; was Vice-President from 1894 to 1901; and President from 1920 to 1921. He became an Associate of the American Ornithologists' Union in 1889, a Fellow in 1949. He has published extensively on animal coloration, genetics, neurology, ossification of the skeleton, comparative anatomy and bird behavior. He is, however, best known for his "A Bibliography of Birds," a three-volume work on the ornithological literature of over twenty languages.

In a recent letter he wrote: "I have kept well and have been out every day for work. I have had a good deal of skating, which the cold weather has made possible." Of such stuff are Founders made!

THE SONG OF THE SONG SPARROW

BY ARETAS A. SAUNDERS

THE songs of oscine birds vary greatly. No two individual birds sing in exactly the same way, and the songs of any given individual bird vary (Saunders, 1924). These two sorts of variation are more obvious in the Song Sparrow, *Melospiza melodia*, than in any other bird I have had opportunity to study.

To date my collection of records of Song Sparrow songs numbers 884, no two of which are exactly alike. The songs were recorded by my 'graphic method' (Saunders, 1915, 1929, 1938). The records are mainly from Connecticut and New York. A few from the vicinity of Columbus, Ohio, include those of certain individuals studied at Interpont by Mrs. Nice (1937, 1943).

Length of song. The 884 recorded songs varied in duration from 1.8 to 5.2 seconds, the average being 2.7 seconds. The shortest and longest songs were exceptional, the latter being a flight-song (Fig. 1). If we disregard one short song of 1.8 seconds duration and three unusually long songs (respectively of 4, 5, and 5.2 seconds) the remaining 880 songs varied from 2.2 to 3.2 seconds in length, and 81% of these were from 2.6 to 3 seconds in length. Of the 884 songs, 265 were 2.8 seconds long.

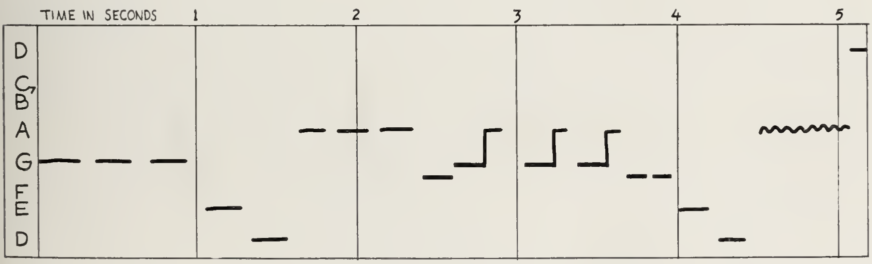

FIG. 1. Graphic record of an exceptionally long Song Sparrow song. This song was a flight-song. Fairfield, Connecticut, March 21, 1925.

Song Sparrow songs are usually rhythmic. The accented, obviously *beat-out* introductory notes are followed by notes each equal in time to one of the introductory notes, or exactly twice as fast, and trills are frequently just two or three times the length of one introductory note. A few rhythms are exceptional, as, for example, that produced in two exactly equal periods of time, one by five notes, the other by seven. Occasionally a song seems to have no rhythm at all except in the introductory part.

Pitch. In former papers on bird songs I have used such symbols as C''' and C'''' to indicate the different octaves. Brand (1935) used a better method, namely, C for the lowest C on the piano; and C_1, C_2, etc., for notes respectively one, two and more octaves higher, C_7 being the highest. In my method C meant middle C on the piano, C'''' the highest C. In this paper I am using Brand's method.

Brand (1935: 49–50) studied three Song Sparrow song-records made by sound photography on film, finding therein numerous short notes which were inaudible to the human ear and exceedingly high in pitch. From his later study of four recordings (1938: 267) he concluded that the vibration-frequencies of Song Sparrow songs varied from 1900 to 7700 per second. This is practically a two-octave range, from about A_5 to A_7. The four recordings under discussion were evidently made from three individual birds. My own records have been limited to notes that the human ear could hear, of course. The 884 records—of about 685 individual birds—display a range in pitch from D_5 to F_7 (1150 to 5450 vibrations), though the great majority of them range only from A_5 to D_7 (1900 to 4600 vibrations). I did not record pitches as high as those found by Brand, probably because the highest-pitched notes were so very short that I did not hear them. I have heard and recorded songs (of other bird species) ranging higher than 7700 vibrations, but these high notes were sustained. From my experience I conclude that it is exceedingly rare for a Song Sparrow to sing a note pitched higher than D_7—that is, long enough for the human ear to hear it.

In recording bird songs in the field, taking down the relative pitches of the notes and the pitch-intervals between one note and another is a simple matter; but taking the exact pitch, as heard by ear, is another step that I did not always have time to complete. In only 445 records did I ascertain the exact pitch. In none of the remaining 439 songs was the pitch unusually high or unusually low: had it been so, I would certainly have recorded the exact pitch.

Song Sparrows usually are quite accurate in pitch; that is, they use definite tones and half-tones in their singing. Occasionally one encounters a bird whose singing includes an off-pitch note or two. See, in this connection, the fourth note of record No. 14 (Fig. 2). Here the bird used approximately a quarter-tone.

An average Song Sparrow song ranges through a little more than $3\frac{1}{2}$ tones. The greatest range I have recorded for a single song is $7\frac{1}{2}$ tones, the least for a whole song, 1 tone. According to my records far more Song Sparrows have, oddly enough, a range of $2\frac{1}{2}$, $3\frac{1}{2}$, 4, or $4\frac{1}{2}$ tones than have a range of 2 or 3 tones. Of the 884 songs I recorded, 1 (only) had a range of but 1 tone; 5 had a range of $1\frac{1}{2}$ tones; 35 had a range of 2 tones; 149 had a range of $2\frac{1}{2}$ tones; 38 had a range of 3 tones; 304 had a range of $3\frac{1}{2}$ tones; 106 had a range of 4 tones; 132 had a range of $4\frac{1}{2}$ tones; 64 had a range of 5 tones; 15 had a range of $5\frac{1}{2}$ tones; 32 had a range of 6 tones; and 1 each had a range of $6\frac{1}{2}$, 7, and $7\frac{1}{2}$ tones.

To a musician the significance of the above-mentioned figures will be apparent. For those whose knowledge of music is not so great, the following explanation may be welcome. All of the simpler, better known melodies in human music, if played on the piano in the key of C, will fall almost entirely on the white notes; or if played in any key, they will fall mainly on the notes of the diatonic scale, *do*, *re*, *mi*, etc. Now the interval of two tones, if spaced from each white note in an octave on the piano, will fall on another white note 3 times out of 7, or 43% of the time. The interval of $2\frac{1}{2}$ tones will fall on another white note 6 times out of 7, or 86% of the time. Similarly the other intervals: of 3 tones, 29%; $3\frac{1}{2}$ tones, 86%; 4 tones, 43%; $4\frac{1}{2}$ tones, 47%; 5 tones, 71%; $5\frac{1}{2}$ tones, 29%; and 6 tones, 100%. Compare these figures with the number of Song Sparrow songs having these intervals in the paragraph above. If we allow for the fact that the average song has a range of $3\frac{1}{2}$ tones, and that songs with greater range must be fewer in number, the figures reveal that the Song Sparrow's standard of pitch is similar to that of man; that those intervals which are harder for man to sing are less often used by the Song Sparrow; that the bird uses such intervals as fourths, fifths, and octaves—intervals that are natural, because based on mathematical relationships between the numbers of vibrations: in short that the Song Sparrow sings mainly on the notes of the human diatonic scale.

This is true of most song birds, a fact which has been discussed before by others, notably Clark (1879). It indicates that, in such birds, something more than defending a territory or advertising for a mate must have had a part in song evolution (Saunders, 1929: 125–130). It is because of this that, now and then, we meet with a bird that sings something like a bit of human music. The pitch is higher, the quality is different, but the time and pitch-intervals are the same. For example, the first six notes of song No. 18 (Fig. 2) are identical in pitch-interval and time with certain notes of a song that was popular many years ago. The words that fit the notes are "... Reuben, I've been thinking."

Intensity. The intensity of Song Sparrow song does not vary greatly. Certain songs contain one or more high-pitched, strongly accented notes like the terminal notes of Nos. 10 and 13 (Fig. 2). Other songs contain one or two introductory or terminal notes that are of low intensity and audible only for a short distance. I have made no attempt to measure the intensity of Song Sparrow song. The distance a bird note (or any sound, for that matter) carries is not, necessarily, a measure of its intensity. Variation in intensity can be measured when the notes are of the same quality and pitch, as they are in many songs of the Field Sparrow (*Spizella pusilla*), a species whose song-intensity I have reported on (Saunders, 1922). The high-pitched, though seemingly faint notes of many birds carry farther than low-pitched notes which are obviously louder. Pitch and quality, as well as intensity or volume, determine the distance a sound carries. Overtones may cut down the distance, and since overtones are often low, sounds of low pitch and unclear quality do not carry well. Balloonists tell us that the last sounds they hear from the earth below them as they rise are the high-pitched cries of little children.

Quality. Song Sparrow songs are extremely variable in quality. Average songs are sweetly whistled, but some songs are, as a whole, squeaky, husky, buzz-like or rattle-like, and occasional notes in otherwise 'sweet' songs may be of this sort. To me the quality of the Song Sparrow's song is more variable than that of any other common North American species of the family Fringillidae.

Consonant Sounds. Consonant sounds are not very noticeable in the Song Sparrow's song. Those that occur are explosives, suggesting the letter *t*, or sibilants such as the letter *s*. Individual songs vary greatly in this respect (Nice, 1943: 116).

The Song and its Component Parts

The Song Sparrow song has been described as "short introductory notes, a central trill, and a flourish of notes and slurs at the end" (Wheeler and Nichols, 1924: 445). I would change this description by substituting "two-note phrases" for "slurs." True slurs, in my experience, are rare in Song Sparrow songs, whereas two-note phrases are exceedingly common. Songs Nos. 4 and 17 (Fig. 2) are normal songs containing a *slurred* note each. By a "two-note phrase" I mean a phrase composed of two notes closely connected but of abruptly different pitch. The last two notes of song No. 12 (Fig. 2) is an example. In a *slur* the change of pitch is gradual. A two-note phrase, for example, might sound like "teeto," whereas a corresponding slur would sound like "teeyo."

Introductory notes. These vary in number from 1 to 7 (average: 2.7). They are all short and staccato, of the same pitch, equal in time, and separated by short pauses. They may be sung slowly, at a rate of 3 per 1.2 seconds, or rapidly, at a rate of 3 per .4 of a second. The slower time is commoner.

While these introductory notes are usually as I have described them, I have on occasion heard a song in which each introductory note is actually a two-note phrase with one note shorter than the other. The short extra note may either precede or follow the main note, and it may be of either lower or higher pitch. Each of these four conditions is illustrated, respectively, in songs Nos. 7, 8, 15 and 17 (Fig. 2). I have 77 records of songs with introductory notes of this sort. In 48 of these the extra note followed the main note (25 at higher pitch, 23 at lower pitch). In 29 the short note preceded (26 at lower pitch, 3 at higher pitch).

Central Trill. Most Song Sparrow songs contain, somewhere in the central portion, sometimes at the end, either a trilled note or a series of rapidly repeated notes all on the same pitch. Trills and rapidly repeated notes are essentially the same phenomenon, the difference being merely that in the trill the notes are too rapid for the ear to count. In my records all these rapidly repeated notes are called trills. Of the 884 songs, 55 had no trill, 580 had one trill, 259 had two trills, 9 had three trills, and 1 had four trills. The average had 1.3 trills. Trills are normally sustained on one pitch, but in one song (Fig. 2, No. 11) the trill gradually dropped a full tone.

Remainder of the Song. The terminal flourish of notes and two-note phrases is extremely variable. A given bird may sing the same song over and over, all parts being the same each time except for the last few notes. These final notes may be varied by additions, omissions, or changes in pitch. In recording such songs in the field I encircle notes that are variable or sometimes omitted. Often I am obliged to make records of the two or three different endings in this way. Especially is this true of my recording of Song Sparrow songs. The last note of No. 9 (Fig. 2) is an 'encircled note.'

Types of Songs

When one has a large number of records of the songs of one species it is necessary to f le them so that similar songs can be kept together for comparison. I have divided my Song Sparrow songs into types based on the way they begin. In some cases I have found it useful to subdivide further. Wheeler and Nichols (1924) divided songs into two groups. When I tried classifying my records in this way, altogether too many normal songs belonged to neither group; but when I divided them into five groups all but eight could be placed, and three of these eight were primitive or juvenile songs.

The type to which a given song belongs is determined by the relation in pitch of the introductory notes to the trill and by the position of the trill (or in the case of more than one trill, by that of the first trill). A key to these types is as follows:

Introductory notes followed immediately by trill.

- Introductory notes and trill on the same pitch. Type 1 (Nos. 1–3, Fig. 2. This is Group B of Wheeler and Nichols).
- Trill higher in pitch than introductory notes. Type 2 (Nos. 4–8, Fig. 2. This is Group A of Wheeler and Nichols).
- Trill lower in pitch than introductory notes. Type 3 (Nos. 9–11, Fig. 2).

Introductory notes separated from trill by one or more notes.

- Introductory notes and trill separated by single note which is on a different pitch from either. Type 4 (Nos. 12–14, Fig. 2).
- Introductory notes and trill separated by two or more notes, the first on different pitch from that of the introductory notes. Type 5 (Nos. 15–18, Fig. 2).

Of the 884 recorded songs, 159 (18%) were of Type 1, 191 (21.6%) of Type 2, 144 (16.4%) of Type 3, 137 (15.4%) of Type 4, 245 (27.7%) of Type 5, and 8 (0.9%) irregular.

In certain respects Type 1 is quite different from the others. In Type 1 two introductory notes (rather than three) are the rule. In Type 1 the trill is usually

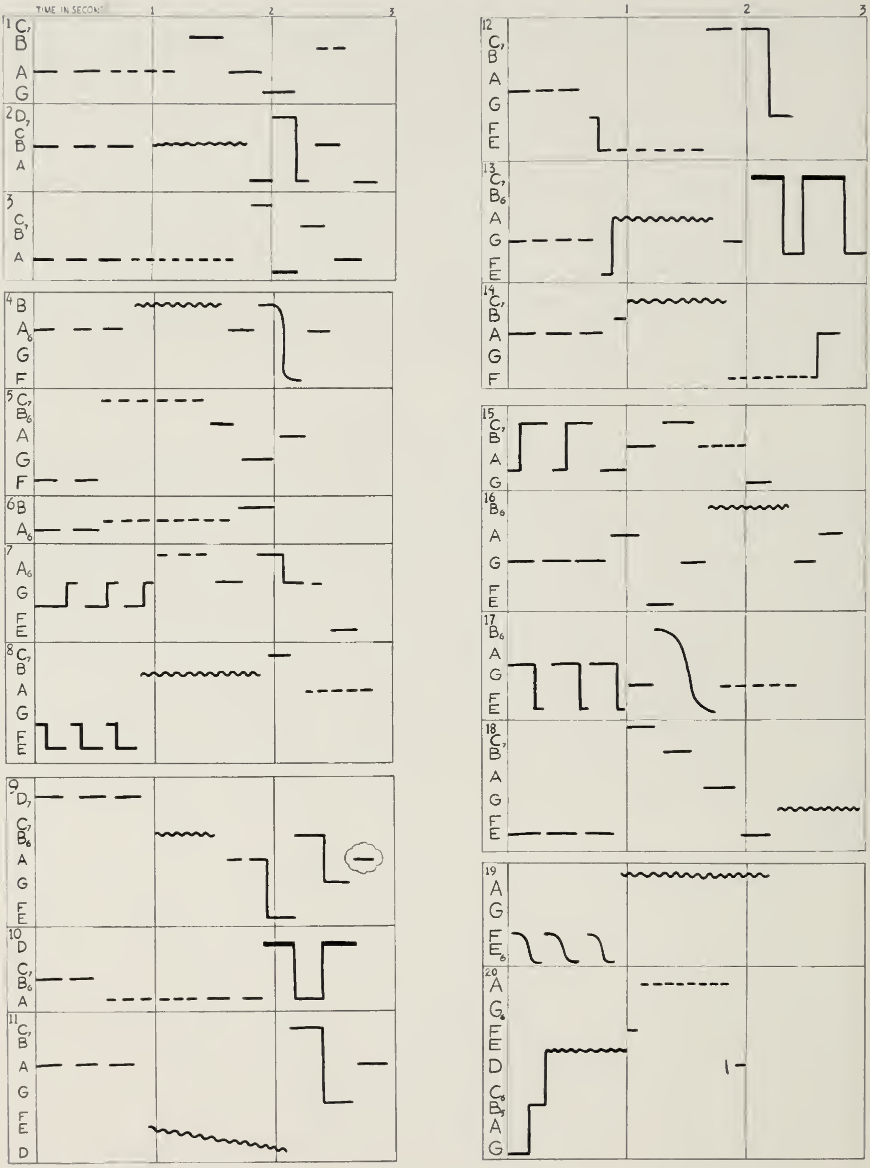

FIG. 2. Graphic records of Song Sparrow songs. 1. March 25, 1922. 2. June 9, 1921. 3. March 4, 1922. 4. July 16, 1921. 5. April 10, 1921. 6. April 11, 1923. 7. July 19, 1923. 8. June 27, 1921. 9. June 14, 1921. 10. March 25, 1922. 11. April 15, 1914. 12. October 24, 1922. 13. May 29, 1921. 14. February 25, 1922. 15. July 2, 1922. 16. August 10, 1921. 17. July 6, 1921. 18. July 22, 1922. 19. July 5, 1920. 20. March 22, 1943. All recorded at Fairfield, Connecticut except 4 and 17 (Quaker Bridge, New York); 7 (Savannah, New York); 11 (West Haven, Connecticut); 12 (Bridgeport, Connecticut); 13 (Norwalk, Connecticut); and 15 and 18 (Syracuse, New York). For a discussion of the types of songs these represent see p. 103).

not a true one (as it is in other types), but a series of rapid notes. An average Type 1 song opens with two notes which are followed by a series of rapid notes, and in a good many cases these rapid notes are just twice as fast as the introductory ones.

Type 4 songs may be further divided into 8 subtypes on the basis of the relative pitches of the introductory notes (which are all on one pitch), the single note between them and the trill, and the trill itself (which is almost invariably on the same pitch throughout). If we call the highest pitch 1, the medium pitch 2, and the lowest pitch 3, there are these six possible arrangements: 1-2-3, 1-3-2, 2-1-3, 2-3-1, 3-1-2, and 3-2-1. There are also two other arrangements in which there are only two pitches, 1-2-1 and 2-1-2, but there seem to be very few songs of these sorts. Of the 137 Type 4 songs, 9 had the 1-2-3 pitch-arrangement of introductory notes, single note, and trill; 35 the 1-3-2 arrangement, 19 the 2-1-3, 39 the 2-3-1, 16 the 3-1-2, 17 the 3-2-1, one the 1-2-1, and one the 2-1-2. Nos. 12–14 are examples of subtypes 4a, 4d, and 4f respectively. In 25 of my records of Type 4 songs, the note between the introductory notes and the trill is very short and connected with the trill, as in No. 13.

Type 5 songs are also divisible into 8 subtypes on the basis of the relative pitch of the introductory notes and the *two* notes immediately following them. Of the 245 songs of Type 5, 22 had a 1-2-3 (high-medium-low pitch) arrangement, 65 a 1-3-2 arrangement, 49 a 2-1-3, 37 a 2-3-1, 17 a 3-1-2, 32 a 3-2-1, 12 a 1-2-1 and 11 a 2-1-2. Note that the last two arrangements (two pitches only) again are less frequently used than the others. Songs 15–18 are examples of subtypes 5b, 5c, 5d, and 5e respectively. In 45 of my Type 5 songs three introductory notes are followed by three other notes in the same time but on different pitches (see Fig. 2, Nos. 16 and 18). Such songs are especially pleasing musically. Two songs of this sort I have diagrammed in a previous paper (Saunders, 1924: 249, Nos. 1 and 2).

Of eight 'irregular' songs that cannot be put into types, three were primitive or juvenile songs (Fig. 3); one began with a trill; three had two sets of introductory notes on different pitches; and one began with four very short notes each on a different pitch. In this last song the introduction was followed by *three* trills. The whole song was of such an unusual quality that I did not definitely know it was a Song Sparrow's until I saw the singer. In my notes I described the song as a husky squeaking suggestive of the twittering of a Cliff Swallow (*Petrochelidon pyrrhonota*).

Local Variation. Occasionally one finds a peculiarity in Song Sparrow song that is common to several individuals in a restricted locality. I have previously stated that slurs are rare in Song Sparrow songs. I have 22 records of normal songs that contain downward slurred notes. Three are from Connecticut, three from scattered localities in central New York, and 16 from Quaker Bridge, Cattaraugus County, New York. Nos. 4 and 17 are examples. The birds that sang slurs of this sort all lived along the Allegheny River within half a mile of the Quaker Bridge railroad station. I have recorded many Song Sparrow songs from regions nearby, particularly in Allegany State Park, but noted no slurs in them. The occurrence of this "Quaker Bridge slur" is the best example I have of local variation in Song Sparrow song.

Geographical Variation. My Song Sparrow records represent three main geographical areas: (1) an eastern—Connecticut and southeastern New York, (2) a central—central New York, and (3) a western—southwestern New York. I have a few records from the Adirondacks and a few from Columbus, Ohio, but these samples are so small that it would be unwise to draw any conclusions from them. All five types of songs are sung by the Song Sparrows of the three above-mentioned areas. Of 514 eastern area songs 77 (15%) were of Type 1, 98 (19%) of Type 2, 103 (20%) of Type 3, 67 (13%) of Type 4, and 169 (33%) of Type 5. Of 167 central area songs 20 (12%) were of Type 1, 50 (30%) of Type 2, 24 (15%) of Type 3, 33 (19%) of Type 4, and 40 (24%) of Type 5. Of 186 western area songs 35 (19%) were of Type 1, 54 (29%) of Type 2, 21 (12%) of Type 3, 20 (10%) of Type 4, and 56 (30%) of Type 5. Nothing about these figures reveals any marked correlation between type of song and geographical area.

There is some evidence of geographical variation in the introductory notes of New York and Connecticut songs. In certain songs the main introductory notes are accompanied by shorter notes on a different pitch. Soon after I began recording Song Sparrow songs in the western area (Cattaraugus County, New York), I noticed that this type of introductory note was more common there than it had been in the eastern area (Connecticut and far eastern New York). Of a total of 514 songs recorded in the eastern area only 12 (2.4%) had had double introductory notes; of 167 songs in the central area 33 (19.8%) had had double introductory notes; and of 186 songs in the western area 32 (17.2%) had double introductory notes. Songs of the central and western areas were, in other words, somewhat alike, and together they differed from songs of the eastern area. This is indeed interesting because Song Sparrows of the eastern area belong to the subspecies *melodia;* those of the western area are of the subspecies *euphonia;* and those of the central area (Onondaga, Cayuga and Wayne Counties, New York), though intermediate between these two races, are "more nearly related to those of western New York than to those of the eastern part of the state" (personal letter of December 11, 1950, from Kenneth C. Parkes to George M. Sutton). My song-data presented above are surprisingly corroboratory of this concept.

Each individual male Song Sparrow sings a number of different songs. The number per individual varies from six to 24 (Nice, 1943: 116–117). What I have previously written on this subject (1924, 1938) was included in Mrs. Nice's figures. Since then I have added further data and now have records of 13

TABLE 1

174 Different Songs Sung by 13 Song Sparrows

Bird No.	Song-Type					Total Number Different Songs
	1	2	3	4	5	
1	2	0	1	0	3	6
2	2	0	2	0	4	8
3	0	1	0	3	5	9
4	2	0	1	0	6	9
5	0	5	1	0	5	11
6	0	2	1	2	7	12
7	2	0	3	3	4	12
8	0	3	7	2	3	15
9	1	3	1	1	10	16
10	2	3	2	1	8	16
11	3	3	3	0	9	18
12	0	2	4	3	9	18
13	0	5	6	1	12	24
Totals	14	27	32	16	85	174

individuals. The number of songs per individual still ranges from six to 24. Table 1 shows the number of different songs (and song-types) 13 individual birds sang. Each individual bird sang at least three song-types, several sang four, and two sang all five. Only seven sang Type 1; eight sang Type 4; but every individual sang Type 5, and all but one sang Type 5 as often as, or oftener than, any other type.

I have recorded a flight-song (Fig. 1) which was distinctly longer than other songs. It did not, however, begin with "tit-tit-tit" notes (Nice, 1943: 118). I have heard Song Sparrow flight-songs which began in this way and it is interesting to observe that flight-songs with such a beginning are common to a number of other species, the Phoebe (*Sayornis phoebe*) and Yellow-throat (*Geothlypis trichas*), for example.

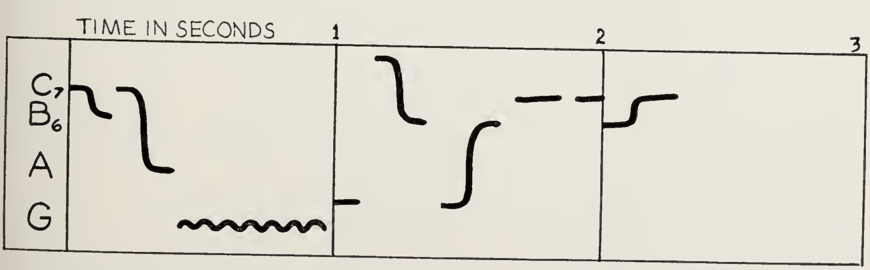

Fig. 3. Graphic record of a 'primitive' Song Sparrow song. Fairfield, Connecticut, September 20, 1924.

Figure 3 is a record of a primitive song. My three records of primitive songs are not much alike and there is nothing definite by which to distinguish them from primitive songs of other species. The notes are usually rapid but not loud.

Imitation. When one finds two Song Sparrows whose songs are nearly alike, the birds are apt to be singing within hearing of each other. In the spring migration, when the roadsides are full of singing Song Sparrows, one may often find two or three birds each beginning its song in the same manner and on the same pitch. But rarely do two such birds end their songs in the same way.

I presume that almost any oscine bird may, at times, do some imitating of the songs of other species. I have one record of a Song Sparrow song (No. 19, Fig. 2) which was much like that of a Field Sparrow, the introductory notes being downward slurs and the rest of the song a long, high-pitched trill. When I first heard this song I was doubtful about the species of bird that produced it. The quality was not quite so clear and sweet as that of a Field Sparrow, yet I did not expect it to be a Song Sparrow.

The last record of a Song Sparrow song (No. 20, Fig. 2) that I have recorded was rather astonishing, for the first 3 notes of the song were a perfect "*con-queree*" of the Red-wing (*Agelaius phoeniceus*). When I first heard this I thought two different birds were singing, first a Red-wing and then a Song Sparrow, but when I drew nearer it was clear that it all came from one bird, a Song Sparrow. So far as my ear could determine, the imitation was perfect. The pitch of the trill on E_6 was exactly right, for at least nine out of ten Red-wings sing it on that pitch.

SUMMARY

From a study of 884 records of the Song Sparrow's song the following facts are determined. Songs vary from 1.2 to 5.2 seconds in length, averaging 2.7 seconds. Pitch varies from D_5 to F_7 (1150 to 5450 vibrations) in notes that are audible to the human ear. Single songs range from 1 to $7\frac{1}{2}$ tones in pitch, averaging $3\frac{1}{2}$ tones. The bird commonly uses pitch-intervals similar to those used in human music. There is little variation in intensity, but some high-pitched notes are loud and strongly accented and carry well. Quality is usually sweet and musical, but quite variable. Consonant sounds are not very noticeable.

The song has three parts: strongly rhythmic introductory notes, a central trill, and a final series of rather irregular and indefinite notes. The introductory notes may vary from 1 to 7 but are usually 2 or 3. Trilling is part of a great majority of songs. Commonly there is one trill, frequently there are two trills, rarely there are three or four.

Songs are of five types. These types differ primarily in the position and relative pitches of the introductory notes and the trill. The percentages of these types vary somewhat geographically. Song Sparrows of the seacoast region of Connecticut and southeastern New York sing a song the introductory notes of

which are usually single; some individuals in central and western New York sing a song whose introductory notes are double.

An individual Song Sparrow sings from six to 24 different songs. It may sing from three to all five types of songs. Two individuals singing near each other sometimes sing songs which sound alike. Especially is this true of the introductory parts. Rarely does a singing Song Sparrow imitate any other species of bird.

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GENERAL NOTES

Gray Heron chased by Common Gull.—On June 23, 1949, at Foerde, Norway (Lat. 61½° N.), "I saw a gull, presumably a Common Gull (*Larus canus*), because that appears to be the common species here—though some may be Herring Gulls (*L. argentatus*)—chasing and harrying a Gray Heron (*Ardea cinerea*) which flew over the valley at about 1000 feet. I was surprised to see the gull harrying it."

The above quotation from my diary is submitted in view of the note by Thomas A. Imhof in the December, 1950, issue of *The Wilson Bulletin* (p. 210), reporting the chasing of a Great Blue Heron (*Ardea herodias*) by a Ring-billed Gull (*Larus delawarensis*) on March 6, 1950, in Alabama.

Note that the Gray Heron is the Old World analog of the Great Blue Heron, and the Common Gull, to some extent at least, that of the Ring-bill.—F. W. PRESTON, *Box 149, Butler, Pennsylvania.*

The genus *Plegadis* in Ohio.—Donald J. Borror, in his "A Check List of the Birds of Ohio, with the Migration Dates for the Birds of Central Ohio" (1950. *Ohio Jour. Sci.*, 50: 2), lists the Eastern Glossy Ibis, *Plegadis f. falcinellus*, mentioning three occurrences for northern Ohio and one for southern Ohio. The earliest of the four records is that of Jared P. Kirtland, who reported two individuals seen in 1848 near Fairport, in Lake County. One of these, an adult male, was shot by a Mr. Prugen and sent to Kirtland, who wrote (1850. *Family Visitor*, 1: 164): "It was duly skinned and mounted, and may now be seen standing along side of a Scarlet Ibis, from the banks of the Amazon, . . . in the cabinet of Nat. Hist. at the Cleve. Med. Coll." On the strength of this statement Wheaton (1882. "Report on the Birds of Ohio," *Geol. Surv. Ohio*, IV, *Section* 2, p. 498), Jones (1903. "The Birds of Ohio," *Ohio State Acad. Sci., Special Papers No. 6*, p. 216) and Dawson (1903. "The Birds of Ohio," p. 481) all listed the Eastern Glossy Ibis.

The Kirtland collection, including the Prugen specimen of *Plegadis*, was given to Western Reserve University. It is now in the Biology Building of that institution. Hoping to learn more about the Prugen specimen, I wrote the late J. Paul Visscher concerning it. Visscher replied that the collection contained two ibises—a White-faced Glossy Ibis (*Plegadis mexicana*) and a Scarlet Ibis (*Guara rubra*). Visscher's untimely death prevented my receiving further information concerning the specimens at that time.

Recently I wrote Harry C. Oberholser about the moot *Plegadis* specimen. On September 22, 1950, Dr. Oberholser replied: "I found the Ibises about which you inquired. The Scarlet Ibis is there, with one White-faced Glossy Ibis. There are no data . . . regarding either, but I agree . . . that the latter is without much doubt the bird concerning which Dr. Kirtland wrote. In this specimen the white forehead is not very conspicuous but still present; and one not familiar with the differences between the two species might easily call this specimen the Eastern Glossy Ibis."

The White-faced Glossy Ibis must, therefore, be added to the Ohio list.

The second and third *Plegadis* records for Ohio were sight records. On May 30, 1943, Harold F. Mayfield and Louis W. Campbell saw three adults in a flooded field adjoining the Cedar Point Marshes, in Jerusalem Township, Lucas County, near Toledo. "The birds were viewed at close range and carefully distinguished from the White-faced Glossy Ibis . . ." (Campbell, 1944. *Auk*, 61: 471). On June 22, 1947, in the same general area, Laurel Van Camp, state game protector for Ottawa County, saw an adult ibis which he identified as an 'Eastern Glossy' (Mayfield, 1947. *Aud. Field Notes*, 1: 176–177).

Details concerning the fourth Ohio *Plegadis* record follow: On October 1, 1949, Ronald

Austing, Edith Folger and I saw an immature bird at Lake Grant, in Brown County, some thirty miles southeast of Cincinnati. Austing collected the bird, which proved to be a male (testes very small). The stomach contained about two hundred adult water beetles of the families Gyrinidae, Hydrophilidae and Dytiscidae. This specimen is in the skin collection of the University of Cincinnati's Department of Zoology. It measures: wing, 265 mm.; tail, 112; culmen, 110 (114 if measured along the curve); tarsus, 93. Thus far I have been unable to identify the bird as to species. In the letter above referred to, Dr. Oberholser expressed belief that *Plegadis falcinellus* and *P. mexicana* were indistinguishable in any but fully adult spring plumage.[1]—EMERSON KEMSIES, *Department of Zoology, University of Cincinnati, Cincinnati, Ohio.*

Reidentification of some Swans, Scoters, and a Jaeger from Kansas.—While engaged in work with the bird collection of the University of Kansas Museum of Natural History, I have noted several important misidentifications of birds taken in Kansas.

Trumpeter Swan (*Cygnus buccinator*). This museum has three skeletons (two without data) and one mounted specimen allegedly of this species. All have proven, when critically examined, to be Whistling Swans (*Cygnus columbianus*). The skeleton with data (UKMNH No. 11949) and the mounted bird (UKMNH No. 7475) were taken at Lawrence, Douglas County, Kansas, in 1888, and have long been regarded as the only state specimens of the Trumpeter Swan. There seems to be no reason to doubt the early records of the Trumpeter Swan in Kansas. Goss (1891. "History of the Birds of Kansas," p. 108) mentions the "loud clarion voice" of this species, and indicates that it was more common in migration than the Whistling Swan (although this may be doubtful, since the Trumpeter apparently has never been as migratory as the Whistler, and it may not have been at all common or regular in Kansas even in the early days). The fact remains, however, that no specimen of the Trumpeter Swan from Kansas seems to have been preserved.

The skeletons mentioned above were readily identified on the basis of the convolutions of the trachea within the sternum. The mounted specimen was identified on the basis of size—wing, 20.5 inches; tail, 6.25; tarsus, 3.75; eye to hind edge of nostril, 2.37; tip of bill to hind edge of nostril, 2.19. Probably the original misidentifications were based on the false premise that all Whistling Swans have a yellow spot on the bill in front of the eye, and, therefore, that any swan lacking this spot must be a Trumpeter.

American Scoter (*Oidemia nigra americana*). This scoter was first reported from Kansas by L. L. Dyche (1909. *Trans. Kansas Acad. Sci.*, 22: 311) on the basis of two specimens. One (UKMNH No. 7735), by plumage a female, was taken at Lakeview, Douglas County, on November 1, 1908, by Edward E. Brown. The other (UKMNH No. 7743), also a female, was taken at Lawrence on October 24, 1908, by George Weyermiller. W. S. Long (1940. *Trans. Kansas Acad. Sci.*, 43: 438) indicates that the specimens taken in 1908 are the only records for the American Scoter in Kansas. Actually, however, both specimens are Surf Scoters (*Melanitta perspicillata*), with the female plumage and feathering about the base of the bill characteristic of that species. These specimens raise to eight the number of known specimens of the Surf Scoter taken in Kansas. The American Scoter, although recorded from the Kansas City region of Missouri (H. Harris, 1919. *Trans. Acad. Sci. St. Louis*, 23: 237), must, for the present, be dropped from the list of Kansas birds.

Parasitic Jaeger (*Stercorarius parasiticus*). F. H. Snow (1904. *Auk*, 21: 284; and 1905. *Trans. Kansas Acad. Sci.*, 19: 263) first reported the Parasitic Jaeger from Kansas. He wrote: "a young male [of this species] was captured along the Kansas river near Lawrence on October 10, 1898, by [Gus Berger and] Banks Brown. The specimen [UKMNH No. 6967] was mounted . . . and is now in the museum of the University of Kansas. . . ." This record has been re-

[1] Note, in this connection, the comments of Ernest P. Edwards (1950. *Condor*, 52: 262) concerning variation in color of facial skin in museum specimens.—Editors.

published or cited unchallenged in subsequent lists pertaining to Kansas birds (see C. D. Bunker, 1913. *Kansas Univ. Sci. Bull.*, 7: 139; W. S. Long, *op. cit.*: 443; and American Ornithologists' Union Check-List, Fourth Ed., 1931: 129).

I recently remade the mounted jaeger in question into a study skin. Examination of the bird at that time disclosed that it was actually an immature Pomarine Jaeger (*Stercorarius pomarinus*). It measured as follows: wing, 337 mm.; tail, 140 (central pair of rectrices rounded and projecting 9.7 mm. beyond adjacent rectrices); tarsus, 51.4; middle toe (without claw), 42.5; exposed culmen, 38; depth of bill at base, 14.2; width of bill at base, 13; cere, 21.6; dertrum, 18.0.

The specimen under discussion is the only jaeger ever reported as taken in Kansas, although all three species have been reported from the vicinity of Kansas City in Missouri (Harris, *op. cit.*, pp. 224–225). The Parasitic Jaeger has not been authentically reported from Kansas, therefore, while the present note will serve to add the Pomarine Jaeger to the Kansas list.—Harrison B. Tordoff, *Museum of Natural History, University of Kansas, Lawrence.*

Deep diving of the Old-squaw.—Having heard that Herman J. Freitag, a commercial fisherman at Kenosha, Wisconsin, had taken 37 Old-squaws (*Clangula hyemalis*) in nets set at a depth of 150 feet seven miles off shore, I wrote to him for confirmation. Under date of December 28, 1950, he stated: ". . . we always sound the depth of the shallow end of the nets. I thought this was deep until I talked to my brothers fishing out of South Haven, Mich., who got them in 180 and 190 feet of water this fall." The latter depths approach the maximum previously reported by me (1947. *Wilson Bulletin*, 59: 151).—A. W. Schorger, *168 N. Prospect Ave., Madison, Wisconsin.*

Marsh Hawk catching a Mourning Dove.—On May 21, 1946, I observed a Marsh Hawk (*Circus cyaneus*) in pursuit of a Mourning Dove (*Zenaidura macroura*) at Craigheads, Cumberland County, Pennsylvania. The hawk flew a few feet above and behind the dove which was about eight feet off the ground at the edge of a square 10-acre wheat field. By swerving sharply to one side or the other and dipping low over the ground, the dove was able to elude several strikes of the hawk before they reached the center of the field. Each time the hawk closed the gap as it struck, then banked quickly to maintain a slight altitude advantage when the maneuvering dove eluded it. The erratic twisting course made both birds appear slow-moving. In the center of the field, however, the dove was closer to the ground and appeared exhausted. The hawk made a swift direct stoop, grasped the dove in one foot, and without pause or change in altitude wheeled and carried the dove back along the course of pursuit and out of my view. This incident was observed through a 7 x 35 mm. binocular from the edge of the field. It took place quickly—perhaps in one minute.—John L. George, *Department of Zoology, Vassar College, Poughkeepsie, New York.*

Marbled Godwit, Upland Plover, Burrowing Owl and Yellow-headed Blackbird in Chicago area.—Week-end bird observations from 1942 to 1950 in the Chicago area produced a few interesting results. On May 4, 1947, I saw a Marbled Godwit (*Limosa fedoa*) near Warrenville, Illinois, and on September 21, 1947, a Burrowing Owl (*Speotyto cunicularia*) near Barrington, Illinois. Each of these had been recorded in the Chicago region only once before (see Ford, Sanborn, and Coursen, 1934. Chicago Acad. Sci. Program of Activities, 5 (2–3), respectively pp. 42 and 46). Two species which I sought especially; which Ford, Sanborn, and Coursen (*ibid.*, respectively pp. 39 and 65) called "fairly common"; and which Woodruff (1907. Chicago Acad. Sci. Bull. 6) called "common", I recorded on only one occasion each: the Upland Plover (*Bartramia longicauda*), a pair with two well grown young, near Brunswick, Lake County, Indiana, June 17, 1949; and the Yellow-headed Blackbird (*X. xanthocephalus*), a male at Calumet Lake, Illinois, May 7, 1948.—W. L. McAtee, *3 Davie Circle, Chapel Hill, North Carolina.*

Iceland Gull in Florida.—On January 6, 1950, while my wife and I were driving over the Long Key viaduct on the Florida Overseas Highway we noticed that one of the gulls drifting overhead was white-winged. It was about twenty-five feet above us and was sailing along on motionless wings apparently using an updraft caused by the viaduct. It was about the size of a small Herring Gull (*Larus argentatus*) and its pure white wing tips stood out brilliantly against the deep blue sky. For more than a mile we drove along slowly, staying about

An Iceland Gull (*Larus glaucoides*) flying over the Florida Overseas Highway. Photographed on January 6, 1950, by Helen Gere Cruickshank.

fifty feet behind the bird, studying it closely. Four times I drove directly under and beyond it, stopping long enough for my wife to take photographs with her Leica. We identified the bird as an Iceland Gull (*Larus glaucoides*).[1]

The Iceland Gull has been reported from Florida only once before. On February 9, 1927, near the town of Crystal River, at the head of Crystal Bay along the west coast in Citrus County (roughly 300 miles northwest of Long Key), O. F. Swed collected a specimen which is now in the Florida State Museum (Howell, 1932. "Florida Bird Life," p. 255). Our seeing the species off extreme southern Florida calls to mind Griscom's statement (1950. *Aud. Field Notes*, 4: 191) that the flight of white-winged gulls in the winter of 1949–1950 was "one of the three heaviest flights in history in the Northeast."—Allan D. Cruickshank, *Highland Hall, Rye, New York.*

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[1] *Larus glaucoides* Meyer (1822) appears to be the earliest name for the Iceland Gull. *Larus leucopterus*, a name currently in wide use for the species, was bestowed by Vieillot in 1820, but Vieillot's description did not apply indubitably to any such small white-winged form as the Iceland Gull is known to be, hence the name *leucopterus* is not acceptable (see Mayaud, 1934. *Alauda*, 6: 370–375).—G. M. S.

The nest and eggs of *Smaragdites t. theresiae*.—The Goldenthroat, *Smaragdites t. theresiae*, is a rather small hummingbird with rounded tail. It is bright green all over except for the primaries and primary coverts, which are dark brownish gray, glossed with purplish blue, and the belly feathers and under tail coverts, which are partly white. The rectrices, which are rather narrow, are glittering grass green. The chin, throat, and breast are brilliant light golden green. The species inhabits the Guianas, Venezuela, and northern Brazil (Pará west to Manáos and the Madeira and Tapajóz Rivers). Specimens which I have collected in Surinam weighed: two males, 3.58 and 3.6 grams; three females, 3.5, 3.5, and 3.8 grams.

Nests of *Smaragdites t. theresiae* in dead shrubbery on open savanna near the airfield at Zanderij, Surinam. That on the left was photographed July 24, 1949; the other, August 26, 1950. Photographs by F. Haverschmidt.

I have been unable to find a description of the nest and eggs of this species. The eggs are not in the collection of the British Museum (Oates and Reid, 1903. Cat. Coll. Eggs in the British Museum, Vol. 3, London), in the Nehrkorn collection (1910. Katalog der Eiersammlung, Berlin), or in the Penard Surinam collection (Hellebrekers, 1942. *Zoologische Mededeelingen*, 24: 254–255).

In Surinam *Smaragdites theresiae* inhabits open sandy savannas throughout which the only vegetation is grass and low-growing shrubbery. Near the Zanderij airfield, where the species is rather common, I found four nests, each in exactly the same sort of exposed situation about 50 cm. from the ground in a fork formed of two dead stems of a low shrub. Each was composed of a very soft material (plant down of some sort, probably) of a beautiful cinammon color. Scattered patches of lichens were attached to the outside. Not one of the nests was concealed in the least, each being visible at a considerable distance.

I found the first nest on July 24, 1949 (see photo). It held two much-incubated eggs. These measured 12.5 x 8.2 and 12.2 x 8.2 mm. The nest—an unusually large one for the species—measured (in millimeters): height, 57; over-all width, 34; thickness of wall, 14; depth of cup,

17. I collected the incubating female so as to be sure of the identification.

On August 21, 1949, I found an empty nest of the same sort not far from the first.

On August 28, 1949, I found an unfinished nest. It contained one egg (weight 0.48 grams) on September 4 and 5. On September 11 it held two eggs and the female was incubating. When I visited it several days later the eggs, as well as the female bird, were gone.

On August 26, 1950, I found a nest through watching the owner fly to it. It contained a well-fledged young bird which flew off as I approached. I collected the adult female.—FR. HAVERSCHMIDT, *P. O. Box 644, Paramaribo, Surinam, Dutch Guiana.*

Clark's Nutcracker in the Chisos Mountains, Texas.—On October 20, 1950, Mr. and Mrs. O. W. Letson, of Tulsa, Oklahoma, and I observed a Clark's Nutcracker (*Nucifraga columbiana*) in the Chisos Mountains, in Big Bend International Park, Brewster County, Texas. The bird was feeding in the tops of not very high pinyon pines (*Pinus edulis*) at an elevation of about 6000 feet on the north side of the divide between The Basin and Juniper Canyon. We first encountered it in the vicinity of the 'cactus garden' on the recently constructed foot trail leading to Lost Mine Peak from the road at the rim of The Basin. The spot was approximately one and one-half miles north of Upper Juniper Spring and the same distance west of Lost Mine Peak. We watched the bird for twenty minutes as it moved about, sometimes flashing its black and white wings and tail while balancing at the tip of a slender branch. It seemed quite unconcerned by our presence, allowing us to approach to within 50 feet of the tree in which it was feeding.

Nucifraga columbiana was not listed by Van Tyne and Sutton from Brewster County, Texas (1937. *Univ. Mich. Mus. Zool. Misc. Publ.*, 37), nor by Burleigh and Lowery from the Guadalupe Mountains of western Texas (1940. *La. State Univ. Occ. Papers No. 8*). The species is believed to range normally southward as far as southern New Mexico, southern Arizona and northern Baja California. Starker Leopold has reported it from the State of Nuevo León, in México (1946. *Condor*, 48: 278). As Bent (1946. *U. S. Natl. Mus. Bull.* 191: 321) has pointed out, "the nutcracker is given to erratic wanderings that sometimes take it considerable distance from its normal range."—JOHN E. GALLEY, *1610 W. Holloway Ave., Midland, Texas.*

First successful nesting of the Cerulean Warbler in New Jersey.—On June 6, 1950, at a picnic in the Greenbrook Sanctuary of the Palisades Interstate Park in New Jersey, less than five miles north of the George Washington Bridge, Mrs. Marjorie Kirkpatrick of Livingston, New Jersey, reported hearing the songs of a Cerulean Warbler (*Dendroica cerulea*). After a search, a dozen or so of us located a pair of the warblers and their partly finished nest. The nest was in a sweet gum well out on a branch high over a junction of paths and a road along which the whole party had passed earlier in the day. Nesting material was being gathered on the ground and from an old vireo nest higher in the same tree. The male sang many times as the female added material to the nest. The presence of the several observers had no noticeable effect on the birds.

On June 10, when I next visited the nest, the female was on it and the male was singing in a nearby tree. On June 17 at 6:30 a.m. Mr. Dater and I again visited the nest. The female was sitting and the male singing, as before. A storm of heavy rain and high wind broke just after our arrival. We checked once more before leaving the area, finding that things seemed to be normal. Later in the day, however, another observer found the nest abandoned and noted a gaping hole in it. Subsequently, Mr. Collins, the park naturalist, detected egg remains on the ground below.

On July 13 two other members of the Ridgewood Audubon Society and I succeeded in finding a second Cerulean Warbler nest some two hundred feet from the first. The new nest was in an oak about thirty-six feet from the ground. In the nest we could see two young birds, which seemed about ready to leave. They were fed at ten minute intervals by both parents, but during our two hours of observation the parents never arrived at the nest at the same time. On July 15 observers reported that the young had left.

Early in November Mr. Dater cut down the nest. It agrees in general appearance and structure with nests described by Chapman (1907. "The Warblers of North America," p. 174), except that there is a great deal of soft, pulpy white paper (perhaps weathered paper napkins left by picnickers) in the base and wall. This paper, which entirely surrounds some of the supporting twigs, is visible even inside the cup. The walls and lining are very thin.

The Cerulean Warbler has been regarded as a rare migrant in New Jersey. The nearest nesting area has been Dutchess County, New York, on the other side of the Hudson River farther north (Cruickshank, 1942. "Birds Around New York City," p. 392). In 1947 a female built a nest near Lyons, New Jersey, but the eggs never hatched (Nichols, 1947. *Audubon Field Notes*, 1: 172).—Eleanor E. (Mrs. J. Y. Jr.) Dater, *259 Grove St., Ramsey, New Jersey.*

English Sparrows eating locust leaf-miners.—For the past several seasons there has been a severe outbreak of the locust leaf-miner (*Chalepus dorsalis* Thunberg) on black locust in the central Appalachian region. Adult beetles appear about the first of June, depositing their eggs within the tissues of the locust leaves. Larvae feed on the tissues between the two outer surfaces, causing blotch mines in the leaves. Often practically every leaf on a tree is affected and the whole tree turns brown. Pupae form within the curled-up edges of the leaf epidermis in late July or early August.

My attention has frequently been called to large numbers of English Sparrows, *Passer domesticus* (Linnaeus), feeding in trees infested with these locust leaf-miners. During the summer of 1950 I repeatedly watched, through binoculars, these birds searching the locust leaves and feeding on adult beetles, larvae, and pupae. The birds systematically searched around the curled-up edges of the browned leaf epidermis. Flocks of thirty to fifty birds regularly fed in this manner in a locust tree near my home at Morgantown, West Virginia. On July 5, I saw one English Sparrow eat eleven larvae in a period of a little more than three minutes.

The leaf-miner outbreak has been an extensive one, and I do not mean to suggest that English Sparrows have been an important factor in the control of the pest. It is of interest, however, to see this much-maligned bird doing useful work in destroying shade-tree insects. —Maurice Brooks, *Division of Forestry, West Virginia University, Morgantown.*

An aberrantly colored Summer Tanager.—On May 17, 1950, while studying the bird population of a tract of 60-year-old loblolly and shortleaf pine (*Pinus taeda* and *P. echinata*) about one mile south of Athens, Clarke County, Georgia, I observed an adult male Summer Tanager (*Piranga rubra*) in company with a slightly smaller red and yellow bird which at first I believed to be a young male. Realizing that young birds were not even out of the nest at that early date, I tried to recall whether I had ever before seen a red and yellow subadult male of that sort in the spring. While watching the two birds I noticed that the adult male was *courting* the other. I collected the red and yellow bird. Dissection revealed it to be an adult female with several well-developed ova, the largest about 10 mm. in diameter. No malignancy or abnormality was perceptible in the ovary or any other internal organ.

In color the specimen resembles an adult male, especially above. Nowhere, except possibly on the tail, is the red quite as bright as that of an average adult male, but the patches of dull olive-green are not noticeable, the general effect being of a *red* bird. Actually, the whole scapular tract on the right side is olive green while that on the left is largely red. In both wings some lesser coverts, middle coverts, greater coverts and remiges are definitely red, others definitely olive green. In both wings the four outermost primaries and all the primary coverts and alula feathers are green-edged or brown-edged (i.e., not red). The under parts throughout are a mixture of dull red and buffy yellow, the effect being rather blotchy, the red being brightest in the middle of the lower throat, on the chest, and in the middle of the belly. Most of the rectrices are missing, but the five remaining ones, all on the right side, are uniformly dull red. According to Ridgway (1902. "The Birds of North and Middle America," Part 2, p. 80) "adult females not unfrequently show touches of red, sometimes a considerable amount of this color, but such females may be distinguished from immature males by the duller color of the red."

In size the specimen resembles a normal adult female. The wing measures 90.5 mm., the tail 69, the exposed culmen 18, the tarsus 19.5.—David W. Johnston, *Department of Biology, University of Georgia, Athens.*

The Cardinal in winter in North Dakota.—During the winter of 1949–50 at least two male Cardinals (*Richmondena cardinalis*) were seen repeatedly near Bismarck, Burleigh County, North Dakota. This is of particular interest since to the best of my knowledge only in recent years has this species been reported anywhere in North Dakota west of the Red River Valley. The Red River is about 200 miles east of Bismarck.

On January 1, 1950, Mr. D. B. Vogtman and I observed one Cardinal at a farm feed-lot in the bottoms of the Missouri River about four miles north of Bismarck. Mr. A. Pasquetti, the farmer on whose place we saw the bird, reported that he had seen it there almost daily since early in December.

On January 2 and 3 a male Cardinal was seen at a point about two miles north of the feed-lot occupied by the first bird. However, not until January 7th was the existence of two birds definitely established. Mr. Pasquetti saw the first Cardinal almost daily through January, February, and March, and I saw it on an average of twice a week during this period. An adequate food supply was available at the feed-lot where millet was being fed to livestock and grain to poultry. Trees and brush in the bottomland and adjacent coulee provided sufficient cover. The bird appeared to be in good condition. We last saw it in the evening before a severe blizzard near the end of March. It may have perished during the storm. Despite a search of known roosting spots just after the storm and later, when the snow had melted, we found no sign of the bird.

Weather during this entire period was severe. The average temperature for January was −10.2°F. with a minimum of − 44°F. Blizzard conditions prevailed on many days. There were 14 inches of snow on the ground at the end of January. February was somewhat milder with an average temperature of 7.9°F. March temperatures averaged about 22°—about 3° below normal. Nearly 30 inches of snow fell during the month and there were several severe blizzards.—Robert N. Randall, *Fish and Wildlife Service, Bismarck, North Dakota.*

Young Goldfinches eaten by garter snake.—In my three-year study of the ecology of Michigan garter snakes I have obtained hundreds of field food records, but of 230 such records for the Common Garter Snake (*Thamnophis s. sirtalis*) only two showed evidence of predation upon birds.

On April 26, 1948, near Dixboro, Washtenaw County, Michigan, I forced a large female Common Garter Snake to regurgitate an adult Song Sparrow (*Melospiza melodia*). The snake may have found the sparrow dead, for I believe it would be difficult for this snake to catch a healthy adult bird of any sort.

On August 1, 1950, in the same area, I found a gravid female Common Garter Snake at the nest of a Goldfinch (*Spinus tristis*). The nest, which was well hidden among leafage, was $2\frac{1}{2}$ feet from the ground on a horizontal branch in a 6-foot hawthorn (*Crataegus* sp.) bush in the center of a pasture.

At first I saw only part of the snake's body, but on closer examination, I noticed that its head was just above the cup of the nest. Protruding from its mouth was some thistle down from the lining of the nest. I approached as close as possible without disturbing it in order to take photographs. In about five minutes, it became wary and started to crawl away.

I caught the snake and forced it to regurgitate four recently hatched Goldfinches plus a small quantity of thistle down. All the birds were dead. Remaining in the nest were one dead nestling (the intestine protruding from the ruptured abdominal wall) and a crushed egg with a dead embryo. I was unable to determine whether the young were dead when the snake ate them. I heard cries of distress from adult Goldfinches while I was near the nest, but could not be sure that any of these birds were the actual owners.—Charles C. Carpenter, *Department of Zoology, University of Michigan, Ann Arbor.*

VIRGINIA CAVENDISH

Virginia Cavendish, renowned landscape architect and garden specialist, active ornithologist and ardent conservationist, and, above all, a much loved citizen of her native Huntington and West Virginia, died January 18, 1951, just after an operation. A member of our Club since 1946, she became a Life Member very recently. At the time of her death she was secretary of the Huntington Galleries project, active in the National Council of Garden Clubs, and a pillar of the Huntington Bird Study Club. A memorial area on the grounds of the Huntington Galleries is being created as a tribute to her. In a letter written just before her death she said: "I don't suppose anyone ever had so much fun as I have had through the years—or left as few ripples as he passed." Birds were an important part of the 'fun' in Miss Cavendish's life. As for the 'ripples', let time and her many friends be the judge.

EDITORIAL

The stimulating report on Graduate Research in Ornithology in the March issue of the *Bulletin* has sharpened focus on the scope of projects currently under investigation. It is encouraging to note the renewed interest in anatomical studies which must inevitably lead to a better understanding of the relationships among birds. Because of our special interest in avian morphology, we present a plea in behalf of all workers engaged in this phase of ornithology.

In 1947 we began a long-term study of the anatomy and classification of the Cuculiformes. While tabulating available skeletal and alcoholic material in American and foreign museums, it soon became evident that as much time would be consumed in obtaining specimens as would be required for the actual research.

Long ago W. A. Forbes (1881. *Ibis:* 175) wrote as follows: "There are, however, still left a considerable number [of genera] of which I have not as yet succeeded in obtaining any examples . . . I hope, therefore, that any members of the B.O.U., or travellers or naturalists generally, who may have it in their power to obtain specimens of any of these my 'desiderata,' will do all they can to enable me to acquire these forms." More recently, the late Percy R. Lowe (1943. *Ibis:* 490) said: "I cannot help thinking that if ornithologists took as much trouble in procuring specimens in spirit, both at home and abroad, the subject of the classification of birds would be proportionately benefited and expedited. Even in such fine collections in spirit as are to be found in the British Museum, it is rare for the labours of the anatomist in any given group not to be held up by lack of material. . ."

Plagued by this lack of material, ornithologists have perforce published anatomical papers based on one or two specimens. Important though these papers may have been, we now know that individual variation must be considered in any thorough study. At the same time, when statistical analysis of variation is based on inadequate data, anatomical or otherwise, it leads to overweening ostentation and to specious conclusions. Biometrics is an essential tool but it becomes a farce when improperly applied.

Students of human anatomy long have recognized the wide limits of "normal variation" in the origin and pattern of blood vessels, nerves and muscles. The origin of a blood vessel, for example, may be described as normal even though it has such an origin in only 50 percent of specimens. It should be pointed out that experienced human anatomists do not attempt to determine the normal pattern or normal limits of variation for a specific structure until at least a hundred (preferably 150 to 200) specimens have been examined. Can we, then, in avian morphology expect reliable results from descriptions based on but one or two specimens? Recent investigations have shown that certain regions of the avian vertebral column are far more variable than early ornithological literature indicates. May not these early papers, quoted so repeatedly in taxonomic works, be leading us to erroneous conclusions?

Each anatomist must determine, for the specific group being investigated, how many alcoholic specimens are necessary to give a reliable picture. There is, however, no maximum number of accurately sexed, *articulated* skeletons which may be analyzed advantageously: the larger the sample, the greater the reliance which can be placed on statistical results. A paucity of skeletal material produces indicative rather than conclusive results. Nevertheless, it is obvious that the anatomist can study only that material which is available to him.

More than forty avian families are endemic to the New World. Notwithstanding the fact that several of these are monotypic, there is not a single monographic treatment of the total anatomy of any family. The internal anatomy of many genera is unknown. This fact was emphasized by Griscom (1950. *Bull. Mus. Comp. Zool.*, vol. 103, No. 6: 344) when he stated that "In several very large tropical American families based on internal characters (not determinable in the museum skin), hundreds of species are currently assigned to these families without a shred of evidence that they possess the necessary internal characters!"

If we hope to encourage thorough anatomical studies, and thereby to further the cause of taxonomy, greater emphasis must be placed on the collecting of skeletons and alcoholic material. The collecting of such material must, for the most part, be a function of the larger scientific institutions. In some cases it appears that a change in philosophy towards specimens must be effected: from "skins, more skins" to "skin, skeleton, spirit."

In the meantime, publication of the report on Graduate Research will have served to acquaint anatomists with the work of their contemporaries and may, therefore, facilitate the collecting and exchange of desired material.—A. J. B.

Not long ago we made a point of seeing Walt Disney's 'Beaver Valley,' a beautiful and entertaining motion picture film which could have been soul-satisfying as well. The scene showing the Marsh Hawk (*Circus cyaneus*) passing prey to its mate in midair was thrilling; but how quickly our pleasure changed to dissatisfaction when, listening to a comment on the feeding of that prey to the young hawks, we saw a Cooper's Hawk (*Accipiter cooperii*) at its nest! Similarly, we followed a Bittern (*Botaurus lentiginosus*) about, heard words to the effect that it was obtaining food for its young, then were shown a *Least* Bittern (*Ixobrychus exilis*) at its nest. For this particular form of inaccuracy or half-honesty there is no excuse in this enlightened age, and it would certainly have been avoided had the two men who took the photographs—Wilson Club members Karl Maslowski and Murl Deusing—been given a chance to edit the film or commentary. Knowing that there was a mixup in the bird identifications we could not help wondering how many amphibians from far removed corners of the continent had contributed their croaking and trilling to that amusing Rocky Mountain beaver pond burlesque of opera. The film was exceptionally good in some ways. We shall long remember it for its late-working beavers and romping otters. But as a whole it could—and should—have been very much better.—G. M. S.

The color plate fund has climbed steadily. So generous has been the response to our implied request for funds—when we offered for sale prints of the color plate used in the December *Bulletin*—that we shall be able to publish soon the engraving of Hal Harrison's beautiful kodachrome of the Wilson's Warbler at its nest. The engraving is being donated by Samuel A. Grimes. Names of all contributors to the fund will be announced later; but we wish to acknowledge here the money 'with no strings attached' given us by Herbert L. Stoddard, Sr., Dr. and Mrs. Powell Cottrille, Clarence B. Randall, Malvina Trussell, the late Virginia Cavendish, Mr. and Mrs. Richard R. Graber, H. Lewis Batts, Jr., and Eugene Eisenmann.

Richard and Jean Graber are hard at work in San Luis Potosí, México, assisting George H. Lowery, Jr. and Robert J. Newman with their ornithological survey of that state. The final report promises to establish a new standard for field and laboratory work of this sort.

With great interest we learn of the recent coming into being of the Oklahoma Ornithological Society. Dale Arvey was elected president, but his being called to service overseas has placed the reins in the hands of Joe C. Creager of Ponca City. The first number of the Society's *Bulletin* appeared in January, 1951. We can see from perusing this that Oklahoma ornithologists are a lively, forward-looking group.

Those of us who have fed birds in winter have long known how fond birds are of nut meats. Pecans are a special favorite—perhaps because of the high fat and protein content, perhaps (we venture to guess) because they taste good Herbert Stoddard has found that such insectivorous birds as warblers, titmice and kinglets eat pecan meats avidly. The Pecano Bird Feed Company is offering 100 percent pecan meats at 25 cents a pound in 10-, 25-, and 50-pound containers. This is good news for the birds. Address the Pecano Bird Feed Company, 110 West Street, Albany, Georgia.

Our Membership Committee has been working hard and the membership has been climbing steadily. Especially gratifying has been the prompt and voluntary action of well over one hundred persons in raising their status from associate to active, or active to sustaining membership. The more funds we have, the better the *Bulletin*.

Jesse M. Shaver, Professor of Biology at George Peabody College for Teachers at Nashville, Tennessee, was awarded the honorary degree of Doctor of Science by Tusculum College, Greeneville, Tennessee, at their 155th Commencement on June 5, 1950. Dr. Shaver has been a member of The Wilson Ornithological Club since 1922. He served the Club as Secretary for several years, and as President from 1932 to 1934. He has been a Member of the American Ornithologists' Union since 1924, and Editor of the *Journal of the Tennessee Academy of Science* since 1928.

We regret to report the death of two prominent members of The Wilson Ornithological Club—Charles William Gustave Eifrig, who died in Windermere, Florida, November 1, 1949, at the age of 78; and Edward Russell Ford, who died in Winnetka, Illinois, January 13, 1951, at the age of 76. Professor Eifrig, an active member of the Club since 1907, was born in Doebeln, Germany and moved to America with his family when he was a child. He was a clergyman for some years, then joined the faculty of Concordia Teachers College. After 33 years of service in this institution he became Professor Emeritus. Valparaiso University conferred upon him the degree of Doctor of Science in 1942. He was an active field ornithologist and published many papers on birds as well as two books on fishes, amphibians, reptiles and mammals. He was president of the Illinois Audubon Society from 1930 to 1941.

Mr. Ford was an associate member of The Wilson Ornithological Club from 1920 to 1936 and an active member from 1936 to the time of his death. He was born in Malden, Massachusetts, on December 27, 1875. He was Honorary Curator of Oölogy at the Chicago Academy of Sciences from 1931 to 1933 and Honorary Curator of Ornithology there from 1933 to the time of his death. Professionally a publisher, he continued in that business until 1928. From then on he was able to devote more time to birds. He was a keen field naturalist and fine companion. He published a number of articles about birds in *The Chicago Naturalist* and *The Audubon Bulletin*. He is best known for his senior authorship of "Birds of the Chicago Region," published in 1934 by the Chicago Academy of Sciences. His co-authors were Colin C. Sanborn and C. Blair Coursen.

Hal H. Harrison as photographer and author, M. Graham Netting as editor, *The Pennsylvania Angler* as original publisher, and the Fish Commission of the Commonwealth of Pennsylvania as distributor, are to be congratulated on "Pennsylvania Reptiles and Amphibians," an opus which has recently come to our desk as a 24-page brochure—all in all one of the liveliest, most informative herpetological presentations we have seen in some time. Ostensibly a picture story, the legends for the many photographs are crammed with facts. For once in their lowly lives, Pennsylvania snakes, turtles, frogs, toads, and salamanders have found good friends. As ornithologists we should rejoice that these 'other vertebrates' are receiving attention of this sort. How much of our thought have we given to reptiles and amphibians and the lives they lead? Have we not let ourselves get into the rut of indifference? Or, worse, have we not allowed ourselves to *use* these animals in attaining our own ends? How many of us have pleaded the cause of hawk protection knowing that each time we mentioned a hawk's eating of snakes we were winning love and praise for the hawk, blame and hatred for the snakes? Such an attitude is unscientific and unfair. The time has come for us to know these 'other vertebrates' for what they are: to enjoy their beauty; to find reward in watching them; to acknowledge, deep inside ourselves, that they belong not 'under our heel,' as the saying goes, but in our world as friends and allies.

Small but highly colorful and pleasing reproductions of 24 of John James Audubon's bird paintings have been reproduced recently by the National Audubon Society as Audubon Centennial Stamps, for use in decorating letters, envelopes and packages "in order that Audubon paintings will receive during the Centennial Year [Audubon died in 1851] the public attention which they merit." We submit that there are other uses for these attractive stamps. One youngster we know has found delight in pasting them into a bird-book of her own making. Another has cut out the tiny bird figures and arranged them in a perfect circle on his own private mirror. The two sets, totalling 24 stamps, are being sold for $1. Proceeds from the sale will be devoted to the conservation work of the Society. Address the National Audubon Society, 1000 Fifth Avenue, New York 28, New York.

Austin L. Rand, Curator of Birds at the Chicago Natural History Museum, is now visiting El Salvador where he will remain about six months conducting field studies that will serve as the basis of a semi-popular bird guide to be written in collaboration with Melvin A. Traylor, Research Associate at the Chicago Museum. The project was undertaken at the request of the Instituto Tropical de Investigaciones Científicas, a research institute associated with the University of El Salvador, as part of a cooperative program entered upon with the Chicago Natural History Museum. Publication of the volume, in Spanish, will be undertaken by the El Salvador institution next year.

Fred T. Hall, a member of our Executive Council, and, until recently, Director of the Davenport Public Museum, has been appointed Director of the Buffalo Museum of Science. He served as Chairman of the Local Committee in charge of Arrangements for our Thirty-Second Annual Meeting in Davenport, in April.

Mr. Hall received his education at Wabash College, Crawfordsville, Indiana, where he majored in biological science, and at the Rochester Institute of Technology, where he studied art. He served for a time as head of the Biological and Anatomical Model Department of Ward's Natural Science Establishment in Rochester. His published papers deal with entomology, paleontology and ornithology. His bird paintings have been shown in many recent exhibits of ornithological art.

The editors are grateful to the following for assistance in preparing for publication the material appearing in this issue: Aaron M. Bagg, E. Alexander Bergstrom, Donald J. Borror, William L. Brudon, Eugene Eisenmann, W. W. H. Gunn, William A. Lunk, Harold F. Mayfield, A. D. Moore, Allan R. Phillips, R. M. Strong, H. B. Tordoff, Milton B. Trautman, and J. Van Tyne. They are especially grateful to Elsa Hertz for her expert typing.

At the recent meeting of the Club, Harrison B. Tordoff was elected editor of *The Wilson Bulletin*. Manuscripts intended for publication in 1952 should be addressed to him at the Museum of Natural History, University of Kansas, Lawrence, Kansas. Correspondence concerning the 1951 volume should, however, be directed to Dr. Sutton or Dr. Berger. Dr. Sutton will teach ornithology and bird art at the University of Oklahoma Biological Station, at Lake Texoma, Willis, Oklahoma, from June 9 to August 4. Dr. Berger may be addressed at the Department of Anatomy, East Medical Building, University of Michigan, Ann Arbor.

In this issue of the *Bulletin* appears the first of a series of color plates based on field sketches made in México in 1938 by George Miksch Sutton. Publication of this series has been made possible through the interest and generosity of the Hilton family, of Lincoln, Nebraska. The plates, eight in all, will stand as a memorial to David Clark Hilton, celebrated physician and surgeon, who died December 12, 1945.

PROPOSED AMENDMENT TO THE CONSTITUTION OF THE WILSON ORNITHOLOGICAL CLUB

The Club's schedule of dues has not been changed for many years. Although printing costs have risen the quality of the *Bulletin* has been maintained because the membership has steadily climbed. Recently, however, increases in printing costs have been outstripping the Club's rate of growth. The Executive Council and the Editors are interested not only in maintaining the *Bulletin's* present high standards, but in seeing the journal substantially enlarged and improved. The program will require additional revenue.

An appropriate amendment to the Constitution was therefore proposed at the general meeting on April 27, 1951, at Davenport, Iowa. This amendment was recommended by unanimous vote of the executive council the previous day. In accordance with the Constitution and By-laws, the Council hereby asks for a mail ballot of approval. Every active member is urged to vote *yes* or *no* to this amendment by sending a letter or postcard, not later than September 1, 1951, to the Secretary, Harold Mayfield, 2557 Portsmouth Ave., Toledo 13, Ohio. The amendment reads as follows:

Effective October 1, 1951, the associate membership class ($2.00 dues) is to be discontinued, and the subscription price of *The Wilson Bulletin* is to be $3.00.

A LIFE MEMBER FROM CAROLINA

Elizabeth Barnhill (Mrs. Edwin O.) Clarkson was born a Texan but has lived in North Carolina all her married life. Educated as a concert pianist and organist, she has long been deeply interested in birds. With her husband she owns the beautiful, 23-year-old bird sanctuary, 'Wing Haven', a bit of which shows in our photograph. She has published a check-list of the birds of Charlotte and Mecklenburg County, North Carolina. She is a Life Associate of the American Ornithologists' Union; a Life Member of the National Audubon Society; and a member of the Cooper Ornithological Club, the Virginia Society for Ornithology, the North Carolina Academy of Science, and the American Association for the Advancement of Science. She became a Life Member of the Wilson Club in 1948.

ORNITHOLOGICAL LITERATURE

Menaboni's Birds. By Athos and Sara Menaboni. Rinehart & Company, New York and Toronto, 1950: $9\frac{1}{4} \times 12\frac{3}{8}$ in., 132 pp., 53 halftones and 32 unnumbered colored plates by Athos Menaboni. $10.00.

It is time that books featuring "bird art," which, in this country at least, has unhappily become segregated as a more or less distinct subdivision of art, and at times been regarded by some misinformed critics as nothing more than a form of two-dimensional taxidermy, be forced to stand on their own merits, rather than upon the claims of various publishing houses motivated primarily by thoughts of cash profits. There has been a regrettable tendency on the part of more than one publisher to announce each forthcoming work with such risky superlatives as "the greatest, the most beautiful, the truest to nature," and so on. If any qualification is made at all, it usually takes the form of "since Audubon," thus serving to perpetuate the awe which still largely paralyzes public thought in regard to the admittedly laudable, but far from superhuman, artistic efforts of the woodsman-artist. Perhaps a new high in ballyhoo has been attained by Rinehart and Company in the advance publicity for "Menaboni's Birds."

"This is a collection," we are told, "of the most beautiful, most faithful bird portraits painted in America in more than one hundred years. Not since Audubon's great Folio, have any American bird pictures created as much excitement. Menaboni's birds in flight, his meticulous detail and realistic settings have surprised and excited the naturalists. Critics and art connoisseurs, praising the unusual technique, the subtle shadings, and the radiant colors of the originals, call Athos Menaboni the greatest living portrait painter of bird life." Strong words! Beautiful some of the pictures may be, but it is a large order to live up to claims such as these; certainly opinions will vary widely. Possibly the statement about the excitement caused is true. If so, it is a testimonial to modern promotional methods. The naturalists have been surprised, there is no question; but "disturbed," rather than "excited," best describes the reactions of those with whom I have discussed this book. As far as the "critics and art connoisseurs" vaguely alluded to in the blurbs are concerned, they are no more qualified to elect the greatest living (or dead) *portrait painter* of bird life than would a Martian who had never seen a man be qualified to choose between Sargent, Al Capp, and Picasso as human portrait artists.

In the first place, let us make it plain that we are here discussing what is sometimes called academic art. That is, art which embodies a strong element of craft, and which requires no phony special genius or divinely-imparted mystic inspiration for its understanding. Those who invariably shout "bourgeois," or "mere illustration" in response to any timid request for truth in the painting of nature need read no further.

A portrait is a likeness. We are told that Menaboni's paintings are portraits of birds, and it seems fair, therefore, that they be so judged. A portrait of a person may be painstakingly executed, the details of hair, skin, and clothing rendered with consummate skill, yet if the carriage is wrong, if the relationships of the bones and features of the head are wanting in accuracy, the portrait fails. The likeness is not there; the essential character is lacking. And who shall judge this success or failure? Surely the acquaintances of the subject should have authority in the matter at least equal to those who have never seen him. Does it not follow that the evaluation of a bird portrait, at least as far as the likeness is concerned, is a province for the ornithologist as much as for the "art critic" whose experience with birds is limited to cursory glances at the pigeons of a Manhattan tower?

Menaboni's paintings reveal a pleasing grasp of the essentials of design and composition, and an excellent feeling for, and use of, color. They are characterized by a surprisingly uniform delicacy of treatment. The artist is good at painting feathers,—remarkably good, yet he has apparently fallen prey to a fascination with diffuse, reflected light, to the extent that, in his paintings the softly abundant plumage of a Great Horned Owl, the fluffy feathers of a kinglet, the iridescent ones of a grackle, and the coarse, boardlike feathers of an eagle all appear to have approximately the same texture. The same is true of his work with plants. Many of the small flowers, twigs, and tendrils are painted with grace and delicacy, but he misses completely the strength and mass and rugged textures of a great bole or stump.

His greatest weakness is in structure. With all his painstaking study of plumages and feathers, his work shows an entirely inadequate grasp of the form, of the bony anatomy, of a bird. This is most evident in the larger species in which this anatomy is less conveniently cloaked in plumage, and results in a vague, disturbing superficiality which affects most of the plates. Particularly bad in this respect are his flying Cardinal (title page), Summer Tanagers, flying Marsh Hawk (resembling an old and poorly stuffed specimen with shiny new feathers), Golden Eagle, Sparrow Hawks, Pileated (consistently mis-spelled "piliated") Woodpeckers, Little Blue Herons, and Sharp-shinned Hawk. Faulty observation is revealed by the fact that many of the birds in flight have too many primaries and/or secondaries. This is painfully evident in the drawing of the flying Cardinal already mentioned above. Allowing the proper number of nine primaries, we find that this individual has eleven, rather than six, secondaries! No wonder this boneless wing looks peculiar.

Menaboni has had difficulty with his perspective in places, being troubled by the admittedly trying task of making a wing go away from him (Belted Kingfisher, Great Horned Owl). The size relationship of the sexes is in error in his drawing of Boat-tailed Grackles. He fails miserably in catching the facial "expressions" so important in portraits, the treatment of hawks and eagles being particularly unsympathetic in this respect.

Several of the plates, notwithstanding, are very good. I personally consider the Kentucky Warblers, Screech Owl, Ruby-crowned Kinglets, and Canada Geese well above the rest, and the half-tone of the two Black Skimmers is a masterpiece of decorative design. Menaboni is at his best with the small black and white vignettes scattered through the text. Many of these are extremely pleasing.

It is difficult to account for the way in which the plates are captioned. The brief description accompanying each appears on the back of the plate, facing the next one. This feature may lead to considerable confusion among non-ornithological readers.

The text by Sara Menaboni is a rambling, sometimes interesting, sometimes dull account of the Menabonis' life with birds, featuring a great deal of reference to various pets, and small experiences with nature. It is a most difficult task to write such a commentary without becoming at times trite and puerile, which pitfalls Mrs. Menaboni has not entirely avoided. Considerable anthropomorphism appears in the text, which seems to reveal the authors as sentimental amateur nature lovers rather than as scientists.

The Menabonis are to be congratulated on their perseverance and their deep love of wildlife. Had the book been publicized as a sincere expression of this love, beautifully produced and expensively illustrated with attractive and decorative pictures (which it is), rather than as one of the most authoritative ornithological works of decades, with the most faithful bird portraits (which it is not), there would be little fault to find with it.—Robert M. Mengel.

Summer Birds of Lincoln County, Maine. By Allan D. Cruickshank. National Audubon Society, 1000 Fifth Avenue, New York City, [1950]: 6 × 9 in., 51 pp., 1 map. Paper. 50¢.

Maine's Lincoln County, lying on the coast, has many deeply cut harbors and inlets, and several offshore islands. Much of the forest cover is coniferous. Such is the general setting of this annotated list, one of the most detailed yet written on a specific area in the state.

Most of the information is based on observations made during summers, beginning in 1936, by the author and others while serving as instructors at the Audubon Nature Camp on Hog Island in Muscongus Bay. Notes and records have been admirably summarized; the status and local distribution of each species have been clearly indicated. Thus the booklet's principal purpose—to help future bird students know "which species to expect and where and when to look for them"—has been well met.

The author states in the introduction that 255 species have been recorded during the four summer months. This impressive total has been derived by including all published records (*e.g.*, the occurrence of the Great Auk in Muscongus Bay about 1605 and the brief residence of the European Migratory Quail following its introduction during 1879 and 1880) and by counting two races of *Ammospiza caudacuta* as separate species. Authorities for noteworthy records are given in parentheses, but it is usually impossible to determine, especially in the case of records antedating 1936, whether the authorities are authors of publications from which the records are taken, or persons who have supplied notes in unpublished form. This confusion could have been avoided by following standard citation practices.—Olin Sewall Pettingill, Jr.

A Study of Bird Populations in the Apple Orchards of the Annapolis Valley, Nova Scotia, With Particular Reference to the Effects of Orchard Sprays upon Them. By John P. Kelsall. Canadian Wildlife Service Wildlife Management Bulletin No. 1, Series 2, 1949: $8\frac{3}{8} \times 10\frac{7}{8}$ in., iv + 69 pp. (processed), 12 figures. Obtainable on request from Canadian Wildlife Service, Ottawa, Ontario.

The study was conducted from May 14 to September 16, 1946, to determine whether certain sprays were detrimental to the bird life. The method was to inspect each orchard by cruising back and forth in parallel strips with two rows of trees intervening. An attempt was made to count each individual bird in the area on each trip. The trips to each area varied from two to seven and were usually quite widely separated, in some instances encompassing both the latter part of the spring migration and first part of the fall migration as well as the breeding season. Schedules of trips to different orchards varied considerably with respect to the time of year covered. Trips were not designed to ascertain before- and after-spraying condition of the bird life, but rather the over-all differences in populations in sprayed and unsprayed orchards, and in orchards with and without insect infestation. The investigator stated that qualitative and quantitative data of a type desirable in a bird population study were frequently not recorded because they were not considered pertinent to the major line of investigation. Thus no distinction was made between migrants, wanderers, and breeding birds on the basis of territorial behavior or calendar period of observations.

The sizes of the orchards varied from 1.2 to 12 acres; some had turf strips between the rows, and some were cultivated completely. All but two of the orchards were sprayed with lead arsenate, calcium arsenate, or nicotine mixtures.

Conclusions were that the sprays did not have any directly injurious effect on bird life since no dead or sick birds were observed. In so far as the sprays were effective in materially reducing the insect population it reduced the bird population also. Birds were much less common in orchards in which insects were scarce than in those which were suffering outbreaks of eye-spotted budmoth or aphids. Birds were determined to be more than twice as numerous in orchards infested with budmoth as in those wherein no outbreak occurred. There was no evidence that birds were effective in keeping the insects under control since they ate only a small part of the larvae present. Song Sparrows, Robins, Chipping Sparrows, Savannah Sparrows, and Slate-colored Juncos made up over 80 percent of the total number of birds observed in all orchards. The Song Sparrow was the most numerous single species. It was thought that aphids were favored by the smaller insectivorous birds and in orchards infested with these insects Yellow Warblers, Redstarts, Yellow-throats (*Geothlypis*), Myrtle Warblers, and Nashville Warblers made up 50 percent of the birds observed.

Bird populations of all orchards were considered to be smaller than those of other habitats in surrounding areas. However, there did not seem to be much difference between numbers of birds recorded in unsprayed orchards (12.7 birds per acre) of a single habitat, and surrounding areas of mixed habitats (13.7 birds per acre) when dates of observation were strictly comparable.—John W. Aldrich.

The Birds of Rocky Mountain National Park. By Fred Mallery Packard. Nature Association, Estes Park, Colorado, 1950: $5\frac{1}{2} \times 8\frac{1}{2}$ in., iv + 81 pp., 12 figures, 1 map. Paper. 75¢.

Every year hundreds of bird students visit Rocky Mountain National Park. Packard's photo-offset booklet, the most attractive and complete booklet of any sort thus far published on the Park, will supply trained observers with necessary background material in the form of bird records. Though a more definitive list of species than any hitherto brought out for the region, it is admittedly incomplete in certain respects. The author calls special attention to the inadequacy of our knowledge concerning one highly interesting ornithological phenomenon —the upward movements of birds after midsummer.

The region covered is Rocky Mountain National Park plus the area around the town of Estes Park on the east and Grand Lake on the west, all in northern Colorado. This comprises over four hundred square miles of mountainous terrain, all above 7,000 feet elevation and ranging upward to over 14,000 feet. A sketch map, giving principal place-names but without indication of altitudes, is included, and there is a brief summary of altitudinal zonation of major plant communities; a comprehensive list of pertinent references; and an index to the common names of bird species discussed.

Brief descriptions and notes on seasonal and altitudinal ranges are given for 219 species and subspecies of birds, thirteen of which are included, according to the author's expressed belief, on questionable grounds. Twelve line drawings of birds by Roger Tory Peterson are primarily decorative. Neither they nor the descriptions are designed to aid the beginner in bird identification. The booklet is primarily for observers already familiar with the avifauna of the region in general. Used with an adequate identification manual it should be of great help to those wishing to list or study the birds of the park.—Gordon Alexander.

Berkshire Birds. By Bartlett Hendricks. Massachusetts Audubon Society, Boston, 1950: 6×9 in., 57 pp., 15 drawings, 6 maps. Paper. 60¢.

This 57-page check-list of Berkshire County birds is essentially a reprint, in convenient booklet form, of a series of articles which appeared recently in ten numbers of *The Bulletin of the Massachusetts Audubon Society* (Vol. 32–34, 1948–50). Aside from a field list published by the Berkshire Museum in 1941, it is the first full account of Berkshire birds since Faxon's and Hoffmann's "Birds of Berkshire County," published in 1900. The fact that the new check-list gives 271 forms compared to 197 in the earlier book is ample evidence of the growth of ornithological interest in the county in the past fifty years.

A 14-page introductory section includes such matters as topography and migration routes, the county's ornithological history, a section on bird identification (which might well have been condensed or perhaps omitted altogether), and helpful preliminary lists (of permanent residents, transients, etc.). Then follows the main list—the common name (without the scientific name) of the bird, each with a letter symbol (A to E) designed to indicate its frequency of occurrence, a graph by months (an ingenious invention of the author) which shows the duration of stay of the bird in the county, and a summarizing statement or two concerning the known status of each, with instances of occurrence and authorities for the rarer species.

The records are based almost entirely on sight identifications. There is no collection of scientific bird skins in the county and there has been little or no deliberate collecting there for many years. For the most part the author, who for more than a decade has been the spirited leader of a corps of enthusiastic observers, has used good judgment in evaluating the records, but there can be no doubt that many of the sight records are open to question. Of 26 accidental visitors listed, apparently only four are supported by specimens.

The booklet is attractively and artistically illustrated with six maps and 15 black and white drawings of birds by Robert F. Seibert. The bird names used do not always conform to those of the American Ornithologists' Union Check-List (*Canvas-back* and *Buffle-head* are not hyphenated, the apostrophe and *s* are dropped from *Wilson's Phalarope* on page 29, and *Red-winged Blackbird*, perhaps consciously, is used for *Red-wing*). In two cases, at least, plural verbs are used with singular subjects. There appear to be some inconsistencies in the listings. For instance, 21 permanent residents are listed on page 10, but only 20 in the summary on page 13; 86 migrants are listed, but 87 are counted in the summary. The Hoary Redpoll and Clay-colored Sparrow are listed as winter and accidental visitors respectively, but omitted from the text, the only two out of 40 to be so slighted. Of the two extinct species listed. the Passenger Pigeon is accounted for in the text but the Heath Hen is not.

In spite of the skepticism that may well attach to a check-list making such extensive use of sight records, this booklet should prove a helpful guide to the many New Englanders, as well as outsiders, who go birding in the Berkshires.—George J. Wallace.

How to Choose and Use Field-Glasses. By E. M. Nicholson. British Trust for Ornithology, Field Guide Number Two, The Potter Press, Oxford, 1950: $8\frac{7}{16} \times 5\frac{1}{2}$ in., 8 pp. (unnumbered). Ninepence.

In this pamphlet the British Trust for Ornithology presents a complete guide on the use and care of field glasses and telescopes for ornithological work. Magnification, field of view, light-gathering power, weight and general design are discussed in relation to specific purposes for which the glasses are to be used. Simple tests are given for determining the quality of a glass.

Though not in wide use, a telescope is indispensable for certain types of bird watching. Mr. Nicholson comments that "Telescopes, in contrast to binoculars, have seen no fundamental improvement in external design since the time of Gilbert White, although coated models are now available. It is evident to anyone who glances at a party of ornithologists trying to use telescopes on a mud-flat that sooner or later either the telescope or the bird-watcher will have to be entirely redesigned." He adds, encouragingly, that a distinct improvement over the traditional telescope has been made in a new type of mirror telescope recently invented in Holland.

Ornithologists contemplating the purchase of new field glasses will do well to obtain a copy of this pamphlet by writing the Secretary, British Trust for Ornithology, 91 Banbury Road, Oxford, England.—Andrew J. Berger.

COMPLEXITIES OF MIGRATION: A REVIEW
With Original Data from Arizona

BY ALLAN R. PHILLIPS

The ancient riddle of bird migration continues to fascinate and baffle ornithologists. New techniques—cooperative color-banding, telescopic observations, artificial transportation of marked birds, and the use of airplanes, radar, and automatic recording devices—have come to supplement the time-honored ones, yet the riddle remains unsolved. Birds show every conceivable sort of migration behavior. Some—for example certain American quail—appear to be strictly non-migratory or resident. Others—notably the Arctic Tern (*Sterna paradisaea*), certain Golden Plovers of the genus *Pluvialis*, the Wilson's Petrel (*Oceanites oceanicus*), and the two remarkable cuckoos, *Chalcites l. lucidus* (Fell, 1947) and "*Urodynamis*" *taitensis*, which breed in New Zealand and winter on remote islands in the vast Pacific Ocean—are famous for their long-distance migrations. The continued and widespread interest in bird migration is reflected in the reprinting, with some revision, of the excellent short survey of the subject by Thomson (1949).

A growing body of evidence indicates that some long migrations are performed in a few long flights or even in a single flight. This is true mainly of water birds (notably certain geese and shorebirds), but also of some Old World landbirds such as the Needle-tailed Swift (*Hirundapus c. caudacutus*), Red-backed Shrike (*Lanius collurio*), and Black-headed Bunting (*Emberiza melanocephala*) (Stresemann, 1944a, 1944b). Among North American birds not commonly recorded between their breeding and winter ranges, and therefore possibly non-stop migrants, are the Western Grebe (*Aechmophorus occidentalis*), Black Swift ("*Nephoecetes*" *niger*), Purple Martin (*Progne subis*), Gray Vireo (*Vireo vicinior*), and House Wren (*Troglodytes aëdon*). We have a very great deal to learn about migration. Such birds as most geese of the genus *Chen*; the two small forms of *Branta—minima* and *hutchinsii*; the Whooping Crane (*Grus americana*); and the Kirtland's Warbler (*Dendroica kirtlandii*) are known or believed to have very restricted breeding ranges, yet the migrations of even these forms will not be understood without long and intensive study.

For some years, and primarily from the standpoint of season and taxonomy, I have been much interested in the migrations of birds in Arizona and other inland parts of our Southwest. My studies indicate that some of the older theories of migration, advanced to explain limited data then available, must be carefully reviewed before they achieve the status of dogma. In this paper I purpose to describe some of these migrations in the Southwest and to discuss their relation to bird migration in general.

Regularity of Migration

The most impressive aspect of present-day bird migration is, of course, its regularity in time and space. Many birds are astonishingly regular in their seasonal comings and goings. But it is not correct to think of waxwings and certain boreal finches and birds of prey as the only irregular migrants. In southern Arizona, the movements of various thrushes, some fringillids—notably the Lawrence's Goldfinch (*Spinus lawrencei*)—some corvids, the Lewis Woodpecker (*Asyndesmus lewis*), the Thick-billed Parrot (*Rhynchopsitta pachyrhyncha*), and probably some sandpipers and the Sprague's Pipit (*Anthus spraguei*), are very erratic. Furthermore, banded individuals of supposedly rather regular species of owls and ducks have made long journeys in quite unexpected directions.

Except for species such as those just mentioned, and others which are extending their ranges, most small birds are extremely regular in their migrations, not varying greatly from year to year in date, route, or abundance. In the Southwest this is true of cuckoos, goatsuckers, swifts, hummingbirds, woodpeckers, and most perching birds. Physiologists now agree that the urge to migrate ("*Zugdisposition*") originates most probably in the cycle of activity of the anterior lobe of the pituitary gland (see the recent summary by Farner, 1950). This must be a very precise cycle, though the actual migration may be stimulated by weather patterns, as reviewed in a recent issue of *The Wilson Bulletin* (Bagg *et al.*, 1950). The general regularity of migration extends even to such peculiar cases of partial migration as those reported for smaller British birds (Lack, 1943–1944); to birds rather sedentary in some northern parts of their ranges but strongly migratory in other northern parts, e.g., the Turkey Vulture (*Cathartes aura*), Brown Creeper (*Certhia familiaris*), Mockingbird (*Mimus polyglottos*), and Golden-crowned Kinglet (*Regulus regulus*); to birds in which migration varies, in time or extent, with age and sex, e.g., certain shorebirds, the Costa's Hummingbird (*Calypte costae*), Yellow-headed Blackbird (*X. xanthocephalus*), and Western Tanager (*Piranga ludoviciana*); and to birds which migrate in different ways—in flocks, family groups, or singly; by day or by night; feeding or fasting as they go.

Complications are shown by the hummingbirds of Arizona. Not only does each species occur in a particular season and range, but within the species the season of occurrence of adult males is often different from that of females and young. The route in spring may be different from, or more restricted than, that in fall. Deelder (1949) found that female Scandinavian Chaffinches (*Fringilla c. coelebs*) migrated earlier, farther, and by a different route from, the males. How can such complexities be explained on a simple basis of temperature, food supply, or photoperiodicity?

Historical and Ecological Basis for Migration

Evidence of the historical and ecological basis of some migrations is the similarity of pattern among unrelated species. In North America several short-distance migrants from the north make their southernmost penetration in the Great Plains and Rocky Mountain regions, and fall off in numbers and extent toward both coasts southwardly. Such birds include the Rough-legged Hawk (*Buteo lagopus*); the larger races of Horned Lark, *Eremophila a. alpestris*, *E. a. hoyti*, and *E. a. arcticola*; the Northern Shrike (*Lanius excubitor*); Tree Sparrow (*Spizella arborea*); Lapland Longspur (*Calcarius lapponicus*); and Snow Bunting (*Plectrophenax nivalis*). In this same area, migration away from lowland breeding grounds tends to be the rule—particularly among ground-feeding birds like the Turkey Vulture, Mourning Dove (*Zenaidura macroura*), Mockingbird, Loggerhead Shrike (*Lanius ludovicianus*), Cowbird (*Molothrus ater*), and Rufous-crowned, Field, and Song Sparrows (*Aimophila ruficeps*, *Spizella pusilla*, and *Melospiza melodia*). Correlations between migration, winter temperatures, and the depth and duration of snow-cover[1] may be seen here. On the other hand, certain tree-feeding boreal birds show considerably less tendency to migrate in the mountains of this same region than they do farther east. Red-breasted Nuthatches (*Sitta canadensis*), Brown Creepers, Winter Wrens (*Troglodytes troglodytes*), Golden-crowned Kinglets, and even jays and chickadees seem to be less migratory here than along the Atlantic seaboard.

Variation in Time of Migration Within the Species

Discussions of the migration of certain species often suffer from indiscriminate lumping of individuals and races. This can easily produce false impressions. For example, the Yellow Warbler (*Dendroica petechia*) arrives in extreme southern Arizona by mid-March, in northeastern Arizona in late April, and in Canada and Alaska in May and early June. It would, therefore, be perfectly logical to assume that these birds move northward in the manner suggested by the old theory. The theory was that migration paralleled the advance of isotherms in the spring: that the birds moved northward very slowly at first, but more rapidly each day, in keeping with the increasing tempo of the advance of spring over the continent. In this way,

[1] Snow-cover as an ecological factor has been little discussed in North America, though there is an extensive Russian literature concerning it (Formosov, 1946).

each bird was alleged to arrive on its breeding grounds, by convenient flights, just when it was ready to breed (Griscom, 1945: 92, 108). Unfortunately for this attractive theory, all March and early April Yellow Warbler specimens from Arizona are of the bright-colored southwestern race, *sonorana*, which arrives and establishes territories here long before it is ready to breed; the more northern races do not normally reach Sonora and the southwestern United States before rather late April; while the dull far northern race, *rubiginosa*, does not ordinarily enter the United States until May. This form has been taken in extreme southern Sonora as late as June 8 and 30! While it is dangerous to argue from analogy, do not these known facts about the Yellow Warbler suggest that Red-eyed Vireos (*Vireo olivaceus*) which reach the Florida Keys in early May (when the Red-eyed Vireos of the southern United States are already beginning to nest) are individuals bound for points along the northern frontier of the species' range?[2]

An example of the complexity of fall migration is provided by the Hermit Thrush (*Hylocichla guttata*). In the mountains of southern and central Arizona the large race *auduboni* nests in the fir and spruce forests of the boreal life-zones. It is joined in mid-September by migrants of the same and other southern races; during early October these range widely in the mountains and appear uncommonly in the lowlands. Practically all, both breeding race and migrants, leave for the south by late October, when they are rapidly replaced by Alaskan birds (of the nominate race). The Alaskan birds winter here at a little lower altitude (mainly in Upper Sonoran Zone chaparral) than the breeding areas of *auduboni*, which has now retired to the highlands of México and Guatemala. Thanks to the well marked and readily identifiable subspecific characters of these birds, an apparently vertical migration has been shown, by careful collecting and identification, to be actually a composite of different latitudinal migrations! Nearly all "vertical migrations" in the northern hemisphere can be equally well regarded as short southward migrations; few if any birds descend to the lowlands on the *north* side of their mountain homes in the fall. Individuals may wander in that direction, however, as seems to be indicated by the Steller's Jay (*Cyanocitta stelleri*) reported by Hough (1949).

Alleged up-mountain movements in late summer and "midsummer wandering" should be further investigated. Most birds concerned are either southbound transients or breeding birds present before the arrival of human observers. Fledged young seeking territories move about, of course, to some extent; and this may be the explanation of the Canyon Wrens (*Catherpes mexicanus*) reported by Packard (1946: 157) from high in the mountains of Colorado "in summer and autumn." [3] What is more significant, it seems to me, is that Packard does *not* list any high-altitude records of such birds as the Scrub or Woodhouse's Jay ("*Aphelocoma*" *coerulescens*), Mockingbird, Virginia's Warbler (*Vermivora virginiae*), Arkansas Goldfinch (*Spinus psaltria*), or Cassin's Sparrow (*Aimophila cassini*), which are near the northern limits of their ranges in this region, nor of the several sagebrush, juniper, and piñon-inhabiting species to the west. In late August and September, Marsh Hawks (*Circus cyaneus*), Sparrow Hawks (*Falco sparverius*), Mourning Doves, Arkansas Kingbirds (*Tyrannus verticalis*) and Lark Sparrows (*Chondestes grammacus*) are to be seen in virtually all unforested high parts of the western United States. Have these species moved up the mountains from their breeding grounds? Probably not. Probably they are performing a normal north-to-south migration.

The "Flyways" Concept

The three main zoogeographic divisions of the United States are bounded by the Great

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[2] Svärdson (1947) reported that in 1946 the spring migration of the Wood Warbler (*Phylloscopus sibilatrix*) through Denmark and Sweden proceeded independently of isotherms. One hundred observers collaborated in the study.—Editors.

[3] This wren, however, apparently forages up and down steep hillsides for hundreds if not thousands of feet in the course of a day, and the actual distance from occupied territory is not mentioned.

Plains (at about the 100th meridian) and by the Sierra Nevada-Cascade Mountain axis. Yet even these major regions hardly deserve to be called migration "flyways". Such a term might imply, to the uninitiated, that migratory birds are found only along certain rather narrow lines. Actually, of course, migration is almost universal, though it is less conspicuous in some tropical islands, and in humid areas such as Pacific northwestern North America, than in most mid-continental areas. Concentrations of migrants do follow coast-lines, to be sure, and some species utilize thermal air-currents above hills and mountains. Waterfowl and swallows tend to follow rivers flowing north to south or south to north across arid regions. But the same species occur over wide areas away from these lines, also. Ducks are known to cross quite normally from one "flyway" to another (Aldrich *et al.*, 1949). Many North American fringillids and other land-birds do not even stay within the same major zoogeographic division while migrating. Examples include hummingbirds, thrushes, warblers, and perhaps even some such partial migrants as the Ground Dove (*Columbigallina passerina*) and Vermilion Flycatcher (*Pyrocephalus rubinus*). Ignoring our "flyways", the Catbirds (*Dumetella carolinensis*), Veeries (*Hylocichla fuscescens*), Red-eyed Vireos, and Bobolinks (*Dolichonyx oryzivorus*) of the Rocky Mountain-Great Basin region retrace the route by which, presumably, they entered that area. So do the many eastern birds now nesting in Alaska and northern British Columbia, and the Old World forms now nesting in Alaska and Greenland. Such criss-crossing of constant, regular routes at definite seasons shows the innate character of migration.

Accuracy in Orientation and Navigation

The accuracy of this innate control is remarkable. Although the vast Pacific Ocean is neither absolutely uniform nor wholly without landmarks (Preston, 1949), the annual visits of shorebirds to remote atolls southward as far as New Zealand are still amazing. Without precise orientation surely these birds would have been exterminated long since. Of special interest in this connection is the Townsend's Warbler (*Dendroica townsendi*), which has two winter ranges, separated by hundreds of miles. Some winter along the California coast from Pasadena northward to San Francisco Bay, while the rest apparently winter from central and northeastern México (Nuevo León) to El Salvador, and the species is purely casual in the extensive region intervening. The winter range of the Alaska Myrtle Warbler (*Dendroica coronata hooveri*) is similarly divided, but stragglers have been reported from the intervening territory more frequently.

A migrating bird may, after getting its bearings, continue by using visual clues; its sense of direction may function only at certain times. Thorpe (1949) divides the flight into its start, body, and termination, and points out that each part presents a separate problem. Suggested means of possible orientation are magnetic receptors (Yeagley, 1947), sensitivity to the earth's rotation (Ising, 1945), winds and air pressure patterns, and the directions of sunrise, sunset, the heavenly bodies, etc. None of these has met with general acceptance, but each may prove of some value to certain birds. We must be cautious lest we reject a theory merely because differences to be detected in stimuli are minute. Differences in time and force of sound-waves received by our two ears are also very small, yet almost without exception we instantly know the direction whence the waves have come.

At least one migratory bird, the Black-chinned Hummingbird (*Archilochus alexandri*), evidently possesses a remarkably accurate memory of the location of spots visited only once previously (Bené, 1945: 21). Visual orientation is apparently important during migration as well. In the northeastern United States, where visibility is generally limited, migrants often fly low. They can be heard calling overhead even on clear nights and they often collide with man-made obstacles of no very great height. In the clear air of Arizona, on the other hand, migrants are seldom if ever heard. This silence is not due to lack of birds. There are more species of land birds migrating in the Santa Cruz River region of southern Arizona during an average year than in more publicized areas like New York City; and only slightly fewer of them are song-birds, which are the birds we usually hear calling as they fly overhead. The difference in proportion of song-birds is due to the relatively few species of warblers and *Hylocichla* thrushes in the west. Geyr von Schweppenburg (1949) has noted a similar silence in the Sahara Desert. This can be correlated with the range of vision in arid regions. From one western Arizona mountain it is easy to see, at dawn, mountains to the east as far distant as 135 miles, while mountains 100 miles away are usually visible all day in clear weather. Thorpe (1949) questions whether significant migrations ever occur on heavily overcast nights. Use of the eyes does not necessarily imply, however, that migrants simply see a route and learn it. Some evidence from banded birds in Europe indicates that even regular migrants may follow different routes in succeeding years (Drost, 1941).

Relation to Molt and the Sexual Cycle

The directness of the apparent correlations between migration, molt, and the sexual cycle seems doubtful. Studies of molt in relation to autumn nesting are desirable. There are genera, such as *Empidonax* and *Phylloscopus*, in which some species complete their molt before fall migration while other species, closely related, do not. In late April and May, some male warblers and sparrows taken in Arizona, hundreds of miles south of their breeding ranges, have fully developed testes; were they not fat, one would suppose they were breeding birds. Van Rossem (1945) contends that a Yellow-green Vireo, *Vireo olivaceus hypoleucus*, migrates in breeding condition through the breeding range of another race, *V. o. flavoviridis*, in Central America. Dickey and van Rossem (1938) record eggs supposed to have been laid at an overnight roost of migrating hawks in El Salvador; if, as supposed, the birds were really Swainson's Hawks (*Buteo swainsoni*), they were still well over a thousand miles south of their breeding range. McIlhenny (1932: 294) reports eggs dropped by Blue Geese (*Chen caerulescens*) just before their departure from Louisiana for the Arctic. Certain eggs found in northern Arizona do not appear to be those of any species normally nesting in the region. We know all too little about "dropped" eggs. Attention is called, too, to the fervent singing and prolonged maximum in gonad-size among Cassin's Sparrows in a region throughout which they are not known to breed (Phillips, 1944).

Various workers have recently challenged the familiar axiom that no bird ever breeds twice during the same year in different regions. It would of course require extraordinary luck and persistence, or both, to prove this. Wagner (1948) believes that Broad-tailed Hummingbirds (*Selasphorus platycercus*) which nest in the vicinity of Mexico City in autumn are the same ones that have already nested, earlier in the summer, in the Rocky Mountains of the United States. Some Arizona ornithologists have noted a post-breeding disappearance, probably a migration, from the low, hot valleys of southwestern Arizona of such birds as the Costa's Hummingbird, Say's Phoebe (*Sayornis saya*), Phainopepla (*Phainopepla nitens*), and Loggerhead Shrike. Of these, the Phainopepla is the most likely to raise a second brood elsewhere; but all are worthy of careful investigation. The casual breeding of European White Storks (*Ciconia ciconia*) in South Africa has been recorded, but this must certainly be exceptional.

Effect of Short-term Weather Influences

Accidents which happen on migration, sometimes as a result of meteorological irregularities, occasionally resolve themselves into natural experiments that may yield important clues. At the Nashville ceilometer Spofford (1949) saw birds kill themselves by flying straight into the ground when a beam of light struck them. Bishop (1949) noted the same behavior among petrels. Many of the circumstances were, of course, widely different in these two cases, and the cause is obscure in both. The great trans-Atlantic flight of Lapwings in December, 1927 (Witherby, 1928), was evidently caused by exceptional winds combined perhaps with poor visibility. But wind and rain are perfectly normal; very few storms produce remarkable flights; and an attempt to explain unusual occurrences on such a basis (Williams, 1950) may produce conclusions which are at variance with known facts of bird distribution and migration, even if no errors of identification are involved among the "records" so explained. Weather variations have been much discussed recently by Williams (1950 and elsewhere), Bagg *et al.* (1950), Robbins (1949), Vleugel (1948), and others. Except in winter, their role is apparently merely regulatory. Seldom are migrating birds the passive playthings of the elements!

Landmarks vs. Sense of Direction

The writer does not share the optimistic opinion expressed by Griffin and Hock (1949) that many migration phenomena are explicable in terms of exploration for landmarks. Buss's observations (1946) indicate otherwise; and if Golden Plovers leaving the Bering Sea are apt to fly in *any* direction, how can we account for the extreme rarity of the entire genus in that intensively studied region to the south—the west coast of the United States, with its extensive shoreline? The Bristle-thighed Curlew (*Numenius tahitiensis*) apparently maintains an even more rigid course across the Pacific Ocean. This does not argue inefficient navigation. Neither do the observations of F. W. Loetscher, Jr., and myself on San Francisco Mountain, the highest mountain in Arizona, on July 28, 1939. There, not far below timberline, in the Inner Basin, Audubon's Warbler (*Dendroica auduboni*) is the only breeding *Dendroica*; yet during our visit we collected two of three to five Black-throated Gray Warblers (*D. nigrescens*) seen, three Hermit Warblers (*D. occidentalis*), and three Townsend's Warblers of four or five seen. The date is about the beginning of the warbler migration, especially for the last two species, which were already hundreds of miles south (or east) of their breeding grounds. An even earlier Hermit Warbler had been taken ten days before in the Santa Rita Mountains, still farther south. The important point is that every warbler observed on July 28 (as well as the Hermit Warbler taken July 18) was an immature. Within two months of hatching, these young birds had flown unerringly and unguided to the points of autumn concentration of their species! San Francisco Mountain is surrounded by a great plateau, an area superficially similar to the mountain itself, though less high of course. The forest covering the Mogollon Plateau is said to be the largest forest of yellow pine (*Pinus ponderosa*) in existence. It extends eastward as far as, and into, New Mexico. But though much more field work has been done here on the plateau, near Flagstaff, than on the mountain above, neither the Townsend's nor the Hermit Warbler has ever been found at Flagstaff before August 2, and no Townsend's before August 25. Both species are commonest in the highest forests available.

Verwey (1949) concludes that not only birds, but also fishes and aquatic mammals, have in some cases a sense of direction.

Conclusion

Is it not likely that, among the many migrations known to take place today, different kinds have arisen at different times and places, in response to different sets of conditions during geologic time? If so, how can any one set of simple theories cover all the facts? Dangerous as it may be to formulate general hypotheses on the basis of local data, we cannot ignore data simply because they do not fit widely accepted hypotheses. To be useful, a hypothesis should be flexible enough to account for quantities of local data without forcing facts to fit theories.

Migration remains a mystery, and it seems unlikely that any one simple explanation will cover any very large percentage of the known facts. The latter become stranger and stranger; readers of *The Wilson Bulletin* will recall Broley's (1947: 3–6) discovery that the Bald Eagle (*Haliaeetus leucocephalus*) is absent from Florida "during July and August." In conclusion, quoting Thomson: "What, in particular, guides the young birds in those cases where they travel apart from their parents when only a few weeks old, and yet perform a long journey in accordance with the constant pattern of their species? Therein lies the real mystery of migration."

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Museum of Northern Arizona, Flagstaff

NEW LIFE MEMBER

Burt L. Monroe, Sr., of Anchorage, Kentucky, has served our Club in so many ways that it is natural to think of him as one of our most important members. He will long be remembered for the thought and devotion he gave the treasurership from 1946 to 1950. He was Chairman of the Membership Committee for a time and also an elective member of Council. Now our Second Vice-President, he is also our official representative on the Council of the American Ornithologists' Union.

Among the most active of Ohio Valley ornithologists, not only has he published many papers on birds of the region, but he has gone out of his way in encouraging others to watch birds and report on their findings. He has been president of, and editor and curator for, the Kentucky Ornithological Society. He helped to develop the large and progressive League of Kentucky Sportsmen, of which he was president for a time. As State Ornithologist, a post he has held many years, he advises the Kentucky Division of Game and Fish, and has had much to do with bringing about that organization's present stature and power. He is an editor of the Division's magazine. He writes a column on conservation for *The Louisville Courier-Journal*.

His reputation as a genial companion and spinner of yarns almost rivals his reputation as an ornithologist. How he manages to do his daily stint as planning engineer and assistant secretary of the Commonwealth Life Insurance Company no one knows—but he does.

THE PERSECUTION OF PREDACEOUS BIRDS

Of real concern to ornithologists today should be the wanton destruction of non-game species. Although many naturalists condemn all hunting, it is clear that a great many outstanding, influential conservationists have also been avid hunters. As Aldo Leopold wrote, "that we who love geese should also love to hunt them is a paradox which puzzles logicians." Hunting as practiced on a wide scale is to be condoned if the shooter is governed by self-restraint and does not indulge in careless waste of wildlife; but not all shooting is of this type and for that reason laws and enforcement officers are necessary not only to cope with the myriad problems arising from the intense competition for the supply of wild game, but also to protect species not labelled *game*.

These laws are not uniformly enforced or enforceable. In some states hawks, owls, and fish-eating birds are shot and pole-trapped with complete disregard for law. Fox and wolf drives result in mass extermination of anything that moves. Pest control campaigns and bounty payments continue contrary to biological justification. These problems are only part of the bigger one—a disregard for the value of wildlife not considered game.

This disregard is exemplified, first, by the hunter who shoots all hawks and owls in the belief that he is protecting quail and rabbits. Selfish in his desire to increase meat for his game pocket, he is willing to barter the bare existence of one species for the anticipated increase of another, quite ignorant of the essential role all may play.

Secondly, there is the shooter in search of any live targets to lay his long-range rifle on. In recent years "souped-up" varmint rifles have become the special toy of a certain class of shooters. These rifles, delivering up to 4200 feet per second muzzle velocity, equipped with high power scopes, and otherwise designed for shooting from a rest, are ideal for those who like to find targets and destroy them from the comfort of an automobile. Unsuspicious perching hawks and other "varmints" are completely at the mercy of such shooters whose range of accuracy is up to 200 yards. When approached about the matter of hawk shooting, a few "varminter" men righteously aver that they shoot only crows and cats, or only bird hawks, but some blithely admit, "I just want to see what this gun will do."

The lack of facts and esthetics characteristic of the above two types is clearly the result of continuous propaganda by the hunting and fishing magazines. These magazines, replete with "true" stories, letters from oldtimers who "know," and the colorful broadsides of arms and ammunition manufacturers, clamor for the destruction of various non-game species—crows, magpies, jays, horned owls, goshawks, sharp-shins, and even duck hawks, plus mammals of many kinds. Thus, species which many of us like to see and watch and claim as a rightful part of our heritage are labelled by sporting magazines as vermin, and even some state conservation agencies take this attitude.

But the shooter is not the only evil—there are several worms in a bad apple. Pest hunts usually originate with good intentions. In some areas rabbits, ground squirrels, starlings, blackbirds, etc. become too abundant, causing some sort of damage. However, campaigns enlisting children under the guise of good conservation, and often sponsored by vocational agricultural leaders, county agents, and conservation officers, expose the impressionable mind of youth to the false precept that organized slaughter with "point" rewards is the answer to pest problems. This is not only a bad attempt at conservation but poor esthetics as well, and will never foster a generation of conservators of wildlife.

The conservation officer represents the state and is regarded by the public as the local authority on wildlife matters. From our experience in several states, however, the attitude of these officers toward raptors and other predators is often not in keeping with biological facts or even the laws. The public acceptance and support of laws for wildlife conservation will be no more sincere than official attitude.

Another worm in the apple is the control measures conducted around game farms and fish hatcheries. Hawks and owls lured in by easy hunting are promptly dispatched at state as well as private game farms. Fish predators likewise are summarily disposed of at hatcheries. One fish hatchery is known to pay a bounty to employees for kingfishers and herons shot. The merit of artificial rearing itself is questionable, but as long as we have the system we shall probably have its undesirable details. Should we tilt at "pole-trap windmills?"

Laws protecting hawks go unenforced in many states because it is claimed that conviction would be impossible. If so, a clear-cut need for better education at a civic level is apparent. Along the roads in Alberta the telephone poles are resplendent with hawks during the fall migration, yet few are shot for, as several farmers said, "Each hawk is worth $40.00 to the farmer." A grain farmer is in an excellent position to make this evaluation. Perhaps we could spread this simple idea more effectively.

The best way to get the teaching job done is to stimulate a public desire for the addition of conservation subjects to the lower grade curricula; but basic to this is the production of leaders. Leadership training should be available in conservation camps and normal schools to provide teachers who understand the correct use of natural resources, and who recognize the opportunities for improving the relationship between man and his environment.

State and local ornithological groups, while not usually blessed with surplus funds, could lend active support to leadership training programs through publicity in their own journals. Since the acceptance of new ideas in public education is slow at best, stop-gap measures are desirable. The publicity campaign is useful. Competent ornithologists in each state should consider a publicity campaign for the conservation of predaceous birds, particularly in those states where no *real* protection is given. Newspaper articles, radio programs, and booklets could be used to spread the word. Booklets should be free, attractive, and informative. Few such booklets are now available. Publications from Pennsylvania and Wyoming fit these specifications except that they are available for nominal prices which definitely limit distribution. A publicity program usually requires competent personnel with journalistic ability as well as financial support, but much could be done through the cooperation of interested organizations.

The education of the public is but one approach. What other chances are there for doing something positive for predaceous birds? In this era of cheap money, one wonders if there is not something to be garnered for the less-prized species. While non-game birds benefit considerably from the acquisition and development of refuge areas set aside annually with the use of Federal Aid funds, more than just a token acknowledgement is due this important segment of the bird fauna, particularly predatory species. Why not counter-balance the heavy subsidization of game investigations with some much needed research on non-game? There is danger of the present system nurturing the philosophy that conservation is *only* for game species. As Hochbaum put it, "the game manager or wildlife technician has built up a science of his own which breaks too far away from the fundamentals of biology upon which it was founded." Notwithstanding the fact that a large portion of the money comes from the sportsman's pocket, any activity that does not adhere to the principle of saving all the flora and all the fauna is not true conservation.

Nothing in the wording of the Pittman-Robertson Act indicates that Federal Aid money may not be used for the benefit of non-game species. Selection of projects appears to be a matter of choice with the states, and the emphasis upon game species was natural in the early years of the assistance program. Despite expensive duplication of effort, states do carry on parallel research on quail, pheasants, grouse, waterfowl, deer etc. A mountain of data is accumulated, publications are cluttered with details differing mainly in their place of origin, and the technical sessions of annual meetings still labor with the old topics. Perhaps it is now time to question whether some of the game research money being spent is really *well* spent. Would it be better spent if applied to a less intensively cultivated field of wildlife investigation, namely, predaceous birds?

With the availability of Dingell-Johnson funds the relationship of fish-eating birds to the production of game fishes assumes greater importance. The facts are none too well known. On warm water impoundments, where underfishing and stunting are the major problems, perhaps we could find a means of soliciting the help of fish predators in removing the small, unharvestable fishes. It will be extremely disheartening if the persecution of fish-eating birds is to be permitted on the water areas created or maintained with Dingell-Johnson money.

Local support for strong protection programs by the various states means a strong national program. As the local attitude is bettered the state enforcement officer's task becomes more justifiable in the public mind. On a national scale this means an easier course in conserving and perpetuating species whose fame, if not distribution, transcends state boundaries, e.g., the California Condor and the Everglade Kite. Citizens of the western states no longer will wonder what is their stake in the future of the Everglade Kite, for an awareness of the inherent values of local fauna will align them with the group that seeks to help not only a bird but man himself.—Charles M. Kirkpatrick and William H. Elder.

NEW LIFE MEMBER

Paul J. Nowland was born in Wilmington, Delaware in 1895 and has maintained residence there all his life. He attended Princeton for two years. During the first World War he served overseas as a member of the aviation section of the U. S. Army Signal Corps. One beautiful moonlit night in 1918, near Romsey, England, he heard his first Nightingale (*Luscinia megarhyncha*) sing. He has long been an admirer of Alexander Wilson. His love for birds and desire to protect them has focussed recently upon the Hawk Mountain Sanctuary in Pennsylvania. Our photograph of Mr. Nowland shows him standing near the entrance to this famous sanctuary—the only one of its sort in America.

The actual dates of publication of the four numbers of *The Wilson Bulletin* in 1950 were: March 27, June 29, September 20, and December 22.

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. Use figures for all definite weights, measurements, percentages and degrees of temperature (for example: 2 kgm., 1 inch, 20.5 cc., 300°C.). Spell out indefinite and approximate periods of time and numerals used in a general manner (for example: one hundred years ago; about two and one-half hours; seven times). 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. Follow carefully the style used in this issue in listing, after the paper, 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.

NOTICE OF CHANGE OF ADDRESS

If your address changes, notify the Club immediately. Send your complete new address to the Treasurer, Leonard C. Brecher, 1900 Spring Drive, Louisville 5, Kentucky. He in turn will notify the publisher and editor.

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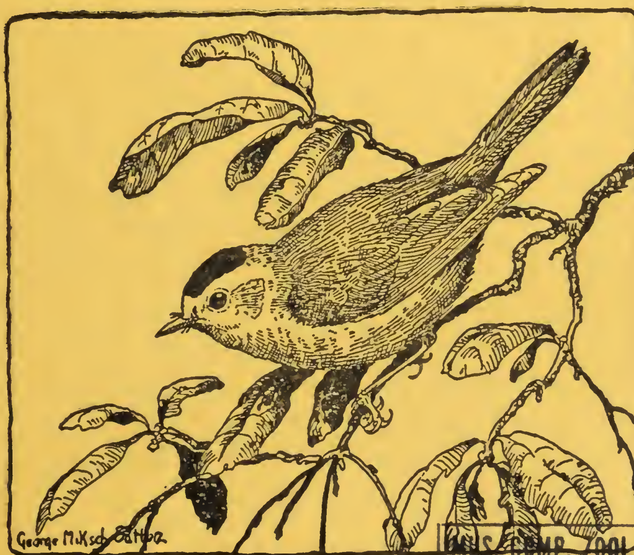

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Wilson Ornithological Club Library

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 2 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 of 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 85 periodicals, as gifts, and in exchange for *The Wilson Bulletin*. With the usual exception of rare books in the collection, 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 preliminary index of the Library's holdings was printed in the September 1943 issue of *The Wilson Bulletin*, and each September number lists the book titles in the accessions of the current year. A brief report on the recent gifts to the Library is published in every issue of the *Bulletin*.

The Wilson Bulletin

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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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THE PRESIDENT'S PAGE

A year or so ago the presidential address at the annual Meeting of the American Association for the Advancement of Science was titled "Ten Million Scientists." This was a plea for full use of our scientific potential, and made specific mention of bird watchers as an important and promising segment in the mass of possible scientific observers. I often think of this when I see the wealth of enthusiasm among members of local bird groups. Such zeal and energy needs only good leadership to be productive of sound scientific results.

There are many types of studies which a local bird club may profitably undertake. Nearly every community has a "pet" bird species, one which is particularly abundant or peculiarly a favorite among club members. I know of one club which has made a group study of Swainson's Warbler, to the benefit of its members and to the advantage of ornithology. Individual members keep careful notes on arrival and departure times, search for nests, spend many hours in observation at the nests, and record all observed items of life history and behavior. Attention is paid to the environments and communities which the birds occupy. Data are pooled, and the result is a mine of information on this somewhat elusive species.

Another local group has systematically conducted forays into significant areas, and in each one has made carefully planned breeding bird censuses. In some cases smaller groups have returned in later years for a repetition of these census studies. As a result of such planning and direction, these forays have genuine meaning and purpose for participating members, and for other bird students as well.

It is axiomatic that bird habitats in every community are changing constantly, and that bird populations fluctuate with these changes. Local students, continuously working in an area, have real opportunities for noting and recording such fluctuations. Gradually but surely data accumulate for a significant ecological study. Witmer Stone's "Bird Studies at Old Cape May" is a classic among such studies. It was made possible through the systematic, and carefully directed, efforts of many workers in the Delaware Valley Ornithological Club, and in other local bird groups.

Field trips to interesting spots, "Century Days," and such like activities are fun for all of us, and certainly have their place in local club programs. The same amount of time and energy, well directed, can be much more productive than such efforts usually are. Furthermore, a well-planned program, looking toward attainable results, is much more likely to hold the continuing interest of members.

If the work of local groups is often rather diffuse and meaningless, the fault may lie with professional students and trained amateurs who feel that such activities are beneath their dignity. Yet it is safe to say that many serious workers got their first ornithological inspiration from local bird clubs. Perhaps we might remember that Roger Tory Peterson began his career as a member of a Junior Audubon Club.

MAURICE BROOKS

WILSON'S OR BLACK-CAPPED WARBLER
(*Wilsonia pusilla pusilla*)

Photographed at the nest on July 13, 1950, along U. S. Route 1, in Hancock County, Maine, by Hal H. Harrison.

NOTES AND OBSERVATIONS ON THE WILSON'S WARBLER

BY HAL H. HARRISON

SURPRISINGLY little has been written about the breeding habits of the well-known Wilson's or Black-capped Warbler, *Wilsonia pusilla*. Though its nest has been found many times no one seems to have ascertained the length of its incubation and fledging periods, and very little attention has been paid to its behavior at the nest. A possible reason for this dearth of data is that the nests and eggs have been so desirable as specimens that they have been collected rather than observed.

A brief early account of the nest of the eastern race, *W. p. pusilla*, was that of Fred B. Spaulding (1894), who collected four fresh eggs on June 6, 1894, near Lancaster, New Hampshire. J. Merton Swain (1904) reported at somewhat greater length on nests found in Maine, illustrating his paper with two photographs taken June 1, 1902, of the same nest in Hermon Bog, Penobscot County. One picture showed the female bird incubating, the other the five eggs. Chapman (1907: 277) briefly discussed the species' breeding habits, mentioning nests of *W. p. pusilla* reported by Spaulding from New Hampshire and by Swain and Morrell from Maine. Knight (1908: 565–570) gave an extended account of the bird's occurrence in Maine, mentioning several summer records. Austin (1932: 181) considered the species "not uncommon as a summer resident in the wooded regions from Hamilton Inlet south" in Labrador, but did not say a word as to its nesting habits. Baillie and Harrington (1937: 254) mentioned a nest with five "incubated" eggs collected June 14, 1936 in the Sudbury District of Ontario.

As to the summer range of *Wilsonia p. pusilla* in Maine, Palmer (1949: 494) wrote: ". . . fairly common in eastern parts of Piscataquis and Aroostook Counties, and in Penobscot, Hancock, and Washington Counties (common about Bangor and in eastern Washington County), and apparently rare elsewhere inland." Palmer gave a complete summary of the breeding data actually available for the State, mentioning the nest with five eggs found in Hermon Bog on June 1, 1902 (see above); a nest with four heavily incubated eggs found at Pittsfield, Somerset County, June 4, 1897; a nest with four "nearly fresh" eggs found at Pittsfield, June 12, 1892; a nest with four fresh eggs found near Bangor on June 19, 1900; a nest with four young just leaving, observed near Bangor about June 29, 1900; a young bird barely able to fly, at Fort Fairfield, Aroostook County, June 23, 1879; and "a pair of adults, the female carrying food," observed at Ellsworth, Hancock County, June 9, 1910.

The breeding habits of the western races appear to be little, if any, better known than those of the eastern race. *W. p. pileolata*, the so-called Pileolated Warbler, breeds from the shrubby borders of the tundra in Alaska southward in the Rocky Mountains (at progressively higher elevations) as far as New Mexico, eastern California, and central western Texas. Herbert Brandt (1943: 440) described five Alaska nests, each with *six* eggs. Florence M. Bailey (1928: 632) reported a nest with five fresh eggs found June 5, 1921 in Santa Fe Canyon, near Monument Rock, New Mexico. Cooke (1900: 220) mentioned a nest and eggs taken along the eastern side of South Park, Colorado, July 3, 1878. McCreary (1939: 90) recorded a nest with five eggs found near Towner Lake, Wyoming, June 27, 1931. Saunders (1921: 152) reported two nests from Montana—one with four much-incubated eggs, June 24, 1901, at Lake MacDonald, Missoula County; the other with five eggs, June 16, 1910, in Pipestone Basin, Jefferson County.

Concerning the habits of the Golden Pileolated Warbler, *W. p. chryseola*, a Pacific coast subspecies which breeds from southern British Columbia to southern California, little seems to have been written, though the bird is common in parts of Oregon and California. Barlow (1893) who discussed nests found in California, almost certainly was writing of *chryseola*, which had not yet been described. Gabrielson and Jewett (1940: 517) mentioned a nest and four much-incubated eggs collected at Linton, Multnomah County, Oregon, on June 17, 1917. Leupold (1946) wrote briefly of a nest and four eggs found July 20, 1945, near Hidden Lake, on the southwestern slope of Mt. Hood, Oregon, at an elevation of about 4000 feet. Dawson (1923: 515–517), who considered *chryseola* one of the commonest breeding birds of the coastal part of Humboldt County, California, called attention to its preference for blackberry thickets in the Monterey district and for willow-lined streams near San Diego, and expressed suspicion that it might rear "two broods, possibly at different levels" in a season.

In the summer of 1950 I had an excellent opportunity to add to our knowledge of the life history of the 'little Black-cap' when Ralph H. Long, Jr., of South Paris, Maine, and I visited an area inhabited by several pairs of the birds in Hancock County, Maine. This particular habitat had been discovered some years ago by James Bond, of the Academy of Natural Sciences in Philadelphia, and it was he who suggested that we look for nests there. A place which seemed to be especially favored by the birds bordered a wet swale along U. S. Route 1 near the boundary between the towns of Hancock and Ellsworth. Several males were singing thereabouts.

On June 24, Long and I went to this area determined to find a nest. As we tramped about we noted that the Alder Flycatcher (*Empidonax traillii*), Chestnut-sided Warbler (*Dendroica pensylvanica*), Yellow-throat (*Geothlypis*

Alder swale nesting habitat of Wilson's Warbler along U. S. Route 1, Hancock County, Maine. Photographed July 13, 1950, by Hal H. Harrison.

trichas), Nashville Warbler (*Vermivora ruficapilla*), Purple Finch (*Carpodacus purpureus*) and White-throated Sparrow (*Zonotrichia albicollis*) all seemed to be rather common in the vicinity.

Happening to notice a Wilson's Warbler with a dry leaf in its bill, we watched it take this leaf to a spot about twenty feet from us, disappear momentarily into the low-growing vegetation, and fly off with empty bill. Going directly to the spot, we found a partly built nest. It was at the base of a blackberry bush, well concealed by the surrounding grass and leafage. It was not in the swale proper but in a dry spot to one side. We noted that the leaf had been added to others forming the foundation. A tiny cup of dry grasses was already under construction on top of and among the dry leaves. Several times we watched the bird (presumably the female, though its black cap was quite distinct) bring material to the nest. She brought grasses as well as small leaves. Her visits to the nest were short. Her mate was attentive, but we did not see him gather any material or participate in the nest construction. Indeed, we did not observe him at the nest at all during the building process though he sang frequently as the female came and went. His singing-perches seemed to be the tops of alders and tamaracks at various distances (a few yards to several rods) from the nest.

To me his chattering song sounded very similar to that of the Nashville Warbler. It was two-parted, but each part was of equal length whereas the two parts of the Nashville's song were not equal in length, the first part being the shorter. The song of the Wilson's seemed to lack the volume of the Nashville's and was harder to detect at a distance.

About two hundred yards from the nest we heard a second male Wilson's Warbler singing, and across the highway, again in a similar habitat, there was a third. It seemed evident to us that this particular area was so attractive to the species that a concentration of breeding pairs, almost a colony, had established itself there.

We made our second visit to the nest on the evening of June 28 (four days later) finding one egg in it. We did not see or hear either the male or the female on that date and the other Wilson's Warblers of the area were quiet also.

When we visited the nest at 4 p.m. on July 1, the female was incubating four eggs. She left the nest at our approach, drooping and rapidly fluttering her wings as she moved slowly from branch to branch among the alders, retreating in the direction of the swale. As soon as we withdrew, she returned to the nest.

We visited the nest again at 7:30 p.m., July 11. This time the female sat very close, permitting us almost to touch her before she left. The four eggs were apparently in good order.

At 8 o'clock the next evening (July 12) the nest contained three young birds and one egg. The incubation period of three of the eggs had been at the very least ten days and about four hours (4 p.m. July 1 to shortly after 7:30 p.m. July 11) and at most 12 days (about 8 p.m. June 30 to shortly before 8 p.m. July 12). The female probably spent the night of June 30 on the nest, laid her fourth egg the following morning, and continued her incubation until the hatching. Early on the morning of July 13 we found four young birds in the nest, but one was dead under the other three. We removed the dead bird.

Female Wilson's Warbler on nest. Photographed in Hancock County, Maine, on July 13, 1950, by Hal H. Harrison.

We spent eight hours that day taking photographs from a blind erected ten feet from the nest. The weather was extremely hot and the female brooded much of the time. Occasionally the male went to the nest; but usually when he approached with food the female left the nest and went to meet him, took the food from him, and fed the young herself. Whenever she left the nest for several minutes she brought food on her return. Both parent birds occasionally fluttered their wings rapidly as if the camera, blind or photographer had roused their suspicion. The female seemed to be much more wary than her mate.

Our next visit to the nest was on July 18, when the young were six days old. They were covered with quills which appeared to be ready to break. We noted that the male parent was no longer singing. Both parent birds were silent as they went about the task of bringing food to the young.

On July 19, when the young birds were seven days old, they seemed to be well feathered. They crouched low in the nest. When we disturbed them in attempting to take pictures one of them scrambled rapidly off. Though apparently unable to fly it was strong on its legs. The other two young birds remained in the nest.

On the afternoon of July 20 the two young (now eight days old) were still in the nest. The parent birds chipped loudly in protest as we approached and attempted further photography, and all at once the young bolted. Keeping to the ground, and apparently unable to fly, they made off through the undergrowth. Had we not disturbed them they certainly would have remained longer—but how much longer no one can say. They were fairly well feathered, but not yet fully fledged.

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NEW LIFE MEMBER

Ludlow Griscom was born June 17, 1890, in New York City. He received an A.B. from Columbia in 1912; an A.M. from Cornell in 1915; was Research Curator in Zoology at the Museum of Comparative Zoology at Harvard from 1928 to 1948; and has served that institution since as Research Ornithologist and Editor. His 'life list' is very large—about 950 species for North America, 2500 for the world. He has made sixteen trips to Europe, four to Newfoundland-Labrador, several to Central America and the West Indies. He is especially interested in the origin, distribution and taxonomy of Middle American birds. He is one of the authors of "Distributional Check-list of the Birds of México," now in press. He is Chairman of the Board of Directors of the National Audubon Society and a Vice-President of the American Ornithologists' Union. His book "Modern Bird Study" is well known to members of our Club. His "Distribution and Origin of the Birds of México" will be reviewed in the next issue of *The Wilson Bulletin.*

FOOD HABITS OF THE BARRED DOVE IN HAWAII

BY CHARLES W. SCHWARTZ AND ELIZABETH REEDER SCHWARTZ[1]

OF THE nearly one hundred avian species introduced into the Hawaiian Islands since their discovery by the English explorer Cook in 1778, few have become established. Even fewer have increased as prolifically as has the Barred Dove (*Geopelia s. striata*), a native of Malaya. The successful establishment and increase of this species is doubtless related to its ability to breed the year around in the equable coastal climate (Schwartz and Schwartz, 1950) and to feed upon a wide variety of plant foods.

The Barred Dove probably was first introduced into Hawaii in 1922 when a shipment of doves from Australia was liberated on the islands of Oahu, Kauai, Maui, Lanai, and probably Molokai (Caum, 1933; Munro, 1944; D. Fleming, in conversation). The original planting on Lanai did not succeed. The bird became established there some time after 1929, reaching the island unaided, probably from 10-mile distant Maui (Munro, 1944). Barred Doves have been seen flying to and from Kauai and Niihau and volunteer flight between these islands, a distance of 18 miles, is responsible for establishment of the species on Niihau where it is very abundant (L. Robinson, in conversation; Fisher, 1951). The Barred Dove's occurrence on the island of Hawaii dates from approximately 1935, but whether or not it arrived with human assistance is not known. On this island the bird inhabits only the leeward coast, at the closest point 29 miles distant from Maui, but its range and population here are still increasing.

The Barred Dove now inhabits all the major islands, ranging from sea-level to 4000 feet elevation (the highest elevation in the group being 13,784 feet). The total area occupied is approximately 1475 square miles. Throughout this habitat the mean annual temperature ranges from 75°F. at sea-level to 60°F. at 4000 feet, with a monthly fluctuation in mean of less than 8°F. Rainfall varies from about 10 to 160 inches annually. The bird inhabits nearly all types of land including urban and homestead areas, pineapple and sugar cane plantations, truck gardens, pasture lands, and waste areas exclusive of barren lava.

[1] This study was made from February, 1946, through July, 1947, in connection with a survey of game birds in the Hawaiian Islands, Project 1-R of the Federal Aid–Wildlife Program of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii (Schwartz and Schwartz, 1949). We are grateful to E. Y. Hosaka of the University of Hawaii Agricultural Experiment Station and B. P. Bishop Museum, G. O. Fagerlund, formerly with the Hawaii National Park, and H. St. John of the University of Hawaii, for identification of certain plants; and to Ernst Mayr, of the American Museum of Natural History, for subspecific identification of the dove specimens collected.

Adult Barred Dove (*Geopelia striata*). Photographed at Lihue on Kauai of the Hawaiian Group, in October, 1946, by Charles and Elizabeth Schwartz.

It seldom uses the heavily-forested sections in which the rainfall is extremely high (up to 450 inches annually), visiting only the margins where clearing and road maintenance support and encourage desirable food plants.

The bird is most abundant from sea-level to about 2000 feet elevation along the coast. Throughout this favored habitat the mean annual temperature is between 75° and 70°F., and rainfall between 10 and 40 inches annually. Densities up to 800 birds per square mile, even higher in certain localities, exist where there is a combination of attractive roosting cover, water, and an abundance of food of the xerophilous type. Roosting cover is furnished by dense algaroba (*Prosopis chilensis*) and koa haole (*Leucaena glauca*). Water is available in seeps and cattle watering-troughs. Temperatures lower than 60°F. and rainfall higher than 160 inches annually probably limit distribution. Where temperatures are lower the preferred food plants do not flourish, and where rainfall is heavier the eggs or young may be adversely affected or the cover becomes so dense as to be unattractive for nesting.

Early in the morning, shortly after the doves leave their roosting places, they start feeding casually in the vicinity. They may spend considerable time dusting and sunning and males may indulge in courtship displays and songs.

The birds usually feed in pairs or family groups—i.e., two adults and two recently fledged young. Although hundreds of birds may gather at common feeding, watering, or idling places, they do not form definite flocks or age-groups. Our collecting failed to indicate any segregation of the sexes.

Where food and water are available near roosting places, no extensive daily flights are necessary; but where attractive feeding areas (e.g., the pineapple fields on Lanai) are far removed from the roosting places, flights up to three and even five miles may be taken late in the morning. The daily period of greatest feeding activity is in the afternoon (Figure 1). Ninety birds taken after 3 p.m. had well filled crops (average crop content: 3.4 cc.; one very full crop contained 15.0 cc.). Wherever a considerable flight to a good feeding ground is necessary, there is an evening flight also—back to the roosting place.

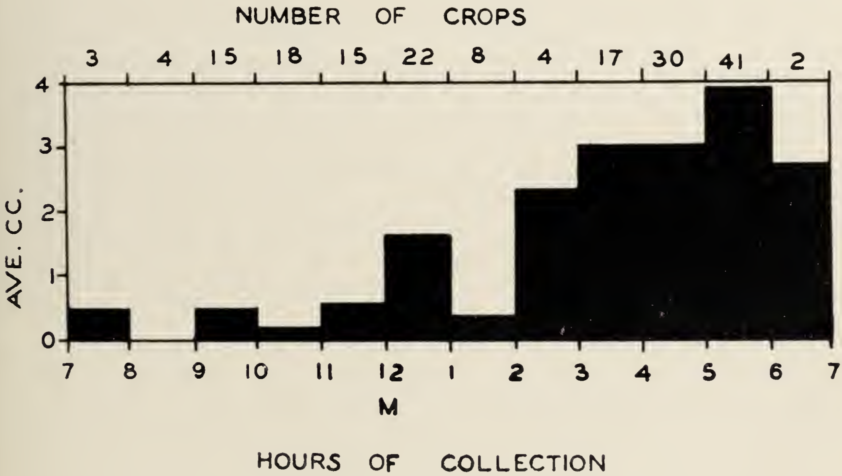

Fig. 1. Variation in volume throughout the day in Barred Dove crop contents.

In the Hawaiian Islands the Barred Dove and another introduced species, the Lace-necked Dove (*Streptopelia c. chinensis*), often feed in the same fields, but they usually do so during different stages of cultivation or plant succession. In general, the Barred Dove feeds on small seeds, while the Lace-necked Dove takes larger seeds and fruits. There is no competition between them for food. Only three plants were shown by our studies to be present in the alimentary tracts of the two dove species in quantities of more than one percent by volume, and these plants, *Waltheria americana*, *Lantana Camara*, and *Sida* sp., are plentiful throughout the ranges of both birds (Schwartz and Schwartz, 1951).

Since the Barred Dove subsists mainly on foods providing little moisture, surface water is a necessity. We have observed the doves drinking at rainwater puddles, cattle watering troughs, brackish and fresh-water pools or seeps, irrigation ditches, and reservoirs.

TABLE 1

FOODS OF THE BARRED DOVE IN HAWAII

Species	Percent of crop volume	Number of occurrences in 165 crops	Number of occurrences in 136 gizzards
Plants (seeds unless otherwise indicated)	*96.7*		
Amaranthus hybridus, spleen amaranth	15.9	57	48
Setaria verticillata, bristly foxtail	11.7	56	33
Paspalum Urvillei, vasey grass	9.7	10	8
Portulaca cyanosperma, small pigweed; seed, pod	8.9	33	15
Waltheria americana, uhaloa	7.4	42	58
Eleusine indica, wire grass	7.0	19	2
Lantana Camara, Lantana; seed, fruit	5.4	6	12
Setaria geniculata, yellow foxtail	3.4	13	6
Echinochloa colonum, jungle rice grass	3.3	4	6
Digitaria horizontalis, kukaipuaa	2.6	9	8
Sida rhombifolia, ilima	2.6	8	5
Setaria glauca, yellow foxtail	2.2	3	3
Sida sp., ilima	1.9	14	6
Richardia brasiliensis, Richardsonia	1.8	5	3
Atriplex semibaccata, Australian salt bush	1.5	13	5
Euphorbia hypericifolia, graceful spurge	1.5	8	6
Unidentified seeds and debris	1.2	13	2
Sida cordifolia, ilima*			
Sida fallax, ilima*	1.1	6	8
Digitaria sanguinalis, large crab grass	1.1	5	2
Portulaca oleracea, pigweed	0.9	25	8
Euphorbia hirta, garden spurge	0.7	27	9
Cynodon Dactylon, Bermuda grass	0.6	13	10
Emilia sonchifolia, red pualele	0.6	12	0
Panicum maximum, guinea grass	0.6	7	2
Cuphea carthagenensis, tarweed	0.5	1	1
Hordeum vulgare, barley	0.5	1	0
Siegesbeckia orientalis, small yellow crown beard	0.5	10	2
Tephrosia purpurea, ahuhu	0.5	9	11
Amaranthus spinosus, spiny amaranth	0.2	9	2
Carica papaya, papaya	0.2	1	0
Casuarina sp., ironwood	0.2	6	4
Scirpus sp.	0.2	2	2
Chenopodium sp.	0.1	2	2
Grevillea robusta, silk oak	0.1	1	0
Solanum nodiflorum, popolo	0.1	5	2
Abutilon molle, mao	T	3	5
Ananas comosus, pineapple; root	T	1	0
Bidens pilosa, pilipili	T	2	0
Centaurea melitensis, Maltese thistle	T	3	0
Chloris inflata, swollen finger grass	T	3	0

TABLE 1—*Continued*

Species	Percent of crop volume	Number of occurrences in 165 crops	Number of occurrences in 136 gizzards
Plants (continued)			
Dodonaea viscosa, aalii	T	4	17
Echinochloa crusgalli var. *crus-pavonis*, barnyard grass	T	5	0
Eclipta prostrata	T	1	1
Heliotropium curassavicum, hinahina	T	1	1
Lepidium auriculatum, pepper plant	T	1	1
Malva parviflora, little mallow	T	3	2
Malvastrum coromandelianum, false mallow	T	2	5
Momordica Balsamina, balsam apple	T	1	0
Nicandra Physalodes, apple of Peru	T	1	0
Oryza sativa, rice	T	1	0
Oxalis corniculata, sweet sour, sorrel	T	1	0
Paspalum conjugatum, Hilo grass	T	1	1
Passiflora sp.	T	2	2
Phaseolus lathyroides, wild pea bean	T	3	0
Polygonum sp.	T	1	1
Prosopis chilensis, algaroba, kiawe; seed, leaf, pod	T	1	1
Sporobolus indicus	T	3	0
Tricholaena repens, Natal redtop	T	3	1
Verbena litoralis, Verbena	T	7	6
Animals	*3.3*		
Carpophilus humeralis, yellow-shouldered souring beetle; adult	2.7	5	4
Muscoidea, fly; larva	0.4	1	0
Carpophilus hemipterus, dried fruit beetle; adult	0.2	6	3
Bruchus amicus, bean weevil; adult	T	1	0
Bruchus prosopis, bean weevil; adult	T	1	0
Coleoptera, beetle; larva	T	1	0
Conoderus exsul, wireworm; larva	T	3	0
Insecta (unidentified), insect; pupa	T	1	0
Megacerus alternatus, pea weevil; adult	T	1	1
Oxidus gracilis, thousand-legged worm; adult	T	1	0
Vespoidea, wasp; adult	T	1	0

* The seeds of these species are practically indistinguishable, hence they are combined herein.

The Barred Dove's food in Hawaii is 96.7 percent vegetable and 3.3 percent animal. Fifty-nine species of plants and 11 species of animals are represented (Table 1). The vegetable matter is almost wholly small seeds from rapidly-maturing herbaceous annuals and grasses which thrive under disturbed soil conditions. Most of these grow in open fields or along roadsides and are soon replaced by the heavier growth of later annuals or cultivated species. Climatic conditions influence the distribution both of these preferred foods and of the doves themselves.

The following detailed report on the Barred Dove's food is based upon an analysis of the contents of 165 crops (and gizzards of 136 of the same birds) as well as upon extensive field observations. We carried out all field work, analyses, and computations ourselves. The contents of crops were dried, identified, separated, and measured in cubic centimeters; frequency of occurrence was recorded; and the aggregate volume was ascertained. Gizzard contents were identified and recorded for occurrence only. We discuss the foods on an annual basis because no great seasonal difference occurs in the food supply of doves in Hawaii, although there may be periods, especially following rains in the drier regions, when certain plant species produce seeds more abundantly. Specimens for this study were collected on all the major islands occupied by the species except Niihau, and from all months of the year except July.

The eight most important foods on the basis of volume and frequency of occurrence in crops (more than 6 percent or more than 15 occurrences) we wish to discuss in particular. Other foods, while occurring in small amounts and few crops, are doubtless valuable as they contribute to variety in the diet and furnish essential nutrients. Only small amounts of fruit (*Lantana Camara*), root (*Ananas comosus*), seed pods (*Portulaca cyanosperma* and *Prosopis chilensis*), and leaves (*P. chilensis*) are eaten. Animal foods are relatively unimportant: almost the entire measurable volume consists of two species of *Carpophilus* beetles. When old pineapple fields are plowed under, these beetles, which commonly infest pineapple, are exposed and the doves gather in large numbers to feed upon them. None of the insects eaten by the dove are known to be hosts of internal helminth parasites common to other game birds in Hawaii. This probably explains the absence of such parasites in the dove specimens we examined.

Important Barred Dove Foods

Amaranthus hybridus, spleen amaranth, is the most common food. The seeds of this exotic species, a native of tropical America, formed 15 percent of the diet and were present in 57 (34 percent) crops and 48 (35 percent) gizzards. The plant grows commonly in the margins of cultivated areas, in fallow fields, and along roadsides below 2500 feet elevation, producing an abundance of seed all year.

Setaria verticillata, bristly foxtail, an exotic grass from Europe and Asia, formed 11 percent of the food. Its seeds were present in 56 (33 percent) crops and 33 (24 percent) gizzards. It grows commonly below 2500 feet elevation and is important because of its widespread distribution. It produces seed the year around (to a lesser extent in winter). The birds usually strip the seed-heads in feeding. Where this grass grows in abundance the doves may gorge themselves exclusively on its seeds during given feeding periods.

Paspalum Urvillei, vasey grass, an exotic from South America, formed 9 percent by volume of the dove's food. Seeds were present in 10 (6 percent) crops and 8 (5 percent) gizzards.

Although the plant grows up to 4000 feet elevation, it is abundant only locally in pastures and along roadways and trails. Here the doves feed heavily upon it. The seed crop is produced mostly during spring, summer, and fall. Along forest roadways the marginal growth of this grass is largely responsible for the dove's presence. The bird lingers in such forested areas only as long as seeds are produced.

Portulaca cyanosperma, an endemic small pigweed, formed 8 percent of the dove's food. We found it in 33 (20 percent) crops and 15 (11 percent) gizzards. The plant is common only below 200 feet elevation on the island of Kauai but since its seeds were eaten by a large percentage of birds collected there, its importance cannot be overlooked. It is frequently associated with algaroba (*Prosopis chilensis*) and provides a ready source of food for birds using these trees for roosting and nesting. It produces seed all year but chiefly during fall, winter, and spring. Both the seeds and pods are eaten, the tiny seeds being ingested with the pods.

Waltheria americana, an exotic from tropical America, constituted 7 percent of the dove's food. Its seeds were found in 42 (25 percent) crops and 58 (42 percent) gizzards. Commonly known as uhaloa, this species of the Sterculiaceae is widespread up to 4000 feet elevation and has an abundant seed production throughout the year.

Eleusine indica, or wire grass, an exotic from the tropics of the Old World, grows below 2500 feet elevation in shallower, poorer soils. Its distribution is spotty, and the doves concentrate upon it when it is in seed. Its seeds, which formed 7 percent of the Barred Dove's diet, were present in 19 (11 percent) of the crops and 2 (1 percent) of the gizzards examined. The low incidence of occurrence in gizzards is probably more apparent than real. We did not even open the gizzards of many doves whose crops were filled with wire grass seeds.

Portulaca oleracea, an exotic pigweed from Europe, formed less than one percent of the total food, but because we found it in 25 (15 percent) crops and 8 (5 percent) gizzards, we consider it an important food. The seeds are extremely small and thousands of them must be consumed before they become an appreciable item. The plant grows commonly below 2500 feet elevation in disturbed soil, especially in young sugar cane and pineapple plantations and other cultivated areas.

Euphorbia hirta, or garden spurge, is an exotic from tropical America. Its tiny seeds contributed less than one percent to the total food volume but were present in large numbers in 27 (16 percent) crops and 9 (6 percent) gizzards. It abounds in Barred Dove range up to 2500 feet elevation along roadsides and in fields in early stages of cultivation. It produces seeds the year around, but its value to the doves varies with the stage of cultivation of the different plantations.

Grit recovered from crops and gizzards consisted of rounded or angular pieces of olivine, basalt, quartz, dried earth, feldspar, coral, and glass. The pieces ranged from 0.5 to 4.0 mm. in diameter, those between one and two mm. in diameter being most common. Only 12 crops contained grit (average grit content: 0.2 cc.). Of the 136 gizzards examined, 60 contained grit (average grit content: 0.2 cc.), 60 contained only a trace, and 16 were without grit.

In the Philippine Islands the Barred Dove eats some rice. Manuel (1934) obtained the "stomachs" of 305 Luzon birds, finding the contents to be 70 percent weed-seed and 30 percent rice. In Luzon the dove's food habits are considered of neutral importance since the bird eats rice from the stubble after the harvest. Rice is not grown extensively in the Hawaiian Islands and no depredations by Barred Doves in the rice fields were reported to us, though complaints against the rice bird (*Munia punctulata topela*) were frequent and numerous. While the parts and types of plants used as food by *Geopelia striata* are similar in these widely separated island-groups, only two species—*Paspalum conjugatum* and *Portulaca oleracea*—were found in the alimentary tracts of *both* Hawaiian and Philippine doves examined.

Only one bird of the 305 examined in connection with the Philippine study had eaten any animal matter. This individual had eaten 170 dipterous pupae. In our Hawaiian study we recorded a low percentage of dipterous larvae, and animal matter in general formed a very small part of the total food.

Summary

The food of the Barred Dove in the Hawaiian Islands is almost wholly vegetable. Analysis of the *food* contents of 165 crops and 136 gizzards (from the same birds): 96.7 percent plant matter (principally small seeds); 3.3 percent animal matter (almost wholly beetles of the genus *Carpophilus*). Seeds most commonly eaten are from rapidly maturing herbaceous annuals and grasses which thrive in disturbed soil. Some grit is ingested—average amount in 12 crops and 60 gizzards: 0.2 cc.

The dove feeds most actively in the afternoon. Birds may feed and roost in the same locality if conditions are suitable, but where good feeding areas are far removed from favored roosting places daily flights of from three to five miles may be taken. Since the dove obtains little moisture from its food it must drink: surface water is therefore an important range-requirement.

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THE FRONTAL SHIELD OF THE AMERICAN COOT

BY GORDON W. GULLION

DURING the fall of 1949, in connection with a study of the breeding behavior of the American Coot (*Fulica americana*), several coots were trapped at Lake Merritt, in down-town Oakland, California. These birds were held captive on the University of California campus at Berkeley or, after various experiments, released on nearby lakes. The finding of swollen frontal shields on a large proportion of these coots in the fall led to a series of observations and experiments on the shield.

Structure

The frontal shield of the American Coot (and other coots of the genus *Fulica*) is a fleshy protuberance extending dorsocaudad onto the forehead from the upper mandible. Ridgway and Friedmann (1941: 41) say that "the rhinotheca or covering of the maxilla [is] continued upon the forehead, where it widens into a more or less gibbous or expanded plate or frontal shield. . . ." Speaking of breeding American Coots, these authors say (p. 213) that the "frontal shield [is] larger than in winter birds, dark reddish brown or chestnut. . . ." According to Coues (1903: 862), the shield "is said to swell in the breeding season after a shrunken winter state."

Callus.—The reddish portion of the shield (Fig. 1B) cannot truly be called the shield since it is not continuous structurally with the covering of the maxilla (see Ridgway and Friedmann, *loc. cit.*). It is not, therefore, comparable with the shields as defined for other Fulicinae (except perhaps *Fulica ardesiaca*, the Slate-colored Coot) and for the several genera of gallinules, reed-hens and water-hens. The reddish portion, or *callus*, is horny or corneous in texture and is distinctly an accessory to the shield proper, the latter being white and continuous with the rhinotheca of the maxilla in the American Coot.

Histology.—Frontal shields of eight coots were imbedded in celloidin. Transverse and longitudinal sections were made and the details that follow represent a composite picture derived from the study of these sections. The histological nomenclature follows Maximow and Bloom (1942).

The callus is a pigmented, keratinized layer, a *stratum corneum*, derived from the underlying epithelial elements. It is about 0.05 mm. thick. There is a sharp demarcation, both in color and structure, between the callus and the underlying cellular elements.

The cellular Malpighian layer underlying the callus is continuous with that covering the maxilla and comprises the true rhinotheca. It is of normal epidermal construction, resembling calloused portions of human skin (cf. Maximow and Bloom, 1942: 337) and ranges from 0.085 to 0.141 mm. in thickness. The cells of the Malpighian layer, all of which are nucleated, are flat toward the surface but become more polyhedral towards the middle of the layer. These cells are connected to one another by distinct intercellular bridges. The innermost cells, which are densely packed, narrow, and columnar, are consistently and conspicuously vacuolated beneath the callus, but not vacuolated where the callus is not overlying. Dermal papillae containing both blood vessels and nerve fibers penetrate the germinal layer at regular intervals (about 0.05 mm. apart).

The dermis or corium is composed of very thick and dense connective tissue fibers and is, apparently, elastic in nature (hence accounting for the yellowish cast apparent in coot shields). Between these heavy fibers are masses of cells which serve to enlarge or flatten the shield. Data not presented here indicate that these may be chondrocytes. Towards the posterior end of the shield, the dermis is penetrated by bundles of smooth muscle and anteriorly the dense connective tissue is without the cellular aggregations responsible for variation in size.

Under the dermis is a layer of fine but dense connective tissue fibers, the periosteum, which is attached to and closely envelops the maxilla.

Size.—The shield (plus callus) varies in size, depending upon the physiological state of the bird. The swelling of the shield is the result of extensive vacuolation of the masses of cells between the heavy fibers of the dermis. The vacuolation commences close to the periosteum and progresses peripherally until distended cells immediately underlie the Malpighian layer.

The shield increases not only in thickness but also in length and breadth (Figs. 1C and 1D). Fresh growth of the callus is evidenced by growth posteriorly and laterally (Fig. 1B). The flat shield of non-breeding coots (Fig. 1A) is about 2.1 mm. thick, 4 to 8 mm. wide, and 4 to 10 mm. long. In breeding coots the swollen shield and callus (Fig. 1E) may be over 3.6 mm. thick, as much as 14 mm. wide, and up to 17 mm. long.

Development

Observations in the field and on the flock of captive birds have revealed certain basic facts about the development of the frontal shield in adult coots.

First, enlargement of the shield is closely associated with breeding activity. All breeding birds have a large shield, and furthermore, single, non-resident birds show a marked increase in shield-size on the wintering grounds in the one or two weeks prior to departure for their breeding grounds.

Second, birds permanently paired and defending territory throughout the year, whether resident or migrant, retain the enlarged shield as long as they remain paired and on territory. (For a more complete discussion of coot territorial behavior, see Gullion, 1950: 41–72).

Fig. 1. Photographs of shield conditions in the American Coot. A. A flat shield, ♀T97; B. New callus growth as it appeared 10 days after a testosterone implant, ♀79; the shiny portion laterally and posteriorly represents the new growth; C. ♂652 on the day of a testosterone implant, possessing a semi-swollen shield; D. ♂652 16 days after C was taken, and 7 days after attaining its full shield-growth; E. A naturally developed swollen shield on a dominant coot (♂T94) at the peak of breeding activity; F. The same bird as E showing the final subsidence of the shield about 2 months following the failure to establish territory and to breed.

Third, loss of territory and the reduction of breeding activity result in a decrease in shield-size and eventual regression to the flat shield characteristic of immatures in mid-winter.

Natural Control.—Perhaps the best illustration of shield-growth is that provided by the data on birds (4♂♂, 4♀♀) held in captivity (Fig. 2B). Birds in the flat condition (F, Fig. 1A) in mid-January progressed to the semi-swollen condition (SS, Fig. 1C) by early February and to the final swollen condition (S, Figs. 1D and 1E) by early March. I considered a shield flat when it was concave, semi-swollen when it was smooth, and swollen when a convexity was apparent. By March 4, a nest had been constructed and territorial behavior had begun. One captive female (♀T00) displayed frequently and the approach of the breeding season was generally apparent. As in wild populations, courtship and territorial activity reached a frenzied peak in early April, and the shields of the captive coots were at their maximal size. Constant disturbance, plus crowding and lack of suitable habitat, however, precluded actual nesting. Breeding behavior then tapered off and was no longer evident after about May 12. Subsidence of breeding activity resulted in a decrease in shield-size (Figs. 1E and 1F).

That shield-growth precedes migration was indicated by observations in Berkeley's Aquatic Park, a salt-water impoundment on the Alameda County waterfront. No territorial or paired birds were present among the 100 to 110 coots wintering there during 1949–1950, and all shields were flat. By March 10, about one-half of the birds present were showing marked shield-enlargement and by March 24 the population had correspondingly decreased by about one-half. Most birds with swollen shields had departed, only three or four birds with swollen shields remaining behind. Of the 43 coots remaining on March 24, only four or five had flat shields, the shields of the others mostly being semi-swollen or a little further enlarged. Sixteen coots remained on March 29, all with either flat or slightly swollen shields. Seven were present on April 12, all with semi-swollen shields. All had departed by April 21.

Decrease in shield-size accompanying loss of territory was demonstrated by seven November-trapped Lake Merritt coots, selected for their swollen shields, and released on Lake Temescal, in the northeastern part of Oakland, in mid-December. By early February not one of the four surviving birds possessed a swollen shield, and not one was engaged in territorial activity. On the other hand, three pairs of territorial birds showed no regression through the winter and several captive birds were beginning to show gradual swelling in winter. Furthermore, migrant, paired coots at Lake Merritt, sporadically defending territories through the winter, also had enlarged shields throughout the non-breeding season. By March 26, the four transplanted birds were beginning to show shield-growth. By mid-April, two of the males had fully enlarged shields and were paired and on territory.

Subsidence of shield-size following cessation of breeding activity, as described above for the captive flock, has not been adequately observed in the field.

Experimental Control.—Between late January and the first of July, 1950, a series of sex hormone implants were made in seven birds (3♂♂, 4♀♀). The hormones, testosterone and estradiol, were implanted subcutaneously as pellets weighing about one milligram each. Figure 2A gives the individual records of each experimental coot.

Testosterone implants in both sexes, with one exception, resulted in a rapid growth of the frontal shield (Figs. 1C and 1D; and birds ♂T96, ♂652, ♂654, ♀653 in Fig. 2A). Maximum shield-size, once attained, remained constant so long as the hormone pellet was present, and in one case it persisted for at least one month after the pellet was removed. The one exception to this rapid growth was ♀79. A testosterone pellet implanted immediately following the removal of an estradiol pellet from this bird failed to induce shield-growth. However, another testosterone implant, made 54 days later, resulted in the usual rapid growth (Fig. 1B).

The results of the estrogen implants were not as spectacular as those of testosterone, nor were they in any way conclusive. The failure of two estrogen-implanted females to develop larger shields during the time that most of the control birds were doing so, suggests an inhibitory effect. However, one of these birds (♀77) began to show some increase in shield-size about forty days after the implant, and a female (♀81) with a naturally swollen shield, after receiving an estradiol implant, failed to show any evidence of regression for at least 49 days after the implant.

On the other hand, estradiol implants in two birds previously treated with testosterone resulted in abrupt decreases in shield-size. The shield of ♂T96 commenced immediately to recede from its maximum development at a surprising rate (Fig. 2A). The shield of ♀653 failed to respond for about twelve days, then receded at a rate comparable with that of the male.

Eight coots (4♂♂, 4♀♀) being held for other purposes under the same conditions and as part of the same flock were used as controls in these experiments. These are the same captive birds discussed earlier. Their shield-growths are shown in Figure 2B.

Gonad Activity.—Microscopic examination of testes revealed a direct correlation between state of gonadal activity and shield-size. Males with enlarged shields, killed in mid-winter, were found to have an extensive proliferation of the testicular interstitial cells. A great deal of spermial debris was present within the tubules of several birds. No spermatogenesis was evident.

Non-breeding males killed during the breeding season all possessed more or less enlarged shields, but in none was the shield greatly enlarged. Correlated with this was a general proliferation of the interstitial cells and a certain amount of spermatogenesis, although not as much as was expected for that season. Unfortunately, no breeding birds could be obtained for examination.

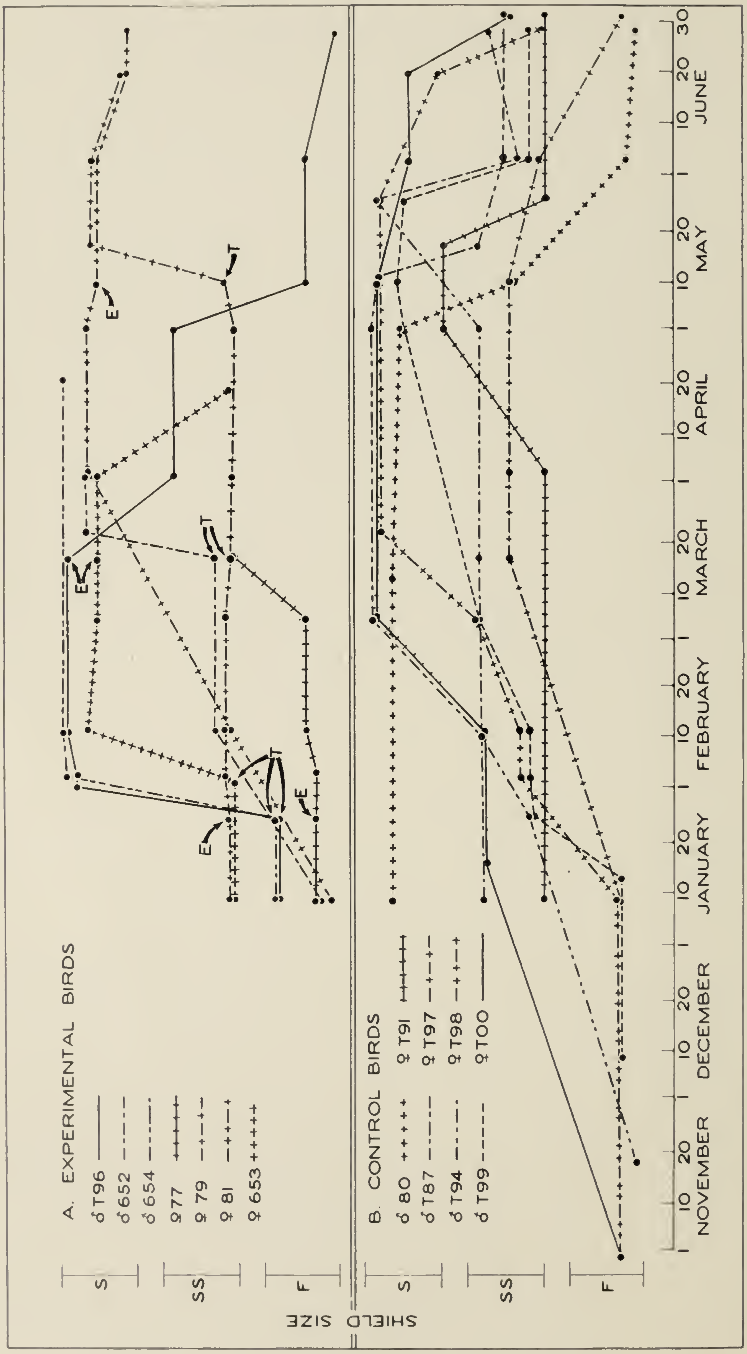

Fig. 2. Development and regression records of the shields of 15 captive American Coots. A. Records of experimental birds, showing the reactions following testosterone and estrogen implants (indicated by the letters T and E). B. Records of control birds held under the same conditions and as part of the same flock as the experimental birds.

The testes of males with flat shields showed no proliferation of interstitial cells and no evidence of spermial debris. The tubules were filled with large but inactive gonial cells.

In several females examined, no correlation could be detected between follicle size or general ovarian activity and the size of the shield.

Function of the Shield

Displays.—Observations have shown that the frontal shield functions in aggressive territorial displays of the American Coot, as discussed in detail elsewhere (Gullion, 1950: 13–27). The enlarged shield is normally prominent and birds engaging in anti-social displays erect the neck feathers behind the shield, forming a black background which further emphasizes the shield-size.

Recognition.—It is believed that paired birds are able to recognize their mates by the shape of the callus. I have recognized fifteen distinct callus patterns among the 130 coots handled in the course of this breeding behavior study (*cf.* Gullion, 1950: 33, Fig. 12) and there is so much individual variation among the general types that no two birds have identically the same callus-shape. In small populations an observer can identify reliably any bird at close range, on the basis of its callus-shape.

I have several times observed that, during pitched battles, a bird coming to the aid of its mate mistakenly attacks its mate. The attack continues until the mate turns about, thus revealing its callus. I also have observed that paired birds, defending the same territory, after being out of one another's sight for a little while, will often converge in a typically aggressive display until close enough to recognize one another, apparently by callus-shape, whereupon the aggressive display is replaced by a social courtship display.

Dominance.—Birds with enlarged shields maintain a dominance over coots without them, even though direct aggressive activity may be negligible. Since enlarged shields indicate either active or impending territorialism, birds lacking the swollen shields usually give wide berth to those with swollen shields, even though the latter may not be engaged in any display.

In connection with the hormone experiments discussed above, it was found that both males and females climbed from a low rank in the peck-order to dominance over their respective sexes at the same rate as their shields increased following a testosterone implant, thus agreeing with Allee's (1942: 160) conclusions on the effect of testosterone on dominance in birds. Furthermore, it was found that birds with artificially enlarged shields, when released in a wild population, obtained a distinct but momentary dominance over flat-shielded resident coots. However, these birds were unable to hold their dominant position. This is illustrated by the following experiment.

Two dominant males with testosterone implants and enlarged shields (♂652, ♂654) were released in territorial areas at Lake Temescal. Despite their aggressiveness and dominance in the captive flock, they were at the mercy of the resident territorial birds. Even after fleeing from territorial areas, they were subjected to relentless attack and pursuit by non-territorial birds, something that was not experienced by a bird (♀653) released with a red painted bill.

It seems probable that shield-size serves initially to indicate a bird's social attitude to nearby coots, the swollen shield being indicative of an aggressive attitude. But shield-size alone is not sufficient: it must be supplemented by a pugnacious disposition and probably by a familiarity with home grounds. Although resident coots shied away momentarily, allowing the big-shielded newcomers an initial dominance, once it was realized that shield-size was not supported by an aggressive attitude, the residents turned upon the newcomers and drove them from the more heavily used parts of the lake.

Discussion

The exact substance leading to shield development is not known, but experiments with testosterone show that in both sexes the shield can be changed from the flat to the swollen condition, and behavior from the mild gregariousness of mid-winter to a highly pugnacious attitude in less than 10 days. It seems probable that a pituitary hormone, perhaps a gonadotropin, maintains an overall control upon shield-size, territorial behavior, gonad activity and migration, since all these functions may operate simultaneously.

It is of interest in this regard that the shields of breeding females are as large as those of males. Also, it was found that certain very old (to eleven years) banded migrant birds develop and retain through the winter knobbed, much enlarged shields although the birds may not be engaged in any territorial activity.

The ease with which the callus is altered in the North American Coot (*F. a. americana*) suggests that its development on this continent may represent an intermediate evolutionary stage between the non-callused shield of *F. caribea* and the callused shield of *F. ardesiaca*. At least four American Coots have been handled that had very rudimentary calli. One, in fact, had only a reddish spot on an otherwise white frontal shield.

Taxonomic Usefulness.—Ridgway and Friedmann (1941: 207) use callus-size in separating the race *F. a. americana* from *F. a. grenadensis* (Grenada American Coot) and *F. a. columbiana* (Colombian American Coot). For *F. a. americana* a maximum callus-length of 13 mm. is given while the second and third races are both stated to have calli 14 mm. or longer.

In contradiction, two experimental birds have exceeded this maximum (♂T96—12 x 15 mm.; ♂654—14 x 17 mm.) as has one of the control birds (♂T94—12 x 15 mm.). Bird ♂654, with the largest callus, still maintained its callus-size one month after the pellet was removed (68 days after reaching its extreme size), and coots have been seen at Lake Merritt with naturally developed calli fully as large as that of ♂654.

If callus-size is to be used as a taxonomic tool for separating races, age of the individual as well as correlation between date of capture and the breeding season obviously must be taken into account in view of the amount of seasonal variation occurring in the callus. The shield and callus figured by Ridgway and Friedmann (1941: 206, Fig. 14) is only semi-swollen, equivalent in size and shape to that possessed by ♀T00 while in non-breeding condition during late January and early February (Fig. 2B). By early March this female possessed a shield and callus much larger than that shown in the figure in question.

Other Rallidae.—Frontal shields are characteristic of a number of rallid genera. They are well developed in *Tribonyx*, *Gallicrex*, *Gallinula*, *Porphyriornis*, *Pareudiastes*, *Porphyrula*, *Porphyrio*, *Notornis* and *Fulica* (*cf.* Sharpe, 1894: 5–6). In addition at least the genera *Porphyriops* and *Amaurornis* have the posterior portion of the culmen distinctly expanded although not sufficiently to form a frontal shield.

Seasonal variation comparable to that recorded for the shield of the American Coot is known to occur in some other rallids. Witherby *et al.* (1947: 208) report a seasonal variation in the Black Coot (*Fulica atra*) in England. During the breeding season the male Water-Cock (*Gallicrex cinerea*) of the Orient "acquires a fleshy horn at the end of the frontal shield" which is absent in winter (Robinson and Chasen, 1936: 71). The Red-knobbed Coot (*Fulica cristata*) of Africa has an enlargement of the red knobs during the breeding season (*cf.* Priest, 1934: 31). Sclater and Salvin (1868: 467), in discussing the South American "*Fulica frontata*," allegedly a distinct species whose principal diagnostic character was a much expanded shield, concluded that the bird was in reality a Red-gartered Coot (*Fulica armillata*) "with the frontal shield very much developed," a statement suggesting that this species may also have a seasonal variation in shield-size.

Summary

The frontal shield plays an important role in the life of the American Coot. Paired birds recognize one another at least in part by means of shield-shape and -size, and the social behavior of birds can be predicted from the size of the shield.

Since territory defense and enlargement of the frontal shield are synchronous phenomena, it seems probable that both result from the same stimulus. Furthermore, the secretions governing shield-growth and territorial behavior are apparently also involved in migratory and sexual behavior.

Acknowledgements

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NESTING OF THE MARSH HAWK AT DELTA, MANITOBA

BY WILLIAM ROBERT HECHT[1]

ONE way of gaining insight into the complex phenomenon of predation is through careful local studies of predatory species. The food habits of the Marsh Hawk (*Circus cyaneus hudsonius*) vary greatly both seasonally and geographically, a fact brought to light by many writers, among them Ridgway (1877), Fisher (1893), McAtee (1935), Breckenridge (1935), May (1935), Errington and Breckenridge (1936), Bent (1937), Randall (1940), Selleck and Glading (1943), and Grange (1948). During June and July, 1947, I studied the food habits and nest life of the Marsh Hawk on an area supporting also a concentrated breeding population of waterfowl—the Delta Waterfowl Research Station. This paper is a report on my findings. I am indebted to William H. Elder for his supervision of the study and his aid in the preparation of the manuscript. Many helpful suggestions were made by H. Albert Hochbaum, director of the Station. Richard W. Sutton, of the Manitoba Museum in Winnipeg, identified some of the small-bird remains.

The Study Area and Nest Sites

Description of the Area. The Delta Marsh, a vast stand of yellow cane (*Phragmites*), broken by Cadham Bay and many sloughs and potholes, extends southward from Lake Manitoba to the black earth wheatlands of the Portage plains. The bays and sloughs are bordered by bulrush (largely *Scirpus acutus*) and cattail (*Typha latifolia*). Stands of whitetop grass (*Fluminea*) grow in close association with the *Phragmites*. The Delta area has been described in detail by Hochbaum (1944).

The greater portion of the study area, the part indicated on the inset in Figure 1, lies at the southern end of Lake Manitoba. Eleven Marsh Hawk nests were under observation during this study. The five nests (Nos. 5, 6, 8, 9, and 11) at which I obtained food-habits data presented here were all within a one-square-mile part of the greater area.

Locating Nests. I found all 11 nests between June 14 and June 27. All nests contained eggs and/or nestlings when discovered. In locating nests I found the following technique to be most successful. Frequent observation of both sexes simultaneously in flight over a given area indicated that a nest was nearby, especially if exchanges of prey were observed. Further observations revealed

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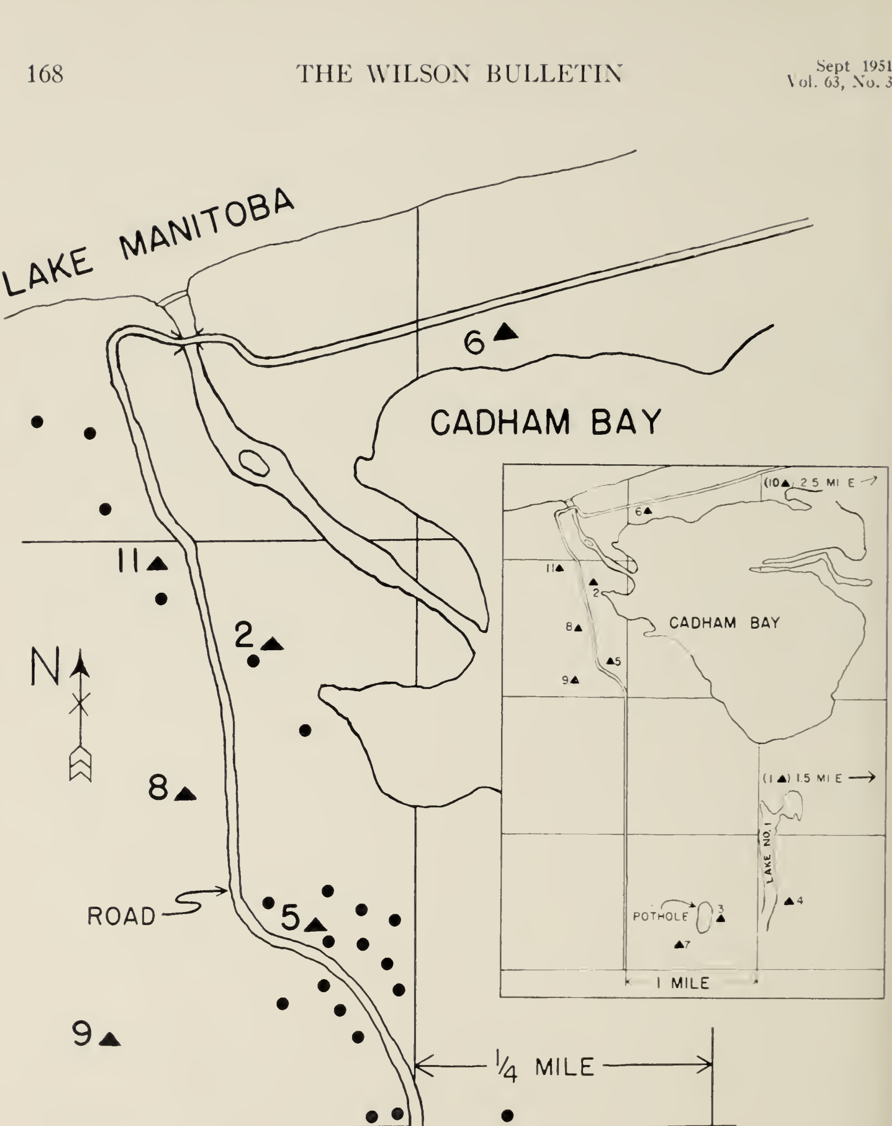

Fig. 1. Map of part of the Delta Marsh, at the southern end of Lake Manitoba, showing Marsh Hawk nests (triangles) studied in June and July, 1947, and duck nests (circles) also active during that period.

the spot from which the female arose to meet the male as he returned with prey. When the female was presumed to be at this spot I headed directly for it. If the female failed to flush I returned later and repeated the procedure. Attempts to locate the nest were futile unless, through flushing the female, I could narrow the area to be searched down to about two square rods.

Nest Site. All 11 nests were on dry ground in the *Phragmites-Fluminea* ecotone. No nest was in a burned or mowed meadow area. Nests were placed in cover composed largely of dead *Fluminea* and *Phragmites*. This cover furnished some protection from the start, regardless of what later growth of vegetation of the year might afford.

Each nest was about 15 inches in overall diameter. The nests were made of dead stalks of goldenrod (*Solidago* sp.) and nettle (*Urtica* sp.) and dry grasses. In the vicinity of five nests the following five plants (in order of their abundance) dominated: *Phragmites*, *Fluminea*, *Solidago*, *Lactuca* (wild lettuce), and *Cirsium* (thistle).

Some Aspects of Nest Life

Development of the young. The first four or five days of the nestling's life are spent almost wholly under the brooding female. During this period the male brings in all the food. The female flies up from the nest, receives the food midair from her mate, and returns immediately to feed the brood. As she alights the nestlings open their mouths in anticipation. When I visited nests in which the young were less than five days old, the nestlings all opened their mouths for food. This 'gaping response' clearly indicated their inability to distinguish between me and the parent bird.

When the nestlings reach about five days of age the female makes brief hunting flights—at first in the immediate vicinity of the nest, but gradually farther and farther away as the young develop. These food-gathering excursions sometimes keep her away for considerable periods. If the male arrives when his mate is not there he drops his prey from the air on or near the nest and leaves immediately. I have never seen a male Marsh Hawk feed the young directly in the nest.

Nestlings about five days old and older behave quite differently from younger birds. When a human being approaches the nest the parent hawks utter warning notes and the young respond by leaving the nest and hiding in the dense cover close by. With frequent repetition of this egress, small nooks are formed around the nest, usually as many nooks as there are nestlings. With continued use these nooks extend radially as far as ten feet from the nest, functioning as escape lanes.

Defended Area and Hunting Range. Breckenridge (1935: 271–272) concluded that "the function of the male Marsh Hawks during that period when the young were being fed was that of hunting for food and that they guarded the nests only at those times when the females were feeding the young or during the few short periods when females were away hunting. The duties of the females consisted largely of guarding the nests and feeding to the nestlings the food brought in by the males." Of ten nests observed by me at Delta, six were defended against my intrusion largely by the female, three largely by the male, and one almost entirely by the male. The area defended against my intrusion proved to average about 650 yards in diameter, with the nest about in the center.

Throughout the area reported on in this study the adult hawks demonstrated rather uniform behavior in following certain avenues of flight to and from nests. Individual pairs almost invariably used certain areas as hunting range. Overlap in use of these areas was not uncommon, but I never saw the birds chasing or fighting each other. Presumably they had settled earlier the problem of territorial boundaries. Errington (1930: 238) said of Marsh Hawks observed by him in Wisconsin: "Intraspecific raptorial relations grew more amicable as the summer progressed."

Social Behavior in the Colony. That six of the nests I observed were rather closely grouped within an area slightly exceeding one square mile is evident from an examination of Figure 1. Nest 2 was broken up by a mammalian predator before the eggs hatched. There was a lesser concentration of three nests in the Lake No. 1 area (see inset, Fig. 1). These two groups were, at least to some extent, colonial. Dr. Errington informs me (*in litt.*) that he too has noticed the tendency of Marsh Hawks to establish their nests in "clumps," despite territorial antagonisms.

One male Marsh Hawk exhibited polygamous behavior. This male defended Nest 11 and Nest 8. He favored Nest 11 in bringing food, the young of Nest 8 receiving less and less from him as the season progressed. At Nest 11 this male dived at me, striking me solidly on the head, casting my hat about ten feet away. His attack was less fierce at Nest 8. What I have just reported clearly indicates a triangle relationship of two females and one male at Nests 11 and 8.

Nest 5, which held two young hawks and an addled egg the day I found it, may also have had some connection with this triangle. I observed at this nest only one normal exchange of prey between a male and the female. Four days after this observation I saw the female rise from her nest area and fly northwest (in the direction of Nest 8) meeting a male that was returning to Nest 8. She actually *attacked* this male, seized the prey he was carrying, and returned to her nest. She attempted this again, half an hour later, but the male had no prey in his talons that time. I never saw the female of Nest 5 in contact with a male otherwise. So far as I know she raised her two nestlings without any other assistance. I am not even sure that a male bird brought food to the nest during the first five days of the fledging period.

Examination of the literature reveals two reports of polygamy and several of semi-colonialism in the Marsh Hawk, and one of polygamy each in the Montagu's Harrier (*Circus pygargus*) and the European Sparrow Hawk (*Accipiter nisus*). Reindahl (1941) found five nests of the Marsh Hawk within a radius of half a mile. A male which defended two of these nests was believed to have mated with both females. Always more alert than the other males of that area, this particular bird was very aggressive in driving intruders away. Yocom (1944), reporting on two Marsh Hawk nests 400 yards apart in an 80-acre tract, stated that the only male observed in the vicinity vigorously defended both nests but that each of the two females was concerned only with her own nest. Hall (1947) reported five Marsh Hawk nests in a 5-acre area. Three nests reported by Errington (1930) were closely grouped. As for the Montagu's Harrier: Dent (1939) found that the two mates of a certain male bird nested within 70 yards of each other. At first there was some fighting between the two females. For a few days hen No. 2 showed a tendency to leave the nest out of turn when the male called hen No. 1 off to take food. On these occasions the male drove hen No. 2 back to her own nest before giving food to hen No. 1. Both broods were reared almost entirely on food brought by the one male. Hughes-Onslow (1925) has reported two female European Sparrow Hawks using the same nest.

As for the cause or function of these closely associated groups of nesting Marsh Hawks, we can only speculate. There is no evidence in support of the suspicion that unavailability of suitable nesting habitat prevents a wider distribution of nests. Perhaps the proximity of several pairs provides nest protection in the event of loss of one of the male parents. This may have been the case with Nests 11 and 8, discussed above.

The Marsh Hawk is usually monogamous, yet we know that a male bird is sometimes extremely solicitous in defense of two nests. Whether, in cases of this sort, the male is actually mated with the "second" female or not, the "second" nest is provided with more protection and food than the female alone could provide.

In contrast to the social theory just proposed, one might postulate that disparity in the sex ratio, with a preponderance of females, could lead to polygamy.

Food Habits

Between June 25 and July 20 I obtained food data (56 pellets and 140 gullet regurgitations) from five nests containing 18 nestlings (Table 1). I visited the nests once or twice daily in gathering pellets cast by the young. Using the technique described by Errington (1932), I emptied the gullets by squeezing, tethering the young birds when they grew old enough to move out of sight of the nest.

The Marsh Hawk is neither powerful nor fast. It seldom takes adults of larger mammals or adult birds. Table 1 shows that meadow voles and blackbirds, prolific and widespread forms, ranked first in the species' diet at Delta in the summer of 1947.

General food habits studies by Fisher (1893) and McAtee (1935), based on stomachs collected from all parts of the United States throughout the year, indicated that mice and other rodents were staple foods of the Marsh Hawk. In Pennsylvania, in 1939, Randall (1940) found mice to be the staple food throughout the year except in June and July, during which months they were second only to young passerine birds. During the spring and summer of 1932

TABLE 1

FOOD ITEMS GATHERED AT FIVE MARSH HAWK NESTS, JUNE 25–JULY 20, 1947

	Nest Number					Total
	5	6	8	9	11	
Mammals						
Meadow Vole (*Microtus pennsylvanicus*)	20	28	21	13	38	120
Young Muskrat (*Ondatra zibethica*)	0	0	5	0	3	8
Richardson's Ground Squirrel (*Citellus richardsonii*)	4	0	2	1	1	8
Young Snowshoe Rabbit (*Lepus americanus*)	1	0	1	0	3	5
Red-backed Vole (*Clethrionomys gapperi*)	2	1	0	0	1	4
Franklin's Ground Squirrel (*Citellus franklinii*)	3	0	0	0	0	3
Norway Rat (*Rattus norvegicus*)	1	0	0	1	0	2
Pocket Gopher (*Thomomys talpoides*)	1	0	0	0	0	1
Jumping Mouse (*Zapus hudsonicus*	0	1	0	0	0	1
Total Mammals	32	30	29	15	46	152
Birds						
Nestling Red-wing (*Agelaius phoeniceus*) and/or Yellow-headed Blackbird (*X. xanthocephalus*)	1	2	0	7	3	13
Young American Coot (*Fulica americana*)	2	0	3	3	1	9
Clay-colored Sparrow (*Spizella pallida*)	0	0	1	2	1	4
Young Pintail (*Anas acuta*)	0	0	0	0	2	2
Young Shoveller (*Spatula clypeata*)	0	0	0	1	0	1
Young American Bittern (*Botaurus lentiginosus*)	0	1	0	1	1	3
Young Marsh Hawk (*Circus cyaneus*)*	0	1	1	0	0	2
Long-billed Marsh Wren (*Telmatodytes palustris*)	0	0	0	1	0	1
Cowbird (*Molothrus ater*)	0	0	0	1	0	1
Red Crossbill (*Loxia curvirostra*)	0	1	0	0	0	1
Leconte's Sparrow (*Passerherbulus caudacutus*)	1	0	0	0	0	1
Unidentified passerines	0	1	0	1	2	4
Total Birds	4	6	5	17	10	42

TABLE 1—*Continued*

	Nest Number					Total
	5	6	8	9	11	
Reptiles						
Plains Garter Snake (*Thamnophis radix*)........	1	0	0	0	1	2
Amphibians						
Leopard Frog (*Rana pipiens*)...	2	0	1	0	1	4
Manitoba Toad (*Bufo hemiophrys*)........	1	0	0	0	0	1
Total Amphibians...........	3	0	1	0	1	5
Insects						
Beetles (Coleoptera)...........	2	1	0	0	2	5

* At Nest 6 I saw the young hawks peck at the smallest of the brood almost constantly. It finally died and was eaten by its siblings. At Nest 8 one young one died and was eaten by its siblings.

and 1933, in Minnesota, Breckenridge (1935) found that mice ranked second numerically to passerines, but that most of the food *by weight* was Striped Ground Squirrels (*Citellus tridecemlineatus*) and young Cottontail Rabbits (*Sylvilagus floridanus*). Errington and Breckenridge (1936) found that mice ranked second numerically to Sciuridae in summer at Madison, Wisconsin, from 1929 to 1931. Sowls (1948) considered mice and fledgling blackbirds the principal food at Delta.

My snap trapping in the *Phragmites-Fluminea* ecotone in 1947 indicated an abundance of *Microtus*. Sowls (*in litt.*) rated the general population-level of *Microtus* in 1947 as "medium."

Red-wings and Yellow-headed Blackbirds were abundant in 1947 and nestlings of these species formed an important part of the diet at some Marsh Hawk nests. My data show, however, that they were captured principally during the first half of the Marsh Hawk's nestling period. Of 13 individuals taken, 7 appeared in Nest 9. By contrast, I did not find either species at Nest 8.

Some prey species tend to appear in the gullet- or pellet-remains in waves or groups. Young American Coots (*Fulica americana*) appeared July 9, reached a peak near July 15, then declined. Waves of this sort reflect a prey species availability or vulnerability definitely correlated with abundance of juveniles.

Young muskrats appeared in a wave (July 6–19) and at only two nests: five at Nest 8 and three at Nest 11. This 'selective' diet may actually be quite fortuitous, reflecting local abundance or availability of prey species, or merely the individual prowess, age, or idiosyncracies of the captor.

Wide variation in the food habits of several pairs of Marsh Hawks in the same part of California was reported by Selleck and Glading (1943). I noted this sort of variation at Delta. At Nest 9 the food included 15 mammals and 17 birds; at Nest 10, 46 mammals and 10 birds. Variations at five nests in a one-square-mile area clearly showed that conclusions based on a study of any one nest (see Randall, 1940) might not be at all representative of the area as a whole.

Relationships between Marsh Hawks and Waterfowl

The nesting of waterfowl close to Marsh Hawk nests is not uncommon. Houston (1949: 224) found 18 waterfowl nests within 100 yards of a Marsh Hawk's nest in the Yorkton district of Saskatchewan, nine of them within 50 yards—a Blue-winged Teal's (*Anas discors*) 15 yards away, and a Mallard's (*A. platyrhynchos*) 10 yards away. Over half of these waterfowl nests were started after the hawk's nest had been built. In central Saskatchewan in the breeding season of 1937, Furniss (1938: 25) obtained no evidence that Marsh Hawks were eating ducklings. Around one slough, "within a radius of 50 yards," were a Marsh Hawk nest, three Mallard nests, and one nest of the Common Crow (*Corvus brachyrhynchos*). All were successful. Again in Saskatchewan, Eastgate (1944: 11) found a Marsh Hawk nest about five feet from a duck nest. Mrs. Eastgate informed me (by letter) that crows destroyed all the hawk eggs but that the duck eggs hatched successfully.

Lyle K. Sowls (*in litt.*) has generously provided me with information concerning 21 duck nests (of six species) known by him to have inhabited my study-area while I was making this study. Note, in Figure 1, how close these duck nests were to the Marsh Hawk nests. *At least* 21 duck nests were within the hunting ranges of the Marsh Hawks I was studying.

I found remains of three ducklings in two Marsh Hawk nests: two Pintails (*Anas acuta*) about a week old in Nest 11, and one Shoveller (*Spatula clypeata*) about three weeks old in Nest 9. I obtained no evidence that the hawks were killing adult ducks. Sowls (*in litt.*) rated the population-level of ducks during the period of my study as "low."

I observed very little antagonism between Marsh Hawks and ducks. Once I saw a duck flying between a circling female hawk and the hawk's nest. The hawk "dived" and missed, and the duck made off in haste, unpursued. On numerous occasions I saw a hawk sailing, with apparent indifference, over an adult duck or brood of ducklings swimming in a ditch. Once I saw a brood of Redhead (*Aythya americana*) ducklings in a ditch move quickly into the cane at the edge when a hawk approached.

Summary

In June and July, 1947, at Delta, Manitoba, I studied eleven Marsh Hawk nests, paying special attention to the food of the young hawks. The nests were

all on dry ground in unburned, unmowed parts of the *Phragmites-Fluminea* ecotone. Some were close enough together to suggest semi-colonialism. Nesting evidently required dead vegetation as cover from the start.

The best way to find a nest was through seeing a male hawk drop food midair to a female, then flushing the female direct from the nest.

During about the first five days of their lives young Marsh Hawks observed by me were brooded almost constantly by the female. They were fed by the female but all food was brought in by the male. During this period the nestlings opened their mouths for food when I appeared at the nest.

When the nestlings became about five days old the female obtained some of their food and she spent more and more time hunting as they grew. The male continued to bring food, but he did not feed the young direct. The young, warned by their parents' cries, hid in nooks about the nest. These nooks eventually lengthened, becoming escape lanes.

Six of the nests observed were defended against my intrusion largely by the female, three largely by the male, one almost exclusively by the male.

In a total of 56 pellets and 140 gullet-regurgitations obtained from 18 nestlings at five nests June 25 to July 20, the Meadow Vole, Red-wing, and Yellow-headed Blackbird, prolific and widespread forms, were the prey species most often represented. Other important prey species: ground squirrel, coot (young) and muskrat (young).

Observations indicated such wide variation in the hunting habits of the several pairs of hawks as to suggest that conclusions based on a study of any one nest might be misleading.

In part of the area I studied, six hawk nests and 21 duck nests (six species), were simultaneously active, yet I obtained no evidence that the hawks were preying on adult ducks and the only evidence that ducklings were being captured were the remains of two individuals at one nest, of one at another.

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A LATE SUMMER NEST OF THE RED CROSSBILL IN COLORADO

BY DANA P. SNYDER AND J. FRANK CASSEL

IN COLORADO, the Red Crossbill (*Loxia curvirostra*) usually breeds early in the year. Griscom (1937: 151) states that the breeding season of *L. c. benti* in Colorado is ". . .chiefly from late February to April." (All breeding Red Crossbills from Colorado which Griscom examined belonged to this subspecies.) Gale (*fide* Niedrach and Rockwell, 1939: 156) stated: "Nesting begins

Female Red Crossbill on nest in lodgepole pine. Photographed August 2, 1947, near Ward, Boulder County, Colorado, by Gordon Alexander. Foliage at lower right retouched by George M. Sutton.

at the end of March or beginning of April (1886), with grown young by May 21." Breninger (1894: 100) and Morrison (1888: 73) reported the species' breeding in Colorado still earlier in the year. Breninger collected a young bird recently out of the nest on January 5, 1893.

Late summer breeding of *Loxia curvirostra* has been recorded for a number of states, and a juvenile female was collected in September, 1874, in extreme southern Colorado (Archuleta County) by C. E. Aiken (Henshaw, 1875); but there appear to be no definite records of late summer nests for the state.

The following observations were made while we were students at the University of Colorado. We wish to thank Dr. Gordon Alexander for permitting us to use the accompanying photograph.

On July 26, 1947, while censusing the breeding birds of a forest of lodgepole pine (*Pinus contorta*) near Science Lodge, University of Colorado Mountain Laboratory (9500 feet elevation), we saw a female Red Crossbill carrying a piece of nesting material to her partly completed nest 18 feet up in a 20-foot lodgepole pine. When we returned to the nest on July 29, it was completed and contained one egg, but there was no sign of either the male or the female. Apparently incubation did not begin with the laying of the first egg. In a spring nest in Ontario, Ross and Ross (1950) found evidence that incubation did begin with the first egg. On the afternoon of July 30, however, the female was observed on the nest at 4:30 p.m. and again at 7:00 p.m. Incubation probably had begun. We did not ascertain how many eggs were in the nest for fear of alarming the female. During the next few days we visited the nest several times, finding the female incubating each time.

On August 7, we observed the nest continuously from 4:30 a.m. (sunrise, 5:04) until 7:30 p.m. (sunset, 7:07). Except for six brief periods totalling 26 minutes (Table 1), the female was on the nest throughout these 15 hours. Lawrence (1949) reported similarly long attentive periods for the Red Crossbill in Ontario.

Since there appears to be relatively little information available concerning the nesting behavior of the Red Crossbill in America, a detailed account of the

TABLE 1

Activities of Female Red Crossbill on Ninth Day of Incubation

	On Nest	Off Nest	Fed by Male
4:30 a.m.–8:16 a.m.	3 hrs. 46 min.		7:06 a.m.
8:16 a.m.–8:19 a.m.		3 min.	
8:19 a.m.	a few seconds		8:19 a.m.
8:19 a.m.–8:22 a.m.		3 min.	
8:22 a.m.–9:09 a.m.	47 min.		
9:09 a.m.–9:10 a.m.		1 min.	
9:10 a.m.–10:08 a.m.	58 min.		
10:08 a.m.–10:09 a.m.		1 min.	
10:09 a.m.–3:18 p.m.	5 hrs. 9 min.		12:16 p.m.
3:18 p.m.–3:23 p.m.		5 min.	
3:23 p.m.–4:51 p.m.	1 hr. 28 min.		
4:51 p.m.–5:04 p.m.		13 min.	
5:04 p.m.–7:30 p.m.	2 hrs. 26 min.		
Total	14 hrs. 34 min.	26 min.	

activities on August 7 is in order. From 4:30 to 7:00 a.m. the female stirred only occasionally and did not defecate, preen, or stretch. At 7:06 the male came with food. The female chirped loudly, lifted her head, and opened her mouth. After feeding his mate the male flew to a pine close by, where he chirped briefly. At 8:16 the female departed, perhaps responding to the call of her mate (we heard a crossbill in the distance). In about three minutes both returned to the nest tree. The female quickly went to the nest where, a few seconds later, the male fed her. The pair then left again, flying off together. After three minutes the female returned to the top of a nearby tree and then quickly went to the nest. Presently she exchanged calls with a crossbill we did not see. At 9:09 the female climbed out of the nest, perched briefly on a branch close by, then went back to the nest. At 9:57 she again exchanged calls with a bird we did not see. At 10:07 the male appeared, perched 25 feet away for a moment, then flew to within three feet. The pair then left the nest, flying in different directions. At 10:09 both returned, the female to the nest, the male first to the top of the nest-tree, then to a nearby tree. After several minutes of exchanging chatter with his mate, the male flew away. At 12:16 the female called and the male returned, chirping, fed the female, and flew off. At 3:18 the male reappeared, calling. The female answered and left the nest, followed shortly by the male. At 3:23 both birds returned, the female directly to the nest, the male, chattering, to a tree 25 feet away. At 3:25 he ceased calling, fed for about fifteen minutes, and then left the immediate area. At 4:51 he returned, calling, and alighted in a treetop 20 feet from the nest. The female answered and left the nest. The male then flew off, again in a direction different from hers. At 5:04 both birds returned, the female flying from tree to tree before going to the nest, the male perching in a treetop and chattering quietly. At 5:12 the male flew off. At 5:40, coincident with the falling of a little rain, the female exchanged chatter with a crossbill we did not see. At 5:45 a few more drops fell, and again the chattering commenced. The rain and wind continued intermittently until dark (7:30), during which period the female remained on the nest, and we saw no sign of the male. Table 1 summarizes these activities at the nest on August 7.

On August 11 the incubation period, presumably 12 to 14 days (Forbush, 1929: 15), should have been almost over; the female, however, was not on the nest. We climbed to the nest and found three eggs in it. The eggs were still intact when we returned on August 14, but we saw neither the male nor female. On August 22, we collected the nest and eggs, finding that each of the eggs contained an embryo almost ready to hatch. The nest apparently had been deserted near the end of the incubation period.

The eggs were very pale greenish gray, characteristically marked with a few chocolate-brown spots and scrawls at the larger end. We damaged the eggs while collecting them. The least damaged one measured 20.6 x 16.3 mm.

The foundation of the nest was of twigs of conifers. The superstructure was of fibrous material stripped from plant stems, a few grass blades, several pieces of herbaceous plant stems, a small tuft of hair, and a fascicle of pine needles (*Pinus flexilis*). The lining was of shredded bark, lichens, and fine hair (no feathers so far as we could see). The nest measured (after collection) 107–123 mm. in over-all diameter, 52 mm. in over-all depth. The cup proper was 60 mm. wide and 27 mm. deep.

Summary

A late summer Red Crossbill nest in Colorado was 18 feet from the ground in a 20-foot lodgepole pine. It was started on or about July 26. The first egg was laid on or about July 29. The total clutch consisted of three eggs.

Incubation did not begin with the laying of the first egg but may have begun with the laying of the second.

On August 7 (about the ninth day of incubation), the female was on the nest continuously for 15 daylight hours except for six brief periods totalling 26 minutes. While on the nest that day she was fed three times by the male.

The nest was deserted on or about August 11. The eggs were almost ready to hatch at that time.

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NORTHERN BIRDS SUMMERING IN PANAMA

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THE regular summering of shorebirds far south of their boreal breeding grounds has frequently been noted. Wherever the Charadrii winter abundantly most of the wintering species are to be found throughout the year. Eleven tundra-nesting species of shorebirds are listed as non-breeding "permanent residents" of South Carolina (Sprunt and Chamberlain, 1949: 212–251). The usual explanation—that summering non-breeding individuals are abnormal or senile—seems inadequate to account for so extensive and regular a phenomenon.

D. S. Bullock (1949: 353) has suggested that these summering shorebirds may not be northern at all, but rather migrants from some undiscovered breeding ground in Chile or Argentina. Were this so, one would expect to find such birds assuming fresh nuptial plumage between September and December (the southern hemisphere spring); but Bullock does not supply any evidence of this. Shorebirds collected in southern South America by Wetmore during September and October were either "in worn breeding plumage" or moulting into winter plumage (1926: 150–158)—what one would expect of migrants from northern breeding grounds. Moreover, considering that several of these tundra shorebirds split into recognizable subspecies over their boreal range, it would seem likely that southern-summering individuals, if actually from a widely-separated South American breeding population, should show subspecific differences in at least a few of the species involved. No such differences have been reported.

This regular summering of non-breeding waders within their winter ranges is not peculiar to the New World; it has been noted also in the Old (Witherby *et al.*, 1945: 153–154). Moreover, observations (confirmed by banding data) in Panamá, various parts of Central America, the West Indies, and northern South America clearly indicate that other birds than shorebirds summer regularly in their winter ranges without breeding there.

The probable explanation is that most of these non-breeding birds are immature rather than abnormal. If the impulse to return to the nesting grounds is dependent on the development of the gonads, the immature birds, lacking such stimulus, might be expected to linger around their winter quarters. Social tendencies may cause some young birds to accompany flocks of returning adults, thus accounting for the summering of non-breeders north of the winter range. Palmer (1941: 169) so explains such a situation among Common Terns (*Sterna hirundo*), which take more than one year to achieve breeding condition. While we do not know the time required for the various shorebirds to reach sexual maturity, the fact that the related Laridae usually require at least two years is certainly suggestive. Numbers of gulls and terns regularly summer south of their breeding range, and in the case of the gulls obvious plumage characters make it apparent that most of these summering non-breeders are immature (Cruickshank, 1942: 232, 234; Sprunt and Chamberlain, 1949: 261–262). While age discrimination of this sort in the field is usually impossible among the Charadrii, it can at least be said that very rarely is a summering shorebird found in the tropics in full breeding plumage. Pitelka (1950: 28, 51), who checked the Dowitcher (*Limnodromus*) specimens in most of our museums, found that among those collected in summer far south of the breeding range, a large majority were birds hatched the previous year, and almost all the remainder might have been.

During 1948, 1949, and 1950, I visited the sea-shore near the city of Panamá a number of times between June 17 and July 16, apparently prior to the arrival of post-nuptial migrants from the north. I noted the following northern species, all but four of them each year. The stated number is the maximum seen on any one occasion:

Great Blue Heron (*Ardea herodias*)	2
Osprey (*Pandion haliaetus*)	2
Semipalmated Plover (*Charadrius hiaticula*)	200 (est.)
Black-bellied Plover (*Squatarola squatarola*)	13
Ruddy Turnstone (*Arenaria interpres*)	3
Dowitcher (*Limnodromus griseus*)	4
Hudsonian Curlew (*Numenius phaeopus*)	5
Willet (*Catoptrophorus semipalmatus*)	23
Semipalmated Sandpiper (*Ereunetes pusillus*) / Western Sandpiper (*Ereunetes mauri*)	500 (est.)
Laughing Gull (*Larus atricilla*)	11
Gull-billed Tern (*Gelochelidon nilotica*)	1
Common Tern (*Sterna hirundo*)	5
Royal Tern (*Thalasseus maximus*)	5
Black Tern (*Chlidonias niger*)	200 (est.)

Except for the Turnstones (July 13, 1950), the Dowitchers (June 24, 1949), and the Gull-billed Tern (July 16, 1950)*, all the foregoing species were seen in both late June and early July. The shorebirds were observed on the mud-flats exposed at low tide between the ruins of Old Panamá and San Francisco de la Caleta. The others (save for the Black Terns) were also found there, as well as at other localities. Thomas Imhof, who spent 1942 in Panamá and has gen-

* Except for these three species and the Great Blue Heron, all of the species discussed in this paper were again noted during the same period in 1951. In addition, Franklin's Gull (*Larus pipixcan*) was repeatedly seen at several localities at close range in numbers up to 18, invariably in immature, or at least non-breeding, plumage. A bird suspected to be of this species had been observed in 1950.

erously made his notes available, recorded most of these species during the same period of the year. Of seven Turnstones seen by him on June 15, he listed three as "adult," but these might well have been in their first summer plumage (which in some individuals is much like that of breeding adults). He also saw three White-rumped Sandpipers on June 15 in non-breeding dress. So far as I could determine, none of the shorebirds observed by me during this summer period were in nuptial plumage.

The Great Blue Heron can readily be found in Panamá throughout the year, and probably for this reason has been assumed to nest. Hellmayr and Conover (1948: 170) say it does not breed in Central America, however, and banding has established that northern-bred individuals not only migrate as far as Panamá but may summer in the tropics, e.g., a bird collected in Cuba about July 1, 1934, which had been banded as a juvenile in Wisconsin the previous year (Cooke, 1946; Seth Low, *in litt.*). I suspect that other northern-bred herons, particularly the Little Blue Heron (*Florida caerulea*) and Snowy Egret (*Leucophoyx thula*) commonly occur in Panamá in summer. Examples of both species banded as nestlings in the United States have been recovered in Central America (Lincoln, 1939: 115). While I know of no way to distinguish unbanded northern birds of these species from local birds, certain facts are suggestive. The Little Blue Herons I see in Panamá during the summer are mostly in mottled plumage so probably were hatched the year before. A number of these birds banded as nestlings in Mississippi have been taken the same or the following year in Central America, including Panamá. One banded in 1935 was recovered in British Honduras on July 20, 1936 (Coffey, 1948: 3). The 50 to 70 Snowy Egrets which frequent the mud-flats near Old Panamá in summer have no noticeable plumes. While few banded Snowy Egrets have been reported from Central America, the only summer recovery (Costa Rica, July 8, 1933) was a bird banded as a nestling in Texas in May of the preceding year (Lincoln, 1939: 115; Seth Low, *in litt.*).

Similarly, the Osprey, chiefly a winter visitant in Panamá, is frequently seen there during the summer. De Schauensee (1949: 403) has reported the species summering also in Colombia. LeRoy Wilcox, who has banded 1004 nestling or fledgling Ospreys on Long Island, New York, writes me that there have been only two recoveries of such birds during the year after banding. Both recoveries were in the tropics: one August 12, 1937, in Brazil (banded June 20, 1936), the other May 5, 1942, in Cuba (banded July 3, 1941). The inference that young birds remain on their wintering grounds seems reasonable. Yet not all southern-summering Ospreys are immature, for Seth Low of the U. S. Fish and Wildlife Service informs me that one recovered on June 28, 1935, in Venezuela had been banded *as an adult* in Delaware on April 26, 1934.

Summering Laridae are conspicuous in Panamá. The Laughing Gull, abundant in winter, can be found in numbers the year round. Imhof recorded it every month of 1942, noting as many as 450+ on June 20, and 150 on June 28. My June and July birds all had the brownish wings of immaturity, though an occasional individual showed a well-developed hood. At least five laughing Gulls banded as juveniles on the Atlantic coast of the United States have been taken in Panamá, four of them the same or the following year. One banded in Virginia on July 29, 1940, was found with wing broken at Farfán Beach, Canal Zone, on June 15, 1941 (J. H. Buckalew and S. Low, *in litt.*). Common Terns which I have seen regularly in summer in Panamá, about inland waters as well as on the coast, have been in the white-faced, dusky-billed "*portlandica*" condition—the immature summer dress according to Palmer (1941: 164). A Panamá bird which I picked up sick on June 25, 1949, and a solitary female collected by Jewel on June 9, 1912 (Stone, 1918: 244), were also in this plumage. Young Common Terns banded in the eastern United States have been taken the following summer off the north coast of South America, and one immature banded in Minnesota July 6, 1933, was recovered at La Venta Beach, on the Pacific coast of Panamá, on October 1, 1934 (Lincoln, 1936: 146). Royal Terns, frequently seen in Panamá in June and July (Imhof saw 15 on June 20, 1942), are white-fronted individuals. Northern-bred Royal Terns are known to migrate as far as South America and some summer in the tropics—e.g., one caught in Jamaica on June 22, 1934, banded in South Carolina on July 11, 1933 (Lincoln, 1936: 148). The Black Tern, a common migrant and also a winter visitant, I found in substantial numbers on June 28, 1948, on a launch trip in Panama Bay, not far from Balboa. Although I did not go offshore in the following years, I saw six on Gatun Lake near Barro Colorado Island on June 28, 1949, and a few off Gamboa on July 5, 1949. All were in non-breeding plumage.

The Nighthawk (*Chordeiles minor*) may also belong in this category. Every evening of June and July in 1948, 1949, and 1950, at my brother's home in the Juan Franco suburb of Panama City, I have seen and heard from two to six of these birds flying high and giving repeatedly the familiar, penetrating, characteristic *peent* call. No race of *minor* is known to breed in continental America south of México. Until specimens are collected it is unsafe to assume, however, that these birds summering in Panamá are non-breeding northern birds. It should be noted that a crippled individual of *minor* (identified as *C. m. henryi* by de Schauensee, 1945: 509) has been taken in Colombia in June. Also to be noted is the fact that the Lesser or Trilling Nighthawk (*C. acutipennis*), whose voice is very dissimilar to that of *minor*, is not known to breed in Panamá or Costa Rica.

The summering in the tropics of northern birds is more regular and widespread than has generally been realized. With the increase of banding enough data should in time accumulate to determine the relationship of age to the duration of the southern sojourn. On the fragmentary evidence now available it would seem that most of these summering individuals are immature.

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TEN CONSECUTIVE NESTS OF A SONG SPARROW

BY ANDREW J. BERGER

This brief paper presents data on ten consecutive nests of a color-banded female Song Sparrow (*Melospiza melodia*): one in 1948, five in 1949, and four in 1950. Her mate for the 1948 nest and the first four nests of 1949 was the same color-banded male. One other nest, probably built by this female, is also mentioned.

On July 1, 1948, at Ann Arbor, Michigan, I found a Song Sparrow nest which contained one addled (no embryo) Song Sparrow egg, two Cowbird (*Molothrus ater*) nestlings about 24 hours old, and one Song Sparrow nestling which left the nest as I exposed it. The sparrow was fully feathered and would not remain in the nest when replaced. I trapped and color-banded both adult sparrows. One of the young Cowbirds disappeared from the nest on July 5, but the other fledged July 9. The sparrows fed this Cowbird until July 24. After leaving the nest, the Cowbird's period of dependence on the Song Sparrows was 15 days. On July 28, I saw the color-banded Cowbird with three English Sparrows (*Passer domesticus*) about one-fourth mile from the Song Sparrow nest, and again, on August 5, I saw the Cowbird with several English Sparrows, but I did not see the sparrows feed the Cowbird. This nest is of special interest because the Cowbird eggs must have been laid only two or three days before the Song Sparrow egg hatched.

In Table 1, data from nest No. 1 (three young fledged May 21) are not included in the totals because the adults were not banded at that time. Since nest No. 2 was built only 20 yards from nest No. 1, in an area where there were no other Song Sparrows, however, it seems quite possible that it belonged to the same pair. I knew that after leaving the nest the Cowbird from this nest was attended by the Song Sparrows for at least 13, and possibly 15, days.

In 1949 I saw the male for the first time on March 25, the female on April 14. They occupied the same home range as in 1948. The banded male I last saw on June 28, 1949. On July 2, I first noted the female with an unbanded male. On August 4, I trapped the female at her fifth nest for that year. Both the colored band and the number on the aluminum band were checked. Her unbanded mate would not enter the trap.

During the winter of 1949–50 the area which had been the home range of the female for the two preceding nesting seasons was destroyed by construction of the University Maternity Hospital. On April 20, 1950, I found the female with an unbanded male near the exit to the University Arboretum, approximately a quarter of a mile from the old nesting area. The two areas were separated by the Huron River and a belt of woods on either side of the river.

TABLE 1

Chronology of Song Sparrow Nests

Date Found	Contents when found	First host egg laid	Known host eggs	Cow-bird eggs	No. host young fledged	No. Cow-birds fledged	Remarks
1948							
Apr. 23*	Under construction	Apr. 25	4	1	2	1	Banded Cowbird still being fed June 3
July 1	1 host egg; 1 host and 2 Cowbird nestlings	June 6†	2	2	1	1	Song Sparrow fledged July 1; Cowbird fledged July 9
1949							
Apr. 24	Under construction	Apr. 26	2	0	0	0	Nest destroyed Apr. 27 after 2nd egg was laid
May 3	Under construction	May 4	4	2	0	0	3 host eggs disappeared May 9; nest deserted
May 15	3 Cowbird eggs	May 16	2	3	0	0	3 Cowbirds hatched but disappeared between May 28 and June 2
June 18	4 host eggs	June 4†	4	0	4	0	2 eggs hatched June 19; 3 fledged prematurely June 27 due to banding
July 31	1 host nestling	July 14†	1	0	1	0	Nestling still in nest on August 4
1950							
May 1	1 host egg	May 1	3	1	0	0	Eggs disappeared May 7
May 11	Empty	May 12	2	5	0	0	Eggs disappeared May 23
June 2	5 host eggs	May 28†	5	0	0	0	5 eggs June 11; nest empty June 12
June 18	1 Cowbird and 2 host eggs	June 17†	2	5	0	0	5 eggs June 29; nest empty July 1
Totals			27	18	6	1	

* Data from this nest not included in totals; see text.

† Estimated

On May 11, 1950, I found nest No. 9 by watching two female Cowbirds. One Cowbird flew from a telephone wire to a raspberry thicket and then to the ground. The male Song Sparrow flew to the thicket and gave alarm notes. The Cowbird flew away. I found the complete but empty nest at once by going to the place from which the Cowbird had flown. After this Cowbird left the area, the Song Sparrow flew to a tree 25 yards from the nest, continued giving alarm notes, and the second Cowbird flew from the tree. The first Song Sparrow egg was laid in this nest the following day and the first Cowbird egg two days after that. Two additional Cowbird eggs were laid on May 15. On May 22, the nest contained five Cowbird but no sparrow eggs. It seemed probable that in this case the Cowbirds found the nest by watching the nest building process.

At two other nests, on the other hand, I believe that female Cowbirds I was watching were searching for a nest. On April 29, 1950, while I was trying to find nest No. 8, I watched a female Cowbird for a half hour as she walked about through the grass, peered under clumps and hopped to the top of tussocks. Her movements were deliberate and at no time did I see her pick up food. I feel confident that she did not find the Song Sparrow nest at that time, because after the Cowbird flew off I searched the same area she had covered. Upon finding the nest on May 1, I learned that it was about twenty-five feet beyond the area we had searched. The one Cowbird egg was laid in this nest on May 4. Again on May 30, 1950, while looking for nest No. 10, I watched a female Cowbird in the same type of searching activity. I did not find this nest until June 2, but the Cowbird did not find it at all. Unlike the other nests of the Song Sparrow this nest was built in a field 85 yards from a thicket and the edge of a large grove of trees.

The total number of Song Sparrow eggs laid undoubtedly was greater than that indicated in Table 1. Whenever possible I visited nests daily during the laying period, but the time of visit varied. On some days it seemed certain that a Song Sparrow egg had been removed by a Cowbird before my visit to the nest. The following data from nest No. 9 justify this assumption: May 12, female on nest with one host egg, 11:20 a.m.; May 13, female not on one host egg, 2:30 p.m.; May 14, female on one host and one Cowbird egg, 10:30 a.m.; May 15, female on two host and three Cowbird eggs, 8:30 a.m. I have never known a Song Sparrow to skip a day in the laying of a clutch.

Nest No. 11 was the only nest *not* built on the ground. This nest was 20 inches from the ground in a blackberry thicket. The shortest distance between consecutive nests was 20 yards, the greatest, 175 yards, and the average, 96 yards. For six nests, the interval between the destruction of a nest and the laying of the first egg in the next varied from five to seven days. Only three out of ten nests were successful.

I am indebted to Dr. George M. Sutton for determining the fate of nest No. 11 during my absence from Ann Arbor (June 20 to August 4, 1950). I have been unable to find the banded Song Sparrow since my return to Ann Arbor.

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REMARKS ON THE PHILIPPINE MALLARD

BY S. DILLON RIPLEY

IN THEIR most interesting and provocative review, "The Family Anatidae," Messrs. Delacour and Mayr (1945. *Wilson Bulletin*, 57: 21 and 39), have briefly discussed the Philippine Mallard (*Anas luzonica*), expressing their belief that, together with *A. poecilorhyncha* (the Spot-bill Duck of the Asian mainland and Japan) and *A. superciliosa* (the Australian Duck of the southern Malaysian subregion, Australia, and the southern Pacific islands), it formed a single species.

Very little is known about *luzonica* in the wild state, as any perusal of books on Philippine birds will reveal. Nor are there any significant observations on the form in confinement. Aside from birds in dealers' pens, Philippine Mallards have been kept in captivity only by the late Mr. de Laveaga in California, Mr. Peter Scott (who still has one pair in England), and myself.

My observations on *luzonica* are fragmentary, but I present what I can at this time, as I have recently—by one of those appalling strokes of ill luck reserved for aviculturists—lost my breeding female to a Red-shouldered Hawk (*Buteo lineatus*), and thus have little chance of adding anything further of significance to this record. During the spring seasons of 1949 and 1950 two of my Philippine Mallards paired up, but unluckily I was away most of the time. However, I did manage to see the female frequently indulge in the sideways head-dipping familiar to all who have watched the Common Mallard (*Anas platyrhynchos*) and closely allied forms in display. The dipping was accompanied by a weak quacking of the general intensity and tone of a hen Gadwall's (*A. strepera*) or Pintail's (*A. acuta*). The drake did not indulge in distinctive posturing. He occasionally responded to the duck's head-dipping by swimming rapidly alongside her in a rather stiffly erect pose. He uttered no notes during this time. He was aggressive and indulged in violent chasing of any other duck, whatever the species, that ventured within twenty feet or so of his mate during non-feeding times. At feeding time he was also aggressive, but his radius of tolerance of approach was greatly reduced.

No eggs were laid in 1949. In 1950, at the end of June, four eggs were laid some distance from the water under a box placed on the ground in a covert of alder and willow bushes. The eggs were, according to the man who was caring for my birds, spherical, "like billiard balls," dull greenish-white, and unglossed. Mr. D. S. Rabor of Silliman University, Negros Island, in the Philippines, tells me that in his experience the Philippine Mallard lays only four eggs in the wild state. If this is average, it is an interesting example of reduction of clutch size in a tropical anatid species. The Spot-bill Duck lays a clutch of 8–10 eggs, the Australian Duck 7–8 eggs normally. Exceptionally large clutches may occur in both these species (Phillips, 1923. "A Natural History of the Ducks," Vol. 2, pp. 90–91 and 103–104).

Unfortunately my Philippine Mallard eggs did not hatch well. Only one duckling emerged from the shell, and it died July 30, three or four days after hatching. It is now in the collection at Yale Peabody Museum (No. 11297). Miss Shirley Glaser's line drawing of it is reproduced herewith (Fig. 1).

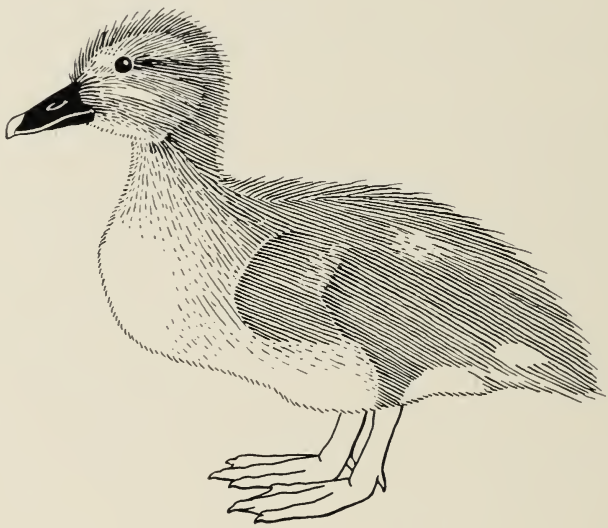

Fig. 1 Downy young of Philippine Mallard (*Anas luzonica*). From a drawing by Shirley Glaser.

The downy young of the Spot-bill Duck, the Australian Duck, and Common Mallard are nearly indistinguishable (personal observation; Phillips, *op. cit.*). A perusal of Figure 1 will show that the downy duckling of *luzonica*, on the other hand, is distinctly different from the ordinary Mallard-like duckling. The eye-stripe is interrupted in front of the eye, in this respect being like that of *Anas waigiuensis* but unlike that of other species of *Anas*. The face is dark, shaded with rich burnt umber. The clove brown of the top of the head is carried down onto the neck to form a partial collar. The white spots on the back near the origin of the wings are very much reduced, only an indication, as is the faint strip of white marking the posterior edge of each wing. The spots on the sides of the rump are also reduced. The breast and upper flanks are shaded with hair brown.

I am not prepared to say that my four eggs were typical of this species. As a clutch they certainly were unlike those of the other Mallard-like ducks. The coloration of my downy young bird is also strikingly different, in degree if not in basic pattern, from that of ducklings of other Mallard-like species. These juvenile characters and the rather distinctive adult plumage of the Philippine Mallard incline me to believe that *luzonica* is an old relict form and, as such, well worthy of full specific rank. As for *superciliosa* and *poecilorhyncha*, admittedly they are closely related to each other, but since *luzonica* to some extent separates them geographically, I submit that all three should be considered distinct species.

Peabody Museum of Natural History, Yale University, New Haven, Connecticut

NEW LIFE MEMBER

Edward L. Chalif was born in Odessa, Russia, on July 17, 1903, but he came to the United States when two years old. His travels have taken him to all 48 States; to the Arctic Circle and beyond in both the New World and the Old; by canoe to within a hundred miles of Hudson Bay; and to México. He studied geology and mineralogy at New York University. During World War II he was a Captain in the U. S. Army. Trained as a dancer, he was asked by the renowned Pavlowa to join the Ballet Russe, but he became a professional dancing teacher instead. His interest in birds was roused by an American Museum display exhibited in his public school. He is now a member of the A.O.U., the Cooper Club, the Linnaean Society of New York, the B.O.U., the B.O.C., and the Societé Ornithologique de France. He has spent the past summer in the field gathering material for his forthcoming guide to Mexican birds.

A REVIEW OF THE RACES OF THE TRAILL'S FLYCATCHER

BY JOHN W. ALDRICH

IN CONNECTION with the preparation of a book on the birds of Washington, I have been prompted to reinvestigate the problem of geographic variation in the Traill's Flycatcher in order to determine the proper names for the subspecies which occur in that state. Like the several other investigators who have come to grips with this species, I have found geographic variations quite difficult of analysis. To evaluate the variations within the restricted region wherein my original interest lay, I have found it necessary to appraise the extent of variation over the entire range of the species. The result has been that some hitherto unnoted facts have come to light. In some cases in the past, what have been considered extreme individual variations or dichromatism have proved to be geographical variations. This has been largely due to failure to distinguish breeding birds from late migrants. As Phillips (1948: 507) has so rightly pointed out, the extreme shortness of the period during the breeding season when it is safe to assume that specimens are not migrants has undoubtedly led to some mistakes in recognition of breeding birds. Such cases, mentioned beyond, involve the type specimens of two (*traillii* and *brewsteri*) out of the seven subspecies described to date.

William Brewster (1895: 159) seems to have noted correctly that the breeding Traill's Flycatcher of the midwestern lowlands is not the same as that which breeds in the northeastern boreal region, a view which he acknowledged was shared by Baird, Ridgway, Merriam, and Bendire. Brewster identified Audubon's type of "*Muscicapa Traillii*" with the breeding bird of the Mississippi Valley region and westward, however, rather than with the northern and eastern boreal region, and described the latter as a new subspecies, *Empidonax traillii alnorum*.

Harry C. Oberholser (1918: 89) appears to have correctly referred Audubon's type of "*Muscicapa Traillii*" to the northern and eastern populations, making *alnorum* a synonym of it, but he failed to recognize the differences (noted by Brewster and others) in breeding birds of the interior from those of the northeastern highlands and northern boreal region. Also, it appears that Allan Phillips, who has written by far the most enlightened and comprehensive review of this species to date, failed to note these differences.

Variations of these flycatchers in the western part of the continent have been described by Oberholser (1918, 1932, and 1947), by Miller (1941), and by Phillips (1944 and 1948).

In the present study approximately 900 specimens were available among which only those collected from June 21 to July 26 were considered as definitely breeding. This limitation was based on the fact that the latest known date for spring migration was June 15, at Orient, Long Island, while the earliest date of fall migration was August 1, at Englewood, New Jersey. Five days were added at each end of the migration period as an arbitrary margin of safety.

The distinct races found recognizable on the basis of combined character differences were as follows:

1. *E. t. brewsteri*. A small, dark, brownish, short- and rounded-winged, large-billed race from the coast of the Pacific Northwest, recently redescribed as *zopholegus* (Oberholser, 1947: 77). The type specimen of *brewsteri* (Oberholser, 1918: 93), which I have compared in the present study, is identical with these dark Pacific Northwest birds, and quite different from what appear to be definitely breeding Great Basin birds. This specimen was collected by Oberholser at Cloverdale, Nevada, May 31, 1898, and at that date could very easily have been a migrant of the northwest coastal breeding population. Under the circumstances there seems to be no alternative but to consider *E. t. zopholegus* a synonym of *E. t. brewsteri*, an action recommended by Phillips (1948: 511), but for a somewhat different reason, and to apply the name *brewsteri* to the Pacific coast race from Vancouver Island southward. The intensity of coloration of this race lessens in Oregon and California west of the Cascades and Sierra Nevada Divide, but the small size remains constant.

2. *E. t. traillii*. A dark greenish, long- and pointed-winged, short-billed, northern and eastern boreal forest region race seems to include Audubon's type of *traillii*, although this specimen was collected as a migrant outside of the breeding range of that race. The Alaskan segment of this population was described by Phillips (1948: 509) on the basis of larger size and given the name *alascensis*. However, I do not believe that this race is tenable since 10 out of 34 specimens (30%) of both sexes of definitely breeding birds from northeastern North America cannot be distinguished from Alaskan breeding birds on the basis of the extremes given by Phillips, and since 6 out of 8 (75%) of both sexes from Alaska cannot be distinguished on the basis of size from the larger birds in a breeding series from the Northeast. The slightly more brownish coloration does not seem to be adequate to distinguish the majority of Alaskan specimens.

A thorough examination of the type specimen of *E. t. traillii* leaves very little doubt that it is an example of the dark greenish northern and eastern boreal population. We now have definite evidence that Traill's Flycatchers breed in the general region where Audubon is presumed to have collected the type, since two males were taken July 18, and a female July 28, 1950, at Stuttgart, Arkansas, by Brooke Meanley. There is considerable doubt, however, that Audubon's type was a breeding bird in view of his statement (1831: 236) that he found the species "only in the skirts of the woods along the prairie lands of the Arkansas river" in April. This would seem to be much too early for the species to be breeding there since Brooke Meanley has informed me (in letter) that, although he made two trips a week to suitable habitat for nesting Traill's Flycatchers at Stuttgart, Arkansas, it was May 24 before he noted the first signs of breeding. Audubon said that the female of the pair belonging to this species contained eggs about the size of "green pease." However, the type, although the sex is not indicated on the label, is almost certainly not a female, but a male, and a big one at that, with a wing of 74 mm. (larger than the maximum for females of even the Alaskan population). All things considered, I believe the type of "*Muscicapa Traillii*" to be a migrant of the breeding population of the northern and eastern boreal region. The specimen matches the dark coloration of that breeding population, not the paler coloration of the midwestern prairie population. The two males and female collected at Stuttgart by Meanley were certainly breeding birds. Although they are not typical of the interior lowland race, they are nearer to it than to typical *traillii*. The two specimens collected by Arthur Howell in Arkansas, and considered by Oberholser as representative of the breeding population there, were collected, respectively, at Stuttgart, May 13, and at Chester, June 4. Both of these dates are too early to be considered as definitely breeding without substantiating evidence; and no definite evidence of breeding was recorded. In any case the two specimens are pale, quite typical of the interior lowland race, and nothing like Audubon's dark colored type of *traillii*.

If the Alaskan race were to be recognized it would be necessary to call it *Empidonax traillii traillii*, the type of which, although unsexed, appears to be a large male (wing, 74 mm.; tail, 57; exposed culmen, 11.5) fairly typical of the Alaskan breeding population. It is certainly closer to the average size for that population than to the average for the northeastern population. If two northern races were to be recognized, the eastern one would bear Brewster's name, *alnorum*.

The most disturbing fact encountered in considering the population from Alaska to the Maritimes as one race is that a segment in western Mackenzie is noticeably paler, showing intermediacy toward the plains race. This intermediate segment evidently completely separates the dark Alaskan population from the dark northeastern one. Despite this fact this entire northern population appears to have no variation clear-cut enough to permit the identification of as much as 75 per cent of the individuals of any segment thereof. I therefore believe that it should be considered a single subspecies.

3. *E. t. adastus.* A medium-toned, greenish, long- and rounded-winged, long-billed race, breeding in the northern Great Basin of Idaho, eastern Oregon, eastern Washington, and southeastern British Columbia; based on birds from Hart Mountain in the Warner Valley of central-southern Oregon; described by Oberholser (1932: 3). Although Miller (1941) was unable to distinguish this race, both Phillips (1948) and I believe that it is distinguishable on the basis of the range and characters above ascribed to it.

4. *E. t. extimus.* A pale-toned, grayish, med'um rounded-winged, long-tailed,

long-billed race which occupies the southern Great Plains, southern Great Basin, and desert region of Arizona and New Mexico; described by Phillips (1948: 512). It is a well-marked subspecies although my concept of its range is somewhat different from that of Phillips. It seems logical to me to include in it all pale-colored southwestern populations, including those of the southern Great Basin and the southern Great Plains assigned by Phillips primarily to *brewsteri*. Birds from west of the Sierra Nevada in southern California approach *extimus* in paleness of coloration but are smaller, in this respect resembling typical *brewsteri*.

5. A pale-toned, greenish, long- and pointed-winged, short-billed, northern Great Plains race appears to have an extension of its range far to the eastward in the Interior Lowlands physiographic province and the eastward extension of that province, the Lake Plains, to the south of the boreal coniferous forest region. Although this prairie population has been considered subspecifically the same as the northeastern boreal race, it now appears to be distinct and it is without a name. The only investigator previously to attempt to separate the two populations taxonomically was Brewster, and he described the wrong bird.

Before a new name is proposed, the possibility that a name is already available must be considered. In view of the fact that van Rossem (1934: 350) identified the type of *Empidonax ridgwayi* Sclater as *Empidonax t. traillii* it was thought that this might actually be a specimen of the pale prairie race, in which case this name would be applicable. Accordingly, typical specimens of both the Great Plains and northeastern boreal populations were sent to the British Museum, London, for comparison with the type of *ridgwayi*. I am indebted to Mr. E. Banks of the Bird Section, British Museum, for making these comparisons. It is Mr. Banks' opinion (letter of April 17, 1950) that neither of the specimens sent him resembles the type of *ridgwayi* at all closely in color tone. Compared with the typical example of *traillii* sent, the type of *ridgwayi* "has a dark olive-green back and darker gray, not white, underside, with the white edge to the outer tail feathers of which there is a hint in *E. t. brewsteri*." Mr. Banks writes further: "This dark specimen is quite unlike anything in our series of *t. traillii* and we do not know the doubtless good reasons which caused Ridgway and Hellmayr to 'sink' it in this race." On the basis of these findings and in view of the fact that the prairie birds are paler, not darker, than typical *traillii*, I feel justified in concluding that the name *ridgwayi* is not applicable to them. Therefore, this distinct subspecies may be described and named as follows:

Empidonax traillii campestris new subspecies. Plains Traill's Flycatcher

Type.—259504, U. S. National Museum (Fish and Wildlife Service Collection); adult male; Oakes, North Dakota; June 29, 1915; H. H. Sheldon, original number 129.

Subspecific characters.—In color very pale, most closely approaching *Empidonax traillii extimus* of the southwestern United States but somewhat more greenish (less grayish or brownish) olive above; tail shorter; bill smaller; wing more pointed with outermost (10th) primary distinctly longer than the 5th (6th from outside); in size and proportions nearest to *Empidonax t. traillii* of the boreal portions of northern and eastern North America, but in color considerably paler above. Compared with *Empidonax t. adastus*, its nearest relative to the west, it is paler and more greenish (less brownish) and has a smaller bill and more pointed wing.

Measurements.—Adult male (12 breeding specimens from North and South Dakota): wing (chord), 69–75 (71.2 mm.); tail, 55–59 (57.4); exposed culmen, 10–12 (10.9); tarsus, 15–18.5 (16.7); middle toe without claw, 9–10.3 (9.7). Adult female (6 breeding specimens from North Dakota): wing (chord), 66–68 (66.8); tail, 52–56.5 (54.5); exposed culmen, 10–11 (10.7); middle toe without claw, 8.5–10 (9.5).

Distribution.—In the breeding season north to northern Alberta and southern Mackenzie; east to central-western Manitoba, northern Wisconsin and northeastern Ohio, also eastward along the Lake Plains into western New York State; south to central-eastern Arkansas; west to southwestern Alberta and probably to the Rocky Mountains in Montana and Wyoming. The southern and western limits are very incompletely known because of lack of definitely breeding specimens from the areas that would demonstrate this.

Migrates west to: central British Columbia (near Vanderhoof), Idaho (Coeur d'Alene), Nevada (Pahranogat Valley), Colorado (Avalo and Loveland), New Mexico (Rinconada), and Michoacán (La Salada); east to northern Ontario (Moose Factory), Pennsylvania (Carlisle), Maryland (Laurel), and District of Columbia (Washington); south to Panamá (Gatun, March 6 and May 8, Porto Bello, May 26, and Cana, March 23).

General Conclusions:

1. That Brewster (1895) was correct in considering the boreal and prairie populations as distinct subspecies.

2. That the type specimen of *E. t. traillii* taken by Audubon in April "in the skirts of the woods along the prairie lands of the Arkansas River" was not breeding but rather a large transient example of the dark, boreal population; that *E. t. alnorum* is therefore a synonym of *traillii*.

3. That the type of *Empidonax ridgwayi* is not a representative of the Northern Great Plains-Interior Lowlands population, and is probably unidentifiable with any population of *Empidonax traillii* known at the present time.

4. That the type specimen of *E. t. brewsteri* taken May 31, at Cloverdale, Nevada, was not a breeding bird in that area but a migrant of the extremely

dark brown population from the northwestern coastal region; that *E. t. zopholegus* is therefore a synonym of *brewsteri*.

5. That the Alaskan population, although averaging slightly larger than the eastern Canadian and northeastern United States population, is not sufficiently different to warrant subspecific distinction; that *E. t. alascensis* is therefore a synonym of *E. t. traillii*.

6. That *E. t. adastus* is a valid race breeding in the northern Great Basin region.

7. That *E. t. extimus* is a valid race which breeds not only in the southwestern desert region but also the southern Great Basin and southern Great Plains, including the range east of the Sierra Nevada assigned by Phillips to *brewsteri*.

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Flight speed of Common Loon (*Gavia immer*).—About a hundred miles up the St. Lawrence River from Montreal, Quebec, at 10 a.m., E.S.T., on October 20, 1950, I had a very favorable opportunity to check the speed of a flying Common Loon for a distance of about five miles. The bird was flying upstream, roughly southwest, possibly migrating, at a height of about four feet above the water. The highway I was driving along paralleled the river quite accurately, and I estimate that, despite the slight curves, the road's course did not exceed the bird's by more than 3 or 4 percent at most.

To keep abreast of the loon I had to increase my speedometer pace to very nearly 55 miles an hour, so that the bird, if it had a very slightly shorter course, was making good a "ground" speed of 53 miles an hour.

There was a cold and rather strong cross wind from the northwest—with a component against the bird. Mr. D. S. Ross, Acting Officer in Charge of the Montreal Airport (Dorval, P.Q.), informs me that over most of this area on October 20 winds were reported as about 25 m.p.h. at 30 feet, and he estimates that at four feet above an open water surface the most probable speed would have been 20 m.p.h. This agrees very closely with my observations at the time. The triangle of velocities is given in Figure 1. The direction of the vector AC

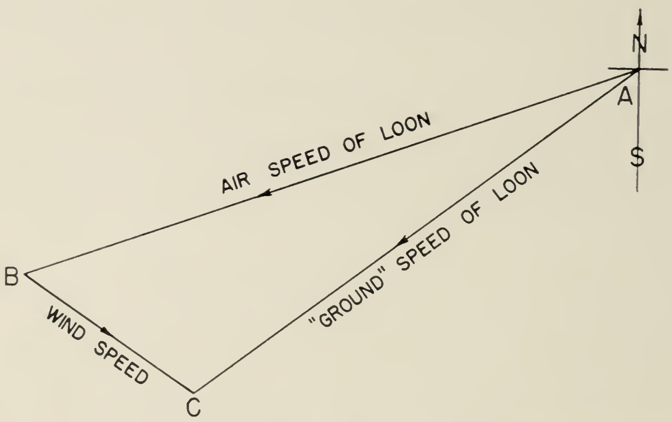

Fig. 1. Ground speed, combined with wind speed, to give air speed of flying Common Loon.

is that of the river, taken from a map. The vector BC is a combination of wind speed (from Mr. Ross's report) and wind direction (from my own observations). AB is the loon's air vector. The length of AB represents the bird's air speed, which comes out at about 62 m.p.h. —F. W. Preston, *Box 149, Butler, Pennsylvania.*

Present size of the Everglade Kite population at Lake Okeechobee, Florida.—Apropos of a statement in the report of the A.O.U. Committee on Bird Protection (1950. *Auk*, 67: 320) that the number of surviving Northern Everglade Kites (*Rostrhamus sociabilis plumbeus*) is not known, and also apropos of Sprunt's estimate (1950. *Audubon Magazine*, 52:

386) of a total of fewer than sixty survivors, I wish to report that on March 14, 1950, in the vicinity of the species' nesting ground at Lake Okeechobee, Mrs. Wilmoth G. Barker, of Ann Arbor, Michigan, Richard A. Herbert, of New York City, and I saw at least a dozen of the kites.

The ancient, one-eyed boatman who has watched over the kites for so many years piloted us into the marsh. Snails (*Pomacea paludosa*) were abundant: we picked clusters of their pink eggs off the reeds. For about an hour we watched the kites as they coursed back and forth hunting snails. They carried the snails in their red feet. Usually they took their prey back toward the nesting area, but occasionally we saw a female perch on a fallen post and eat a snail. We must have seen certain birds several times. Our estimate of 12 kites probably was conservative.

Male Northern Everglade Kite alighting in willow near nest. Photographed at Lake Okeechobee, Florida, May 15, 1941, by Hugo H. Schroder. That day Mr. Schroder saw 27 adult kites in the air at one time and found ten nests, each with eggs or small young.

This being our first experience with the Everglade Kite, we were surprised at noting that the bird, especially the female, seemed to resemble the Rough-legged Hawk (*Buteo lagopus*) rather than the Marsh Hawk (*Circus cyaneus*), a species with which it has often been compared. The kite's short, chunky build, and the white upper tail coverts and basal part of the tail instantly suggested the Rough-leg.

We could not but reflect that, even as this was our first view of these picturesque birds, so it might well be our last, for if the Kissimmee River dam materializes, the changing of the water-level will probably extirpate the snails on which the kites feed.—Kathleen Green Skelton, *355 West 57th Street, New York 19, New York.*

Amphibians and snakes as Ruffed Grouse food.—In the extensive literature pertaining to the Ruffed Grouse (*Bonasa umbellus*) there are few references to the species' eating of snakes and amphibians. Bump *et al.* (1947. "The Ruffed Grouse," pp. 191–192), Petrides (1949. *Wilson Bulletin*, 61: 49), and Findley (1950. *ibid.*, 62: 133) have reported recent records of grouse eating Common Garter Snakes (*Thamnophis sirtalis*) in New York, Michigan, and Minnesota, respectively. Chaddock (1940. "Report of the Ruffed Grouse, Pinnated Grouse and Sharp-tailed Grouse Crop Investigation," Wisconsin Conservation Department mimeographed bulletin) has reported finding a garter snake and a frog (*Rana* sp.), respectively, in the crops of two Ruffed Grouse shot in northern Wisconsin in the fall of 1939. Scott (1947. *Auk*, 64: 140) has reported finding a small Red-bellied Snake (*Storeria occipitomaculata*) in the crop of a Ruffed Grouse collected in Taylor County, Wisconsin, in October, 1942.

We wish to publish here two more interesting records for Wisconsin which came to light in 1950 during our Ruffed Grouse population studies for the Pittman-Robertson grouse research project (13-R) of the Wisconsin Conservation Department. A Ruffed Grouse collected September 20, 1950, in Forest County, Wisconsin, had an American Toad (*Bufo americanus*) in its crop. The toad was 96 mm. long (with legs extended), weighed 9.6 grams, and had been swallowed whole. The grouse, a male, weighed 552 grams, and showed no ill effects, either in behavior or in physical condition, from eating the toad. The postjuvenal wing-molt stage indicated that the bird was 13 weeks old. To the best of our knowledge no one has heretofore reported the toad as Ruffed Grouse food.

In late October, 1950, Harry Rousch of Webster, Wisconsin, while hunting in Burnett County, happened upon a Ruffed Grouse which was trying to swallow a large garter snake. The grouse flushed with the snake dangling from its mouth, and Rousch shot the bird on the wing. The grouse and half-swallowed snake were forwarded to us for examination. The grouse was an immature male. The snake was 23 inches long. About ten inches of it had been swallowed. Its head had been lacerated, presumably by the grouse.

A third record, previously unpublished, concerns a Ruffed Grouse shot by Wendt in Oneida County, Wisconsin, in the fall of 1942, that had eaten whole a small garter snake. No measurements of either the bird or snake were recorded.

It is our belief, based on Wisconsin records, that Ruffed Grouse in all areas eat snakes and amphibians more often than the literature indicates. The fact that most snakes reported

Left: Ruffed Grouse (shot on the wing in Burnett County, Wisconsin, in October, 1950) with half-swallowed garter snake. Right: Toad and head of Ruffed Grouse which swallowed it. Forest County, Wisconsin, September 20, 1950. Photographs by Arthur Doll.

as grouse food have been garter snakes probably reflects the abundance and availability of that species rather than the grouse's preference for it over other snakes. There is also the strong probability that absence of spring and summer records of snake- and amphibian-consumption by grouse indicates not an autumnal preference or need for food of this sort but rather a lack of investigation of grouse specimens at any season aside from fall hunting seasons.—James B. Hale and Robert F. Wendt, *Wisconsin Conservation Department, Madison.*

Barn Owl in Montana.—On June 9, 1950, I found a dead Barn Owl (*Tyto alba*) under a bridge approximately one half mile south of 20-Mile Ranger Station, near Ashland, Powder River County, Montana. The carcass was about a foot and a half from the ground, hanging by one wing from a large splinter projecting from one of the principal vertical supports of the bridge. The splinter was between the bones and tendons of the second joint. The bird apparently had impaled itself while stooping to catch prey. The specimen was so badly decomposed that only the head and feet were saved. These are now in the collection of Montana State College.

On the ground beneath the bridge I found many rodent skulls. A later examination (June 28) of the cubbies formed by the beams at either end of the bridge disclosed a two- to three-inch layer of matted bones, droppings, pellets, and rodent skulls. Among this debris were the remains of a male Sparrow Hawk (*Falco sparverius*), but of course I had no way of knowing how that bird had met its death. Although I spent two months in the immediate vicinity of the bridge in the summer of 1950, and passed it several times a day, I never saw a living owl of any sort there. Two Great Horned Owls (*Bubo virginianus*) lived in the vicinity, however, and these were seen by various persons from time to time.

The above-discussed record seems to be the first for the Barn Owl in Montana. Neither A. A. Saunders (1921. "A Distributional List of the Birds of Montana," *Cooper Orn. Club. Pac. Coast Avif.* 14) nor Harlow B. Mills (1945. "Some Montana Birds. Their Relationship to Insects and Rodents," *Montana State College Agric. Extension Service Bull.* 229) mention the species. I wish to thank Dr. Gustav A. Swanson for pointing out to me the value of this record.—Robert L. Eng, *Department of Zoology and Entomology, Montana State College, Bozeman.*

A nest of *Chaetura vauxi richmondi* in central Honduras.—On July 3, 1948, near the summit of Cerro Uyuca (at an altitude of 6200 feet) in the Department of Francisco Morazán, central Honduras, I noticed a small swift entering an opening twenty to thirty feet above ground in the bole of an immense avocado tree (*Persea* sp.). The upper 2000 feet of this mountain is clothed with the "hardwood cloud forest" described by Carr (1950. *Bull. Am. Mus. Nat. Hist.*, 94: 582). The opening into which the swift disappeared was about eighteen inches in diameter. All attempts to flush the bird from the cavity were unsuccessful. On climbing to the opening, I heard faint chirpings and flutterings inside and discovered that the cavity extended to the ground.

On July 5 I returned to the peak. The opening to the cavity was covered, and two local laborers cut a hole large enough to allow me to crawl into the tree near its base. Finding that I could stand up and move about, I located the swift nest about eighteen feet above ground-level. The adult swifts were flying about within the cavity. The nest contained three young birds about four days old. The nest was very similar to that of the Chimney Swift (*C. pelagica*) in shape and structure—a half-cup made of short lengths of small dead twigs glued together. It was fastened to the vertical wall of the tree and measured approximately 10 by 6 cm. by 4 cm. deep. Both adults escaped from the cavity, but I collected the male later as he flew about the tree.

Dr. George M. Sutton has identified this specimen (J. C. D. Jr. No. 456) as *C. v. richmondi* though he informs me that it is "not as dark on the crown, hind neck and back as March examples of this race from Chiapas, México, or as April specimens from Guatemala, in the collection of the University of Michigan Museum of Zoology. The left wing measures 110 mm. without pressing the primaries flat, 113 with primaries flattened and straightened as much as possible. This wing-length seems definitely too great for *gaumeri*, but the bird may prove to be intermediate between these two races if it can be established, through further inquiry, that *richmondi* does not fade appreciably by July."

Nest of Richmond's Swift found near the summit of Cerro Uyuca, in central Honduras, in early July, 1948. The young are about five days old, according to Richard B. Fischer, who has made a careful study of the growth of young Chimney Swifts. Photo taken at the Escuela Agricola Panamericana, Department of Francisco Morazán, Honduras, by Margaret Hogaboom.

The three young birds, preserved in alcohol, and the skin of the male parent have been deposited in the University of Michigan Museum of Zoology.—J. C. Dickinson, Jr., *Department of Biology, University of Florida, Gainesville.*

A Yellow-shafted Flicker's odd accident.—A dead Northern Yellow-shafted Flicker (*Colaptes auratus luteus*), whose emaciated condition indicated starvation, was picked up near Bolar, Bath County, Virginia, on November 23, 1950, by John Williams of Lexington,

Male Yellow-shafted Flicker with bill held shut by pierced seed. Photo taken November 30, 1950, by William Williams.

Virginia. The bird was a male, with a wing measurement of 155 mm. It had driven its bill into a hole in a small seed, probably that of a dogwood (*Cornus* sp.), and could not extricate itself. The mandibles were much scored by the bird's efforts to dislodge the seed.—J. J. MURRAY, *6 White Street, Lexington, Virginia.*

Red-headed Woodpecker with malformed bill.—On August 23, 1950, two miles northwest of Beltrami, Polk County, Minnesota, we observed a fully adult Red-headed Woodpecker (*Melanerpes erythrocephalus*) which appeared to be entirely normal except that its bill was about $3\frac{1}{2}$ inches long and strongly decurved. We could not be certain that both mandibles were of equal length. The bird visited only the tops of telephone poles and used its bill solely in probing cavities there. At no time during the 20-minute period of our observation (with two pairs of 6× binoculars at distances of 30 to 200 feet) did it pound, gouge, or rap with its bill, nor did it alight, in usual woodpecker-fashion, on the side of a pole. Its habitat in general was a hundred-acre poplar tract and a thinly wooded pasture, surrounded by grain fields. We visited this area frequently earlier in the summer and once in September but saw the odd woodpecker only on August 23. Flickers (*Colaptes auratus*) were common in the region, but Red-headed Woodpeckers were rare.

The above-reported observation is of interest as an indication of the degree of adaptability of the species. Apparently this particular individual's bill, though too fragile or too much curved for wood-chopping, served admirably for reaching into deep cracks and crevices. The bird was active and in good feather. Its head was wholly red, so it must have been more than one year old (cf. Roberts, 1932. "The Birds of Minnesota," Vol. 2, p. 674). We have no idea, of course, how long its bill had been malformed, but surmise that once injury made vigorous pecking and pounding impossible, wear stopped and abnormal growth started. The abnormally long lower mandible of a reared-in-captivity Black Skimmer (*Rynchops nigra*) has been reported by Beebe (1906. "The Bird," pp. 232 and 248).—SCOTT SEARLES AND EMMA U. SEARLES, *Chemistry Department, Northwestern University, Evanston, Illinois.*

Vermilion Flycatcher in Arkansas rice district.—In the heart of the rice district near Stuttgart, Arkansas, I saw three Vermilion Flycatchers (*Pyrocephalus rubinus*) in the fall of 1950. Two of these were adult males which I saw in a haw tree (*Crataegus*) along a rice field irrigation ditch on November 6. I collected one of them that day. The third, an immature male, I collected along a farm road near a large reservoir, November 28. The two specimens are in the U. S. National Museum.

There are, apparently, three other records for the State. In the vicinity of Magnolia, in southwestern Arkansas, in the fall of 1941, J. R. Forbes saw two birds, an immature male from October 18 to November 1, and an adult male from October 28 to November 3. The former, collected on November 1, is now in the Cornell University collection (Forbes, 1942. *Auk*, 59: 579). At Mena, near the Oklahoma border in west central Arkansas, a Vermilion Flycatcher was seen on October 21, 1945. Details of the record, as reported to Dr. W. J. Baerg, will appear in the current revision of his "Birds of Arkansas," now in press.—Brooke Meanley, *U. S. Fish and Wildlife Service, Stuttgart, Arkansas.*

Vermilion Flycatcher on east coast of Florida.—On March 25, 1951, Roger N. Early, of Lakeland, Florida, and I observed a male Vermilion Flycatcher (*Pyrocephalus rubinus*) near the United States Coast Guard Station, New Smyrna, Volusia County, Florida. We first saw it as it flew from a telephone wire along the highway to the top of a small tree. We spent an hour observing it at close range with and without the aid of a binocular. It continued perching in the tops of small trees, feeding with the characteristic technique of its clan. When approached too closely, it merely flew to the next bush or tree and continued feeding. Often it wagged its tail in the manner of a phoebe (*Sayornis*) just after alighting.

During the course of our observations Mr. Early obtained 40 feet of motion pictures in color from a distance of about 35 feet, using a six-inch lens. In my attempts to photograph the bird, I several times approached to within 20 feet before putting it to flight. It appeared to be established in one particular area. By persistent following I induced it to fly in short "hops" to a tree about 200 yards from the spot at which we had first seen it. From this place it circled back to its original perch. Mr. Early attempted to photograph it at close range, causing it to move about 150 yards, but again it returned to its 'base,' as before.

Although the Vermilion Flycatcher has been seen many times in winter in northwestern Florida, there are few published records for the peninsula proper, and this one may be the first for the east coast. We made no attempt to collect the specimen. Our photographs turned out well.—Russell E. Mumford, *812 East Hendrix Street, Brazil, Indiana.*

Wing-flashing by male Mockingbirds.—My observations on a few marked Mockingbirds (*Mimus polyglottos*) run counter to Tomkins' belief that wing-flashing by males is rare (1950. *Wilson Bulletin*, 62: 41–42). This species is scattered through Baltimore's suburban sections as a permanent resident. On the grounds about my home, however, I have seen it only in winter, spring and fall. Six birds that I have color-banded have proved, by spring singing, to be males. I have seen wing-flashing by three of the six: on three occasions (March 21, April 18, April 27) by an individual present from October 1, 1947, to May 2, 1948; on seven occasions—March 6, 17, 21, 24 and 31 (twice), and April 1—by a bird present 43 days (March 4 to April 15, 1946); and on one occasion (April 16) by a bird present from April 9 to 22, 1950. I have seen wing-flashing by a silent (and therefore probably a female) color-banded bird on four occasions during a 7-day stay in April. Wing-flashing by unbanded Mockingbirds (sex ?) elsewhere I have witnessed in January (once), May, July and September.

Like Tomkins, I have seen the gesture made above the ground as well as on it. On the 22 occasions that I have seen adult birds perform, the place has been: lawn, 12 times; concrete paving, 1; my second-floor window feeding shelf, 8; on the bird's nest-bush, 1. I have also once seen a large fledgling flash its wings in a tree (wing-flashing by young birds on the ground appears to be common, but I have had no opportunity to study it systematically). Like Wampole (1949. *Wilson Bulletin*, 61: 113), I find that the extent to which the wings are lifted and spread varies greatly: sometimes they are moved only a little away from the sides and spread only slightly. I have included the less conspicuous instances in my tabulations.

On all but one occasion, as the above summary suggests, wing-flashing by adults has been done during foraging or in the actual presence of food. But although it therefore seems to be connected with feeding, some of my observations, like some of Sutton's (1946. *Wilson Bulletin*, 58: 206–209) make a simple "game flushing" explanation unsatisfactory. On many visits to my uncovered feeding shelf for raisins and suet, the birds have done no wing-flashing; in some of the eight instances that it was done there, and in at least two instances elsewhere, the full circumstances show that the birds were under the influence of emotion, as well as hunger.

My notes on the color-banded bird, WA, which appeared to be a female, will illustrate. This bird was present from April 9 to 15, 1948, during which time she associated with male BA-S, present October 1, 1947, to May 2, 1948. The notes are:

"April 11. At 9:42 a.m. male BA-S visited the feeding shelf for raisins, then left. At 9:43 WA alighted on one corner of the shelf and, as she did so, raised her wings to 45 or 60 degrees and partly spread them. Then after several seconds she advanced onto the shelf and ate raisins, and a number of times during the first part of this feeding again slightly raised and spread her wings. This may have been a sign of uneasiness at my watching from about ten feet back in the room—although she has done no wing-lifting during other such observations.

"At 11 a.m. WA was finishing a rain bath on a rear gate-post. A Robin (*Turdus migratorius*) alighted in the concrete-paved alley a few yards away. Soon WA ended her bath, swooped downward past the Robin and on some yards east, and as she alighted on the concrete in front of a garage she raised her wings once about as high as her back, closed them, then moved about over the concrete and a few more times made the wing-raising gesture distinctly, though not in extreme form. Then she foraged out of sight.

"12:42 p.m. After my presence at the window had kept both BA-S and WA from the feeder for about seven minutes, during which WA once gave a little *skraa* note that seemed to indicate annoyance, I withdrew into the room. BA-S then flew to the feeder and after he left WA flew there, and at first WA, while watching me watch her, slightly flipped her wings a few times.

"April 14. While WA was sitting on a wire in our back yard at 7:41 a.m., BA-S settled about eighteen inches away on a parallel wire. WA looked toward him with bill widely open for some seconds, then practically closed her bill, then in a few seconds flew at him; he darted to another wire a few yards away, then flew next door. Soon WA came to our feeder and ate raisins, and during the eating just *twitched* her wings once or twice."

The two other instances alluded to include my one winter observation of the gesture. With a small hardware-cloth trap I was attempting, on January 8, 1949, to catch a Mockingbird at a ground feeding place it was visiting for raisins. When the bird appeared, it was unable to find its way into the trap; after trying for a while, it hopped up on top of the trap, moderately raised and opened its wings once, then in a few seconds dropped to the ground beside the trap and once raised and opened its wings to a still lesser extent. For some seconds more it tried vainly to find a way in to the raisins, then it left.

On July 12, 1946, I made this observation in another part of Baltimore: "Two Mockingbirds were engaged in a pursuit across some lawns. One of them then flew onto a forsythia bush on one lawn, partly raised its wings a couple of times, then entered the bush. A few minutes later I flushed a bird out of that bush and found a nest with three eggs."

In all but the second of those instances, at least, uneasiness, frustration or sexual excitement seems to have possessed the birds at the time of their wing-flashing. And although all but the last instance occurred while the bird was immediately preoccupied with food or feeding, four times out of five the food was inanimate fruit. My observations, therefore, make me believe that wing-flashing is an instinctive game-flushing gesture, but one that has become a displacement act performed under emotional stress of widely varying sorts, particularly in any real or potential feeding situation. This is much the same conclusion reached by Hebard (1949. *Florida Naturalist,* 23: 16–18).—Hervey Brackbill, *4608 Springdale Avenue, Baltimore 7, Maryland.*

Black-throated Gray Warbler in Ohio.—On November 15, 1950, Gene Rea and I happened upon a Black-throated Gray Warbler (*Dendroica nigrescens*) on the Ohio State University campus at Columbus. It was with a small company of Slate-colored Juncos (*Junco hyemalis*) and Ruby-crowned Kinglets (*Regulus calendula*) feeding in shrubbery above a rock garden south of Mirror Lake. It was active and nervous, though not particularly shy, resembling the kinglets in this respect. Several times we moved to within 15 feet of it.

In the half hour or more during which it was under observation, it spent most of its time feeding actively in the shrubbery. Several times it flew to some tall trees nearby, but returned each time to the lower vegetation. Its call-note, which we heard repeatedly, seemed to our ears somewhat intermediate between, though softer and weaker than, that of the Black-throated Green Warbler (*Dendroica virens*) and that of the Myrtle Warbler (*D. coronata*).

The bird was subsequently observed by a number of persons before it was collected by Jeff Swinebroad, who very kindly presented it to the Ohio State Museum. The specimen, an immature female, is now No. 7939 in our collection. The species apparently has not previously been taken in Ohio.—Edward S. Thomas, *Ohio State Museum, Columbus.*

Audubon on Territory.—An early reference to territorialism in the life of an American bird is to be found in Volume 2 of Audubon's "Ornithological Biography" (Boston, 1835: 218) where, in treating of the Meadowlark (*Sturnella magna*), Audubon wrote: "At the approach of spring, the flocks break up, the females first separating. The males then commence their migration, flying in small flocks, or even sometimes singly. At this season the beauty of their plumage is much improved, their movements have acquired more grace, their manner of flight and all their motions when on the ground evidently shewing how strongly they feel the passion that glows in their bosom. The male is seen to walk with stately measured steps, jerking out his tail, or spreading it to its full extent, and then closing it, like a fan in the hands of some fair damsel. Its loud notes are more melodious than ever, and are now frequently heard, the bird sitting the while on the branch of a tree, or the top of some tall weed of the meadows.

"Woe to the rival who dares to make his appearance! Nay, should any male come in sight, he is at once attacked, and, if conquered, chased beyond the limits of the territory claimed by the first possessor."

This description reappears in Volume 4 of the author's "Birds of America" (1842: 72). Whether or not there may be other similar observations on territory in Audubon's works I do not know.—Francis H. Allen, *9 Francis Ave., Cambridge 38, Massachusetts.*

Nest location, Cowbird parasitism, and nesting success of the Indigo Bunting.—During the summers of 1948, 1949, and 1950, I observed 14 nests of the Indigo Bunting (*Passerina cyanea*). The data on nest location, parasitism by the Cowbird (*Molothrus ater*), and nesting success are tabulated below. Six (42.8%) of the 14 nests were parasitized and only one Cowbird was fledged from the seven eggs laid. Of 41 bunting eggs laid, 18 (43.9%) young were fledged.

On July 3, 1950, I saw a House Wren (*Troglodytes aëdon*) fly from nest No. 11. When I got to the nest, I found the contents of the one bunting egg beginning to seap from a bill hole in the shell.

Nest	Date found	Contents	Height above ground	Location	Distance from edge of woods	Remarks
	1948		*in.*			
1	June 24	3 eggs	38	red raspberry	in open	1 young left July 9; 2 others killed by sunlight
2	Aug. 6	1 Cowbird and 4 bunting eggs	36	red raspberry	in open	abandoned Aug. 10
3	Aug. 7	4 eggs	60	elm sapling	200 ft.	4 young left Aug. 20
	1949					
4	June 6	3 eggs	35	wild raspberry	100 ft.	3 young left June 19
5	June 8	4 eggs	24	elm seedling	100 ft.	4 young left June 20
6	June 16	1 Cowbird and 4 bunting eggs	48	elm sapling	200 ft.	apparently abandoned when found
	1950					
7	June 19	4 eggs	60	silver maple sapling	50 ft.	nest destroyed by storm July 25
8	June 20	2 Cowbird and 3 bunting eggs	24	wild rose	50 ft.	abandoned June 22
9	June 22	1 Cowbird and 2 bunting eggs	18	wild rose	5 ft.	Buntings died when one day old. Cowbird left nest July 5
10	June 28	1 bunting just hatched; 1 bunting and 1 Cowbird egg	24	blackberry	fencerow 30 ft. from woods	no data
11	July 3	1 bunting egg	12	*Crataegus* sp.	30 ft. outside woods	egg picked by House Wren
12	July 5	1 Cowbird and 1 bunting egg	28	wild rose	fencerow, at edge of woods	nest abandoned
13	July 19	4 eggs	12	ironwood sapling	200 ft.	4 young left Aug. 6
14	July 21	2 young	18	wild raspberry	fencerow, along woods	2 young left July 22

—RICHARD S. PHILLIPS, *Biology Department, Findlay College, Findlay, Ohio.*

Observations on fish-eating by the Great-tailed Grackle in southeastern Arizona.— During an ichthyological survey of Arizona we visited San Bernardino ranch (near the U. S.-México boundary about 18 miles east of Douglas), one of the first areas in the western United

States to be occupied by the Great-tailed Grackle, *Cassidix mexicanus* (see Phillips, 1950. *Condor*, 52: 78–81). On April 24, 1950, a small section of one of three drainage ditches, fed by artesian wells, was treated with derris powder in order to obtain a sample of the fish life. Within an hour we observed several grackles eating minnows 1 to 2 inches long. The birds waded to a depth covering half their wings to pick up the fish, which were surfacing and swimming erratically downstream from the effect of the derris powder. After swallowing a fish whole, a grackle would leave the water and walk along the bank until it saw another dying fish. We identified the fish as *Gila purpurea* (Girard) and *Notropis mearnsi* Snyder. We saw about ten male and twenty female grackles.

The above observation suggests the possibility that fish may be a normal part of the grackle's diet at certain seasons. In arid parts of the southwestern United States and northwestern México, in a typical dry season, fishes are isolated in small pools along the stream courses in sufficient concentration to enable grackles to capture them. Oxygen depletion in these potholes would effect a behavior pattern of the fish similar to that caused by derris powder. Small fish hatched in the late spring congregate in still water along the shallow margins of streams and springs, thereby offering another possible normal source of food.

Derris powder has been used in recent years as a method of collecting fish and controlling fish populations. The active ingredient is rotenone. "The 'poison' does not in the least affect the edibility of the fish killed, nor is a concentration lethal to fish poisonous to terrestrial vertebrate animals, including man, which drink the water" (see Myers and Wade, 1946, Allan Hancock Pac. Exped., 9: 152–153). Extensive tests (see Krumholz, 1948, *Jour. Wildl. Mgt.*, 12: 315) have shown that birds may drink water treated with derris powder, and may eat fish killed by this chemical, without ill effects.—ROBERT RUSH MILLER AND HOWARD ELLIOTT WINN, *University of Michigan Museum of Zoology, Ann Arbor.*

A flight-song of Bachman's Sparrow.—On June 18, 1949, I was studying Bachman's Sparrows (*Aimophila aestivalis bachmanii*) on a long, shrub-grown ridge northwest of Bowling Green, Warren County, Kentucky. The day was very hot, and the sparrows did not commence singing until sundown. Shortly after sundown I saw a small fringillid in flight about 150 feet above the ground. It was ascending in an erratic, fluttering manner, singing a song which was completely unfamiliar to me. The song was bubbling and exuberant and, though distinctive, difficult to describe. According to my notes, it reminded me of a much speeded-up Indigo Bunting (*Passerina cyanea*) song of wren-like quality. I did not then succeed in collecting the bird, but the following observation convinced me beyond doubt of its identity.

On June 22, I returned to the ridge. Again the sparrows did not sing until dusk. It had grown too dark to see well when a sparrow flew into a low tree near me and uttered a song which I at once recognized as similar to the flight-song above described. This song was followed almost immediately by one of the typical songs of the Bachman's Sparrow. I collected the singer, a male Bachman's Sparrow in worn plumage with much enlarged testes.

In the literature concerning *A. aestivalis* I have not been able to find a reference to flight-singing or to any song definitely like the one described. However, Maurice Brooks (1938. *Wilson Bulletin*, 50: 102–105), who has compiled much of the pertinent literature, says (p. 104): "The louder songs are not infrequently interspersed with 'whisper songs,' so low that they are inaudible to a person at a little distance. Frequently there are broken twitterings between the more ordered songs as well. As with many of our fine songsters, individual birds show wide variations in their vocal abilities."

It is easy to see how flight-singing in *aestivalis* has been overlooked, especially if the phenomenon is primarily crepuscular. The bird itself is sometimes common in areas where its presence is wholly unsuspected.

One of the considerations prompting this note is the fact that the related Cassin's Sparrow (*Aimophila cassinii*) of the Great Plains has a well developed propensity to flight-singing.

In one of the apparently very few papers devoted to the subject of flight-songs, A. A. Saunders (1922. *Auk*, 39: 175) says: "The true flight singers nest in open grass areas, in places where perches are hard to find. Those that have occasional flight songs nest in woods or thickets where perches may be had if desired. Perhaps the frequency of perches has kept the flight song from developing in these species as it has in the prairie birds. If in some future time, something should change the habitat of these species to more open regions, it is probable that true flight song would develop quickly." In the meadowlarks (*Sturnella*), according to Saunders, *magna* rarely sings in flight, while *neglecta* does so regularly, the flight-songs of the two being very similar. He considers these flight-songs "ancestral," and the dissimilar "ordinary" songs to be a secondary specific development. Something of this sort might be postulated for the species of *Aimophila* here discussed, provided further information on flight-singing in *aestivalis* can be obtained.—ROBERT M. MENGEL, *University of Michigan Museum of Zoology, Ann Arbor.*

NEW LIFE MEMBER

Andrew John Berger was born August 30, 1915, at Warren, Ohio. Graduated from Oberlin College in 1939, he studied game management at the University of Missouri in 1940–1941, obtained his Master's and Doctor's degrees at Michigan in 1947 and 1950. He was in the U. S. Army Air Forces from March 15, 1941 to February 15, 1946, being released from active duty with the rank of Major. He now is teaching gross anatomy at the University of Michigan Medical School. A member of the A.O.U., the Cooper Club, and the Michigan Audubon Society, he has distinguished himself as Assistant Editor of *The Wilson Bulletin* and through his work with color-banded birds. He is especially interested in the morphology, behavior and classification of cuculiform birds.

EDITORIAL

There is a good deal of complaining these days about changes in scientific names. One person is annoyed because, having just learned to spell and pronounce a considerable number of these names, he finds that some of them are no longer applicable. Another complains because the "new name someone has dug up" doesn't describe the bird as well as the "old one" did. Often, in cases of this sort, the "new" name is actually the older of the two, but that is beside the point. Many bird students, among them some avowed taxonomists, feel that names now widely in use should arbitrarily be declared adequate so as to have done with all this haggling as to whether a given early description is adequate or not.

Admittedly there is such a thing as devoting too much time and too many pages to arguments that get us nowhere. But the careful translation of early writings, the study of early drawings, the discovery that certain of these are full evidence that the writer was naming and describing a bird for the first time—this branch of ornithology can be interesting and exciting indeed. We submit that it is also important, that it should continue as part of man's pursuit of knowledge.

In the June issue of *The Wilson Bulletin*, on page 113, a footnote dealing with the correct scientific name for the Iceland Gull appeared. Let no one think that that footnote was added casually. Writing it involved not only a careful translation of the Mayaud article referred to, but also the borrowing from distant libraries of the works of both Vieillot and Meyer and then more translation. Photostatic copies of the pertinent pages were made for reference, and these were added to our species-files. The translation of Vieillot's description clearly showed that the bird he was calling *leucopterus* was a Glaucous Gull, not alone because its total length was too great for an Iceland Gull, but also because the *Larus glaucus* of his discussion was a bird whose wings were "*versus apicem nigricantibus*"—black at the tips. Vieillot's description of *leucopterus* was, in other words, of the bird we know as the Glaucous Gull, the large white-winged gull of the north.

Larus glaucoides, as described in Meyer's work (1822), is clearly of the right size for an Iceland Gull. Indeed, the description is in every way adequate except that the adjective *schmustigweiss*, describing the remiges, does not seem quite accurate. Now it remains for some careful student to ascertain exactly what was meant by the adjective *schmustigweiss*, or exactly why the word was used. In any event, we submit, the inquiry should not stop here, but go right on, until we have the most precise knowledge possible as to what the earliest name-plus-adequate-description of the Iceland Gull is.

Let those who feel that they cannot go to the trouble of learning these "new" names bear in mind that every ornithologist, whether he sets out to do so or not, knows many names of various sorts for most of the birds he knows at all. As children some of us felt that there was really no such bird as a water ousel; the bird was the *water ousel or dipper*, and the four words were requisite. Some of us can easily think back from *Pheucticus* to *Hedymeles* and then to *Zamelodia* and even to *Habia* as part of our personal experience with the Rose-breasted Grosbeak, and the bird is no less beautiful, the study of ornithology no less appealing, on that account. The human brain was made for work. Let us go right on finding these correct early names and memorizing them as occasion demands. As one of our leading ornithologists, in a personal letter written not long ago, said: "I don't think there is a taxonomist worth his salt in this country today who doesn't have to have two or three names in his head for a species, so why not use the earliest valid name and be done with it?"

Why not indeed? Kenneth Parkes (1951. *Proc. Biol. Soc. Washington*, 64: 61) has just made the interesting discovery that Wagler's name *Eudocimus*, published in 1832, is an adequate name for the genus to which the White and Scarlet Ibises belong. This name antedates *Guara* of Reichenbach by twenty years. So now we have the pleasant task of learning the names *Eudocimus albus* and *Eudocimus ruber*—thus seeing old friends in a new light, so to speak. We might even get busy and ascertain what *Eudocimus* means, thus finding out whether Wagler, in his day, was using the human brain to capacity.—G.M.S.

The writings of the late Bayard Henderson Christy, editor for many years of the distinguished regional periodical, *The Cardinal*, were notable for their literary flavor. A few of his papers were published in *The Wilson Bulletin*, among them one entitled "Beach-Combers," which appeared in December, 1935 (47: 265–269). The Carnegie Museum has several dozen reprints of this article, as well as of "Bird Notes from Southern Florida" and "A Wading Bird Rookery," both of which appeared in 1928 (*Auk*, 45: 283–289 and 423–429, respectively). Copies of these reprints will be sent, as long as they last, to anyone sending a stamped, addressed $7\frac{1}{2}$ x $10\frac{1}{2}$ clasp envelope. Mail your request to the Carnegie Museum, Pittsburgh 13, Pennsylvania.

In pursuit of data concerning the Sandhill Crane (*Grus canadensis*), Dr. Lawrence H. Walkinshaw, of Battle Creek, Michigan, recently visited Cuba and the Isle of Pines. He was absent from the United States from April 20 to May 15. On the Isle of Pines he discovered three crane nests. While in Cuba he and another member of The Wilson Ornithological Club, Dr. Abelardo Moreno, who is working on a book dealing with Cuban birds, visited the state of Pinar del Rio, at the western end of the island, and the famous Zapata Swamp. They did not see those interesting endemics, *Ferminia*, *Cyanolimnas*, and *Torreornis*, however.

The museum of the Ross County Historical Society has recently purchased over 700 negative photostats made under the direction of the New York Public Library from illustrations of birds in flight appearing in rare old books. Those interested in seeing or using this valuable collection should get in touch with Eugene D. Rigney, Director of the Ross County Historical Society, 45 West Fifth Street, Chillicothe, Ohio.

Milton B. Trautman, Research Associate at the Franz Theodore Stone Institute of Hydrobiology, Ohio State University, Put-in-Bay, Ohio, and widely known for his scholarly "The Birds of Buckeye Lake, Ohio," was awarded the honorary degree of Doctor of Science by the College of Wooster, Wooster, Ohio, on June 11. Dr. Trautman has been devoting much time recently to completing a book on the fishes of Ohio. He has been illustrating this work as well as writing it. His drawings are notable for their great accuracy and precision of detail.

We deeply regret an error in the March, 1951, issue of the *Bulletin*. The genotype of the third bird from the bottom (CNMH 148778) in the colored frontispiece should read WwSspp, not WwSsPP as stated in the legend at the bottom of page 5.

We are grateful to Katherine Tousey for the excellent snapshot of Ludlow Griscom. The picture is remarkable in that it has caught its subject in such a sedentary pose. The building up of unusually large life-lists obviously is not wholly a matter of climbing cliffs, wallowing through marshes, and stalking wide plains.

Many members of the Club have contributed to the color plate fund. Some did so through purchasing prints of the Crimson-collared Grosbeak plate which appeared in the December, 1950, issue. Others gave money with the expressed wish that it be used in any way that seemed best to the editors. The following contributed: Malvina Trussell, Irving E. Hampe, Jack Satterly, Margaret Morse Nice, Virginia Cavendish (deceased), S. W. Witmer, Dr. and Mrs. Powell Cottrille, Eugene Eisenmann, Betty Stephens, Amelia R. Laskey, Mrs. M. J.

Beemer, Theodora Nelson, Clarence B. Randall, Ben Coffey, Winnifred Smith, Herbert L. Stoddard, Sr., Paul S. Martin, Robert B. Lea, Mrs. Barbara Westphal, Mr. and Mrs. Richard Graber, H. Lewis Batts, Jr., Wilson Schramm, and Earl W. Farmer.

M. Graham Netting, Assistant Director of the Carnegie Museum, was awarded the honorary degree of Doctor of Science by Waynesburg College, Waynesburg, Pennsylvania, on April 27, 1950. Dr. Netting has been a member of The Wilson Ornithological Club since 1941.

In response to the report on "Graduate Research in Ornithology," which appeared in the March issue of the *Bulletin*, Clarence Cottam, Assistant Director of the Fish and Wildlife Service, has sent the editors a mimeographed list of ornithological studies being conducted at 16 Cooperative Wildlife Research Unit schools. A limited supply of this excellent summary of current research on game species is available for distribution. A copy may be obtained by writing to the Fish and Wildlife Service, Washington 25, D. C.

The engraving for the Wilson's Warbler color-plate appearing in this issue of the *Bulletin* was donated by Mr. Samuel A. Grimes of the Respess-Grimes Engraving Company of Jacksonville, Florida. The editors, in behalf of The Wilson Ornithological Club, wish to express their appreciation to Mr. Grimes and his company for their generosity in providing this fine frontispiece.

Frank A. Pitelka, Henry E. Childs, and Gilbert S. Greenwald, of the Museum of Vertebrate Zoology, Berkeley, California, have initiated studies of three common birds—Alaska Longspur, Snow Bunting and Red Phalarope—at the Arctic Research Laboratory, Point Barrow, Alaska. The objective is to gather comparative data on population numbers, breeding success, and various aspects of behavior with relation to the far northern environment. Barrow is at 71°N. latitude and has continuous daylight throughout the nesting season.

We are sorry to report an error in Founder Reuben M. Strong's biographical sketch which appeared in the June issue of the *Bulletin*. Dr. Strong was President, not Vice-President, of The Wilson Ornithological Club from 1894 to 1901. He also was a Member of the American Ornithologists' Union from 1903 until being elected a Fellow in 1949.

The editors are grateful to the following for assistance in preparing for publication the material appearing in this issue: Patsy Belle Bateman, William Brudon, Irving Burr, Richard Fischer, Theodore Hubbell, John F. Kent, William A. Lunk, Margaret Morse Nice, and Hugo Schroder. They are especially grateful to Elsa Hertz for her generous secretarial assistance.

ORNITHOLOGICAL LITERATURE

Check-List of Birds of the World, Vol. 7. By James Lee Peters, Museum of Comparative Zoölogy, Cambridge, Mass., 1951: 6 × 9 in., x + 319 pp. Price $6.00; no discount.

Apart from the small Old World family Eurylaimidae (the broadbills), of which 8 genera and 14 species are recognized, the seventh volume of Peters' monumental check-list of the birds of the world, the publication of which has now been taken over by the Museum of Comparative Zoölogy, is devoted entirely to neotropical families of the superfamily Furnarioidea, including the wood-hewers (Dendrocolaptidae), ovenbirds (Furnariidae), ant-thrushes (Formicariidae), ant-pipits (Conopophagidae) and tapaculos (Rhinocryptidae). No species in this group has been recorded from North America north of México.

Since these New World families were monographed by the late eminent ornithologist Dr. C. E. Hellmayr less than 30 years ago, a comparison of the two works is pertinent. Important changes include the elimination of subfamilies, a decrease in the number of species (527 vs. 540), and a great increase in the number of recognized forms (1581 vs. 1163). Several genera have been removed from the Formicariidae, *Melanopareia* being placed in the Rhinocryptidae, while *Psilorhamphus*, in addition to *Ramphocaenus* and *Microbates*, are referred to the Sylviidae. Of the genera we note that "*Dendroplex*" is merged with *Xiphorhynchus*, "*Dendrophylax*" with *Leptasthenura*, "*Drioctistes*" with *Phacellodomus*, "*Microxenops*" with *Xenops*, "*Apocryptornis*" with *Grallaricula*. Six genera (*Ochetorhynchus*, *Spartonoica*, *Hellmayrea*, *Gyalophylax*, *Roraimia*, and *Simoxenops*) are added to the Furnariidae, two (*Xenornis* and *Myrmophylax*) to the Formicariidae.

This reviewer is impressed not only with the standard of accuracy and attention to details characteristic of Peters' work, but also with his conservative taxonomic treatment in contrast with the works of certain other authors.—James Bond.

Bird Portraits. By J. C. Harrison, with an introduction by Seton Gordon. Country Life Limited, London, and Charles Scribner's Sons, New York, 1950: $8\frac{3}{4} \times 11\frac{1}{2}$ in., 119 pp., with 16 color plates and numerous reproductions of pencil drawings. $12.50.

J. C. Harrison deserves to be far better known in America than he is, for he is one of the most gifted bird artists of our times. Anyone who has worked hard at drawing birds can tell at a glance from the many illustrations in this book how patiently Harrison has studied his models. No one but a very thorough observer would give a Golden Eagle (*Aquila chrysaëtos*) the particular head-shape shown at the lower left on p. 17, or an Eagle Owl (*Bubo bubo*) the peculiarly ungraceful lumpiness which makes the sketches on p. 35 so beautiful and authentic.

Of special interest are the drawings of the Osprey (*Pandion haliaetus*) on pp. 20 and 21. Several of these, especially Nos. 6 and 7, seem a trifle too heavy-winged or heavy-bodied; but Harrison's work is so dependable on the whole that we cannot help wondering whether our American Osprey may be more slender of wing than the European bird. Such a subspecific difference would be quite possible. Two figures shown on p. 20 are, incidentally, wrongly identified: No. 1 is a Golden Eagle and No. 3 an Osprey, rather than *vice versa*.

For several reasons the pencil sketches are an especially valuable part of the book. They have great appeal *per se*, for they are drawn directly, they are not fussed over at all, and they are full of life. Even the most meager outlines have character and charm. Some of the duck and grebe drawings on p. 83 and the ptarmigan on pp. 96 and 97 are especially good. A notable fact about all these pencil sketches is that they graphically report on natural history as well as on the beauty, strength, and poise of birds. Note in this connection the sketches of Montagu's Harrier (*Circus pygargus*) on pp. 23 and 27. Here we see a female calling to her mate from the nest; the male and female passing food midair; a female alighting with a bit of material for the nest.

The drawings of flying birds of prey are appealing and worth careful study. Those showing the birds coming head-on are especially well done, and this angle is far from easy to draw. Students of aeronautics will be especially interested in the way the artist has depicted the primaries and alula feathers. The primaries of the Golden Eagle shown on p. 16 are wonderfully well drawn. Compare these primaries with those of the falconiform birds shown photographically on pp. 65, 70 and 71 in John H. Storer's "Flight of Birds" (1948. Cranbrook Institute of Science, Bull. 28).

Among the drawings of small birds none are more authentic than those on p. 45 of the Rose-colored Starling (*Sturnopastor roseus*). Anyone who has seen the Common Starling (*Sturnus vulgaris*) striding along through the grass hunting for food will instantly recognize the birds as starlings despite the crests and oddness of pattern. All the Raven (*Corvus corax*) drawings are good, though it seems to me that they do not show the tail quite wedge-shaped enough. I have studied *Corvus corax* in the American arctic, the Pennsylvania mountains, the Aleutians, and southwestern México and have many times noted that except when the tail is spread very wide in quick turning flight, the wedge shape is apparent. In some sketches on p. 39 I think the middle rectrices should have been drawn a trifle longer. The croaking bird, coming straight on with mouth wide open, is well done. Making that particular angle look just right is anything but easy draftsmanship.

The color plates, though beautiful, are less appealing to me *as a group* than the pencil drawings. 'Ptarmigan disturbed by a Golden Eagle on the snowy corries of the Cairngorms' (p. 99) is dramatic as well as sound both geologically and ecologically. Its rocks look hard, its snow cold, its birds feather-covered. The rocks in the Golden Eagle frontispiece, on the other hand, have a soft, almost translucent quality which the artist probably did not in the least intend and which may not be apparent in the original. Most of the birds shown in the color plates have good three-dimensional quality, the light and shadow being well worked out; but the Golden Eagle shown on p. 19 is so light underneath, despite the rather heavy shadow it casts on the rock, that it seems almost disembodied. Here the artist might have made his effort count for more had he paid less attention to feather-detail and more to the mass effect of light and shadow. To me the fussiness of this painting tends to reduce the eagle both in size and power.

Harrison's brush work can be remarkably good. Note the way the accessory material in the 'Gray-headed Wagtail' (p. 47) has been whisked in; the freedom of strokes used in representing the marsh vegetation in the 'Mallard' (p. 75); the all but untouched parts of the sky in 'Barnacle Geese taking off' (p. 59).

'Bird Portraits' is a book both artist-commentator and publisher may well be proud of. Let us hope that it will find its way into the hands of many American students of birds and bird art.—George Miksch Sutton.

A Bibliography of the Published Writings of Charles Johnson Maynard 1845–1929. By C. F. Batchelder. *The Journal of the Society for the Bibliography of Natural History*, Volume 2, Part 7, pp. 227–260, January 4, 1951. The Society for the Bibliography of Natural History, British Museum (Natural History), Cromwell Road, London, S.W. 7. $6\frac{7}{8} \times 10\frac{1}{4}$ in., paper, 15*s*. 0*d*.

A published bibliography is particularly useful when it brings attention to important items in unexpected or out-of-the-way places—as this one does.

Maynard wrote much of general interest about the birds of eastern North America, and his works on the birds of Massachusetts, Florida, and the Bahamas are among the most valuable historical references for those areas. Between 1872 and 1916 he proposed more than 40 names for bird species and genera. Many of his field notes are still of exceptional interest; for example, in his writings we find almost the only existing clue to the habitat and behavior of the Kirtland's Warbler on its wintering grounds.

Although first of all an ornithologist, Maynard's interests were broad and his subjects for publication included butterflies and other insects, snails, marine invertebrates, mammals, reptiles, frogs, plants, and Indians.

Yet many of Maynard's works would be missed in a most thorough search of the usual literature. This bibliography, possibly still not complete, lists almost 300 items published from 1868 to 1928, most of them about birds, but only two of them in ornithological journals now being published (or predecessors). Some were published in scientific journals but others found their way into farm, household, and sportsmen's magazines. Many of his books, pamphlets, and periodicals were products of his own craftsmanship—typesetting, presswork, woodcuts, lithography, and hand-coloring of illustrations—and the number of copies printed was small. His choice of method for publication reached the height of singularity when he described several new species of land snails as embellishment for price lists of natural history specimens he was offering for sale.

The bibliography is preceded by an introduction that tells something about the life of this versatile individual and discusses some of the problems he has presented to the bibliographer. It lists the items of the bibliography in chronological order. At the end, there is an index to new scientific names he proposed.—Harold Mayfield.

The Pre-egg Stage in the Albatross Family. Biological Monograph No. 3. By L. E. Richdale. Otago Daily Times and Witness Newspapers Co., Ltd., Dunedin, New Zealand, 1950: 92 pp., 13 figs. Price 10*s.* from the author, 23 Skibo Street, Kew, Dunedin, S. W. 1, New Zealand.

In the third of his admirable series of monographs, Richdale presents original observations on the breeding behavior of the Royal Albatross (*Diomedea epomophora*) on Taiaroa Head, New Zealand, from 1936 to 1949, and uses these as a basis for comparisons with the breeding behavior of the other species of albatrosses. For these comparisons, he draws largely on his own field experience with Buller's Mollymauk, the subject of the second monograph in this series, and from the writings of R. C. Murphy, L. H. Matthews, W. K. Fisher, and F. C. Hadden.

By the term "pre-egg stage" is meant the period from the time the adults return to the breeding grounds until the egg is laid. The types of behavior observed during this period are named, defined, and discussed. Some of the names used for the behavior patterns seem overly anthropomorphic and at times inappropriate (as in the legend for figure 10 which reads in part "The fledgling . . . was refused further food and responded with the ecstatic ritual."). This, however, is quibbling, for the author never makes the mistake of interpreting the behavior anthropomorphically.

The photographs which illustrate the types of behavior are a fine example of the value of photography in life history work. Too often bird photographers concentrate on taking pictures of rare or striking birds for the sake of the pictures themselves. Richdale's photographs illustrate types of behavior and are thus important for their content as well as pleasing to the eye.

In his papers on penguins and tubinares, one of Richdale's major contributions has been his discussions of "unemployed" birds, and this subject is treated at length in this study. Nine classes of unemployed birds are recognized: non-laying mated pairs (pairs which were known to have bred in former years), non-laying paired birds (pairs which have not bred), mated pairs which lost eggs, mated pairs which lost chicks, birds which returned without mate, birds which attempted to breed elsewhere and later returned to Taiaroa breeding area, unattached birds, young birds which returned to place of hatching, and fledglings. The behavior of birds in each class is discussed, and the behavior of unemployed birds is contrasted with that of breeding pairs. The author's ability to identify individual birds, either by means of bands or by irregularities in the web of the foot, made this analysis possible.

As might be expected, the comparisons with the behavior of species with which the author is unfamiliar in the field are not as full as one might wish. The fault lies in the inadequacy of the literature, as anyone who has tried to find good descriptions of even the simplest behavior patterns will agree. Nevertheless, Richdale has made a definite contribution in pointing out what needs to be learned about the other albatrosses. His most important contributions, however, are the series of descriptions of types of behavior, which can be used by future workers as a basis for studying other species, and a full account of the breeding behavior of a second species of this relatively little-studied family of birds.

The author is to be commended further for having founded this monograph series as an outlet for his valuable studies, and we hope that many more such monographs will follow.—Robert W. Storer.

Where to Find Birds in Minnesota. A Guide to 62 Birding Areas, Parks, Sanctuaries. Compiled by Kenneth D. Morrison and Josephine Daneman Herz. The Webb Publishing Co., St. Paul, Minn., 1950: 5 × 8½ in., xiii + 122 pp. Illustrated with maps and line drawings. $1.50.

This is a neat little volume for anyone who goes birding in Minnesota. The North Star State is a varied and fascinating area, with its lakes, coniferous and deciduous forests, and wide prairies. Its biotic resources include the northernmost bit of land in the United States, a large portion of the Quetico-Superior wilderness, the great muskeg north of Red Lakes, the source of the Mississippi, a part of the Red River valley with still discernible beach lines of old glacial Lake Agassiz, and near-Carolinian conditions in the Southeast along the Mississippi.

Some idea of its ornithological possibilities may be gathered by listing a few of the state's breeding birds. These range from Western and Eared Grebes, Franklin's Gull, Prairie Chicken and Sharp-tailed Grouse, Marbled Godwit, and Sprague's Pipit in the West; through Spruce Grouse, Pigeon Hawk, Arctic Three-toed Woodpecker, Canada Jay, Hudsonian Chickadee, and Evening Grosbeak in the North; to Red-bellied Woodpecker, Tufted Titmouse, Carolina Wren, Blue-gray Gnatcatcher, and Prothonotary and Cerulean Warblers in the Southeast. Truly, this is varied fare for the bird finder.

To suit their purposes, the compilers of this book have divided Minnesota into four roughly-equal quadrats, Southwest, Southeast, Northwest, Northeast. Within these quadrats they have presented detailed notes on sixty-two stations which hold typical, or unusually promising, ornithological possibilities. Individual points of interest have been treated by forty-nine persons, most of them Minnesota bird students with special knowledge of certain regions.

Under the places or areas treated, there are road or trail directions, discussion of the terrain, and notes on vantage points for observation, hazards of the areas, and species records of unusual interest. There is a listing of characteristic bird species or groups from each station, with brief tabulations of season of occurrence and local habitats. The information presented is concise and highly usable.

Users of the volume are warned, very properly, by the compilers that not every species listed under a given area is always to be found there. Despite this warning, it must be expected that some visitors will become irked if they miss a single one of a station's bird desiderata. This attitude is one which every author or compiler of local bird guides has to face. It may fairly be classed as an occupational hazard, to be endured by those who serve in this useful capacity.

Mr. Morrison and Mrs. Herz have done for Minnesota what Olin Sewall Pettingill, Jr., in two forthcoming volumes, is doing for the country as a whole. Such labors of love are certain to make the lot of the birding-traveller happier and more productive.—Maurice Brooks.

Trapping Methods for Bird Ringers. By P. A. D. Hollom. British Trust for Ornithology Field Guide Number One. The Potter Press, Oxford, 1950: $5\frac{1}{2} \times 8\frac{1}{2}$ in., 40 pp., 25 figs. Paper 2*s*. 6*d*.

In this Field Guide, the British Trust for Ornithology presents information on automatic and non-automatic traps as well as several types of nets which have been used successfully by British ornithologists. Trap specifications for small birds are similar to those found in Lincoln's "Manual for Bird Banders." American ornithologists, however, might well be able to adapt to their needs the basic principles of the crow trap (p. 7), raft duck trap (p. 8), Skokholm Dunlin trap (p. 24), or the Winchelsea Starling net (p. 37). Techniques little used in this country are *Bat Fowling* (p. 33), "the catching at night of shrub or hedge-roosting birds in a net attached to two light poles" (see also Lincoln, 1947: 67), and *Dazzle Netting* (p. 39, and Lincoln, 1947: 66), blinding birds by flashlight.

It is self-evident that certain basic techniques must be employed in any thorough life-history study. Color-banding is one of these basic techniques. Only by observing marked birds can precise data be obtained on re-nestings, second broods, change of mates, territorial boundaries, post-nesting activities, etc. Bird trapping, then, becomes an essential aspect of life-history study. Furthermore, the life-history student often discovers that traps which have proven successful for some species are unsatisfactory for his problem. Modifications of existing trap-types, therefore, frequently must be made to fit specific needs. Consequently, it is believed that the present pamphlet will be of value to the student of bird behavior as well as for the bird-banding cooperator.—Andrew J. Berger.

Handbook of Attracting Birds. By Thomas P. McElroy, Jr. Illustrated with 51 figures by Lambert Guenther. Alfred A. Knopf, New York, 1950: 8×6 in., xiv + 163 pp. $2.75.

This is another book which briefly discusses methods for attracting birds to gardens, estates and farms. There are the usual chapters on *Why Attract Birds?*, *Artificial Feeding*, *Trees, Shrubs and Vines Attractive to Birds*, *Helping Birds at Nesting Time*, *Homes for Birds*, *Attracting Waterfowl*, *Birds in the Small Garden*, *Care of Young and Wounded Birds*, etc.

Mr. McElroy discusses recognized theories and techniques (territoriality, value of running water, sanctuaries) which may be used to attract birds, but he adds nothing to what has already been presented by McKenny (1939. "Birds in the Garden and How to Attract Them") and Baker (1941. "The Audubon Guide to Attracting Birds"). Desiring thorough coverage, the authors of such books discuss birds whose breeding habits vary from those of Wood Ducks to Baltimore Orioles and Song Sparrows. The suburban dweller or owner of a small garden must, indeed, feel discouraged when his serious efforts fail to attract Purple Finches, Crested Flycatchers and Yellow Warblers. Greater emphasis might have been placed, therefore, on birds easily attracted to small gardens—such as the Song and Chipping Sparrows, House Wren, Cardinal and Catbird.

Encouragement should be given to any book which furthers public education on the subject of predation (Chapter 14) and which stresses the value to wildlife of bushy hedgerows over clean ones (p. 91), but these facts are well known to ornithologists and one wonders how broad an audience these books reach.

This attractively made handbook will, however, serve as an excellent source of information for scout leaders and for the public school teacher who wishes to develop a teaching unit on birds and who is besieged by questions on birds and bird houses by all children, and some parents, at one time or another.—Andrew J. Berger.

DAVID CLARK HILTON

Dr. David Clark Hilton, who was born on a farm near Dorchester, Nebraska, on April 22, 1877, and who died December 12, 1945, had an international reputation as a physician and surgeon. As a young man he headed the Science Department of Cotner University and was Demonstrator in Anatomy at the University of Nebraska. He became an attending surgeon at St. Elizabeth's Hospital in 1905 and Chairman of Surgery at Bryan Memorial Hospital in 1926, and held these two positions all his life. He did post graduate work in Vienna and Paris in 1927. He was consultant in General Surgery for the U.S. Veterans' Bureau Hospital from 1932 to 1940. During the First World War he was a Captain in the Medical Corps. He was instrumental in organizing the 110th Medical Regiment of the Nebraska National Guard, of which outfit he was Commanding Officer from 1925 to 1940. He was Division Surgeon of the 35th Division of the National Guard from 1927 to 1940. He was a graduate of the Command and General Staff School of the U.S. Army, being retired in September, 1940, as a Brigadier General of the line. His interest in military medicine took him to Warsaw, Poland, as American delegate to the International Congress of Military Medicine and Pharmacy in 1927 and to England, as delegate of the 6th Congress, in 1929. He was awarded the Cross of the Army Medical School by Poland in 1927. Honors of many sorts were conferred upon him and his duties, like his interests, were many. He was very active in the Masonic Order and in the Episcopal Church. He is survived by his wife, Sarah Luella O'Toole Hilton, and three children: Mrs. Blossom Virginia Gish of Texas, Mrs. Ruth Burgert of Chicago, and Dr. Hiram David Hilton of Lincoln, Nebraska, himself an accomplished surgeon.

David Hilton was interested all his life in birds. His knowledge concerning, and defense of, the birds of prey made a deep impression on a Nebraska lad who was one day to become a bird artist. The friendship between the famous surgeon and the artist continued. During the last years of his life Dr. Hilton visited México. His letters from that country were full of ornithological questions—some of them difficult to answer. The family of David Hilton, knowing how deeply interested he would be in water color portraits of some of the very birds that had so puzzled him in 1944 and 1945, have offered to finance the reproduction of eight of these in full color and to present the engravings to The Wilson Ornithological Club. The first of the series, that of the Rufescent Tinamou, appeared in the June issue of the *Bulletin.* The next will probably appear in March, 1952. The reproductions will appear also in a book, 'Mexican Birds,' now being published by the University of Oklahoma Press.

INTERGENERIC GALLIFORM HYBRIDS: A REVIEW

BY TONY J. PETERLE

Henry Seebohm, in "The Birds of Siberia" (1901: 501–502), makes this cogent observation: "The subject of the interbreeding of nearly-allied birds in certain localities where their geographical ranges meet or overlap, and the almost identical subject of the existence of intermediate forms in the intervening district between the respective geographical ranges of nearly-allied birds, is one which has not yet received the attention which it deserves from ornithologists. The older brethren of the fraternity have always pooh-pooh'd any attempt to explain some of these complicated facts of nature by the theory of interbreeding, and have looked upon the suggestion that hybridisation was anything but an abnormal circumstance as one of the lamest modes of getting out of an ornithological difficulty." The following summary will show that interbreeding of galliform genera has often been observed: indeed that two wholly different intergeneric hybrids, one of the Old World, one of the New, have been recovered so often that they can hardly be considered 'abnormal' except in a very limited sense.

The Old World hybrid referred to results from the crossing of the Blackcock (*Lyrurus*) and Capercaillie (*Tetrao*). DeWinton (1894: 448) said that "of all hybrids among birds in a wild state this one seems to be the most frequent." Authors seem to be in agreement that the hybrid results principally, if not always, from the interbreeding of male *Lyrurus* with female *Tetrao* in areas throughout which (a) extension of range is taking place, or (b) one or the other genus is rare, e.g., Scotland, where *Tetrao* has been introduced following extirpation (Millais, 1906: 55–56; DeWinton, 1894). Witherby *et al.* (1941: 210) summarize by saying: "In regular extensions of range females [*Tetrao*] habitually precede males, which, however, 'are seldom more than a season in following them' (Millais), and before appearance of males females are liable to pair with Blackcock, producing hybrids." Data as to the fertility of these hybrids are conspicuously lacking. *Lyrurus* and *Tetrao* are known to hybridize also with other genera—especially *Phasianus* and *Lagopus* (see below).

The New World hybrid referred to results from the crossing of the Prairie Chicken or Pinnated Grouse (*Tympanuchus*) and Sharp-tailed Grouse (*Pedioecetes*). William Brewster (1877: 66–68) described this hybrid, "provisonally" calling it *Cupidonia cupidini-columbiana*, following the nomenclatural practice of Robert Collett (1872. "Remarks on the Ornithology of Northern Norway." *Forhandl. Vidensk. Selsk.*, Christiania, p. 50). Since 1877 numerous articles have appeared regarding this hybrid, but so far as I know none of these gives any positive information as to the reproductive capacities of the F_1 generation. Recently observed intergradation between the two genera on Manitoulin Island, Lake Huron, indicates a high percentage of fertility among hybrids. Amadon (1950: 494) says of this area: "Manitoulin Island . . . was recently colonized by both Prairie Chickens . . . and Sharp-tailed Grouse. . . . The latter occur in much smaller numbers and, presumably as a result of their failure to find mates of their own species, a high percentage of the Manitoulin grouse thus far examined show evidence of hybridization."

Tympanuchus and *Pedioecetes* have been known to interbreed also with other genera. A *Tympanuchus* × *Phasianus* hybrid reported recently by Lincoln (1950: 212) was actually taken about 1933. A *Pedioecetes* × *Dendragapus* hybrid reported by Brooks (1907: 167) was taken at Osoyoos, British Columbia. The specimen is in the Provincial Museum at Victoria, Vancouver Island.

Many hybrids involving the Ring-necked Pheasant (*Phasianus colchicus*) have been reported, most of them from the Old World, a few from the New. Jourdain (1912) reported 60 *Phasianus* × *Lyrurus* hybrids of British origin. Clarke (1898: 17–21) described four *Phasianus* × *Tetrao* hybrids from Scotland. Numerous *Phasianus* × *Gallus* hybrids have been reported.

A recent hybrid of this type from Oceana County, Michigan was reported in the newspapers. J. M. Moore, Extension Poultryman at Michigan State College, East Lansing, Michigan, has supplied me the following information (letter dated November 30, 1950) concerning this bird: "Two years ago this spring [i.e., in 1949], a couple in Oceana County bought or were given a number of pheasant eggs from the State Game Farm, which they hatched out and brooded under a White Rock Hen. At 6 weeks old, the birds were released. All except one [a male] left for the wilds immediately. The one pheasant stayed with the mother all that Summer and Fall and during the winter time roosted in a tree outside the house. . . . A year ago this Spring [i.e., in 1950], this pheasant cockbird mated with this [foster mother] White Rock Hen and she stole her nest. The crossbred chicks hatched. Because the hen had stolen her nest quite a few of the eggs were spoiled during the hatching period and finally 5 chicks were hatched out. Unfortunately 4 of the 5 hybrid chicks drowned by getting into an uncovered water dish, leaving only 1 bird. This bird turned out to be a female and was kept in captivity with the mother White Rock Hen." In 1951, a male Ring-necked Pheasant was introduced into the mating pen with both the White Rock Hen and the hybrid female pheasant. Mr. Moore recently wrote that: ". . . the hybrid cross seemed to be so afraid of this foreign bird in the pen that we think she just ran herself to death through fear."

Anthony described a *Phasianus* × *Dendragapus* hybrid from Portland, Oregon (1899: 180) and listed three other specimens of the same sort. He stated that "the report that such crosses are not uncommon would seem to have some foundation."

Bump (1947: 268) reported a *Phasianus* × *Bonasa* hybrid taken about 1930 in western New York. The specimen has been lost. Interbreeding of the Ruffed Grouse and a domestic chicken has been reported by J. E. H. (1886: 4) from West Virginia, but the report has never been confirmed.

Pleske (1887) described and figured both a male and female *Lyrurus* × *Tetrastes* hybrid. He referred to two earlier papers on this hybrid, one by Dresser, the other by Bogdanow.

Hybrids involving the genus *Lagopus* have been reported from Europe far more often than from America, possibly because interest in this genus as a game bird is greater in the Old World than in the New. *Lagopus* × *Lyrurus* hybrids have been reported several times. In his excellent discussion of this cross, Collett (1886) listed 22 specimens from Norway and 12 from Sweden. Millais (1909: 52) considered the *Lagopus scoticus* × *Lyrurus tetrix* hybrid "extremely rare." Collett (1886) mentioned a *Lagopus* × *Tetrastes* hybrid from Sweden.

Taverner (1932: 89) reported a *Lagopus* × *Canachites* hybrid. This is the only instance of intergeneric hybridization involving the Spruce Grouse so far as I know.

Millais (1899: 36), at a meeting of the British Ornithological Club on February 15, 1899, exhibited a hybrid involving *Lagopus scoticus* and a female bantam fowl (*Gallus*).

Strangely enough, of reported intergeneric hybrids among American quail only one, so far as I know, has involved the widespread genus *Colinus*. Aiken (1930: 80) reported on three *Colinus* × *Lophortyx* specimens taken near Salt Lake City, but these have been lost.

Bailey (1928: 210) reported a *Callipepla* × *Lophortyx* hybrid taken near Pinos Altos, New Mexico, in 1916. The specimen was sent to Louis Agassiz Fuertes, who made a very beautiful feather-by-feather painting of it. When Fuertes acknowledged receipt of the specimen he mentioned that he had "once painted a very interesting wild hybrid (male) *Lophortyx* and *Oreortyx* for Mr. Loomis."

All that remains of this particular *Lophortyx* × *Oreortyx* specimen is a *print* of a photograph of the Fuertes drawing. The skin itself, the Fuertes drawing, and apparently the negative of the photograph of the drawing all were destroyed in the San Francisco fire. Through the courtesy of Kenneth C. Parkes I have obtained a photograph of the print referred to. This has been reproduced here.

Peck (1911: 149) described in detail an *Oreortyx* × *Lophortyx* hybrid taken in 1911 in Harney

County, Oregon. The specimen is now in the collection of the University of California Museum of Vertebrate Zoology.

Other intergeneric galliform hybrids have been reported from various parts of the world, but those discussed above seem to be the most important in so far as game species of the northern hemisphere are concerned. Numerous crosses involving *Gallus*, *Numida*, *Pavo*, and certain of the ornamental pheasants have been reported, but these hybrids have appeared

FIG. 1. *Lophortyx* × *Oreortyx* male hybrid. Photograph of a painting by Louis Agassiz Fuertes.

principally under artificial conditions. The validity of certain reports must remain doubtful. Finsch (1892) reported a *Gallus* × *Menura* hybrid. The crossing of a galliform bird with any such *passeriform* bird as the Lyre-bird would seem to be quite impossible.

Habitat and Breeding Behaviour in Relation to Hybridization

Tetrao × *Lyrurus*. The habitats of these grouse apparently overlap to some extent at some seasons. Witherby *et al*. (1941: 209–210) described the habitat of *Tetrao* as follows: "Frequents mature coniferous woodland (larch, spruce, scots pine) of medium density with a fair amount of undergrowth. . . . In autumn, spring and winter numbers make short local movements to low-lying woods of oak, birch and larch, but most, especially old males, return to higher ground in late autumn and spring; in autumn sometimes found amongst heather at some distance from woods and also visits stubble or more rarely turnip fields (Millais)." These authors describe the habitat of *Lyrurus* thus: "Haunts fringes of moorland rather than open moors, resorting to rough, heather grown or bushy land, sparsely wooded places and bushy borders of woods or plantations, rushy pastures and marshy ground; also lowland heaths, peat-moors, etc. with heather, gorse and (or) other scrub and frequently, though not always, with scattered birches or other trees."

Tetrao and *Lyrurus* are somewhat similar in breeding behaviour. Writing of *Tetrao*, Witherby *et al*. (1941: 211–212) say: "'Song' of male is uttered in characteristic attitude with the neck stretched up, tail fanned and vertical or nearly so and wings drooped during most of the time. . . . During displays on ground 'songs' are interspersed with parading to and fro in different directions and leaps of about 3 ft. into air, accompanied by noisy flapping of wings." Of *Lyrurus* they say (1941: 217–218): "Has special display-grounds or 'leks', to which both sexes resort and at which coition takes place . . . In all of the several display attitudes tail is fully spread, . . . , wings are partly drooped and red wattles above eye distended. In crowing . . . , to some extent a social performance, head and neck are held upright and bird either remains stationary, slightly raises head and lowers wings, or jumps into air."

Pedioecetes × *Tympanuchus*. In discussing the habitat requirements of *Pedioecetes*, Grange (1948: 237–239) says: "The final or desired arrangement [of plants] is prevailingly open. In gross appearance it presents long views across grass, sedge, weed and herbaceous covering dotted with innumerable clumps and groves of shrubs, bushes, saplings, and some larger trees. . . . Prairie chickens often use the pattern, overlapping with sharptails, but this is not typical."

In Michigan, according to my observation, the Prairie Chicken and Sharp-tailed Grouse now associate only in areas throughout which scattered colonies of the Prairie Chicken remain. Range-overlap has been increased through the introduction of the Sharp-tailed Grouse into the eastern part of the Upper Peninsula and the northern part of the Lower Peninsula. These introductions were begun about 1937 and hybrids have been reported from the two areas for the past several years.

The breeding behavior of these two genera is so well known that a comparison here is hardly necessary. Both are polygamous and both assemble on displaying or sparring-grounds. The high frequency of interbreeding between these genera must result, in part at least, from range-overlap plus similarity of breeding behavior. It is interesting to note that on the basis of osteology alone, Shufeldt (1881: 348) could "perceive no good reason" why *Tympanuchus* and *Pedioecetes* should not be merged.

This brief summary of galliform hybrids is but a beginning toward a much needed study of the basic factors involved in intergeneric relationships. The importance of habitat and behavior overlap apparently has not been considered by those reporting on the occurrence of wild hybrids. Data as to the viability and fertility of hybrids are almost non-existent. Such data are important economically since they may have profound bearing upon management techniques. Further study of hybridization may effect also certain of our taxonomic concepts.

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A SERIOUS PROBLEM IN CONSERVATION

Dinosaur National Monument had its origin some eons ago when giant, grotesque reptiles died for reasons now resolved only by speculation. These monsters were buried in rock and soil of a land that was later to become part of the state of Utah. So scientifically and recreationally important were the remains of these prehistoric animals, that in 1915, 80 acres surrounding the main fossil site were set aside as a national monument.

The graveyard of the dinosaurs in the valley of the Green River is auspiciously located. The swift flowing Yampa River joins the Green about 20 miles upstream. Together these two streams with whirlpools and eddies have cut a series of exquisitely beautiful canyons from the equally handsome mountain landscape.

The awe-inspiring grandeur of these two river valleys in the region of the dinosaur fossils caused 209,000 acres of the combined watersheds in Utah and Colorado to be added to the monument in 1938. As a national monument, it is not as well known as others; it is none the less as elegant scenically and as important scientifically as they.

Despite the fact that the 1935 amendment to the Federal Power Act prohibits such areas from becoming part of a power project, the Bureau of Reclamation in 1946 proposed two dam sites *within* the area. The National Park Service came to the defense of Dinosaur National Monument with the same fervor it would have shown had the proposal been that Yellowstone National Park be leveled in order to build a mammoth roller skating rink. The problem in brief is this: one government agency is recommending that a national park, which is under the jurisdiction of another government agency, be made into a reservoir instead of serving in its present capacity as a recreational and scientific area.

The main stand of the Bureau of Reclamation is that, without these dams, there will be less annual revenue and higher unit power costs for the people of the Colorado watershed and Bonneville basin. The Park Service contends that it is not unmindful of the needs of even this extremely small fraction of our national population. The benefits of the proposed impoundments would be adequately and satisfactorily derived from dams and reservoirs *outside* the monument.

The life expectancy of a dam and reservoir of this kind and in this place is about 80 to 120 years. The natural beauty and scientific wealth of this area was about a hundred million years in the making. Flooding the Dinosaur National Monument would ruin it for all future generations.

It must be realized that once a proposal of the Bureau of Reclamation is accepted by the Congress, moneys are made available to carry out the dictates of that proposal. In this case, the dams would cost about $207,000,000. The immediate political and economic potency of such a plan might be overwhelming to an agency like the Park Service which must carry its case on the long range benefits derived from the aesthetic values of the land and the fact that national parks were made inviolate as part of our heritage.

This proposal for more water to produce more irrigation to produce more farm commodities comes at a time when this nation is subsidizing farm goods at a phenomenal cost and when our surpluses are greater than at any time in our history. Unfortunately our present emergency creates a *modus operandi* for "big" agencies to gobble up that part of our way of life that cannot be reduced to taxable figures.

No one doubts the sincerity of those who propose to better the economic status of any area or community by the impoundment of water. It is only the wisdom of method that is challenged. The disturbing factor in this conflict of values, however, is the fact that the Reclamation Service should prescribe an apparently unnecessary encroachment on a national park. If such demands are realized, the waters of Yellowstone, Glacier, Yosemite and Grand Canyon national parks (to name a few) would be in jeopardy. To lose Dinosaur National Monument on this issue might well be the opening for other governmental branches and large private interests to exploit our all-too-few national parks.

What does all this mean to you? That depends on how you regard your stake in our national heritage. It depends also on whether you can accept an unnecessary ruination of national property in order to receive a short term monetary benefit for a few, or whether you subscribe to a long range view which keeps the national parks program inviolate in order to insure the greatest good for the greatest number over the longest period. It doesn't matter whether you are a rock-ribbed Vermont yankee or a mullet fisherman from the bayous of Louisiana: the problem in principle exists in your part of the country, your state, and even your local community.

As members of the Wilson Club, this report is directed to you as a matter of information.

What to do about this deplorable situation is a matter of what your conscience dictates, but what your conscience dictates might be of great importance to your congressman in Washington. This report is also to put your conservation committee on record as opposing any violation of our national parks as they are now set up. We feel that if our national parks and monuments are to be ruined in the name of national security, it should be done only as a vitally necessary and unavoidable measure.

Let us not melt our liberty bell except to cast the shells for the last cannon.—Robert A. McCabe.

BOOKS: List 9

Books added to The Wilson Ornithological Club Library since the publication of List 8. Lists 1 to 8 were published in the September issues of *The Wilson Bulletin*, 1943 to 1950.

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PROCEEDINGS OF THE THIRTY-SECOND ANNUAL MEETING

BY HAROLD MAYFIELD, SECRETARY

The thirty-second annual meeting of The Wilson Ornithological Club was held at the Davenport Public Museum, Davenport, Iowa, on Friday and Saturday, April 27 and 28, 1951. It was sponsored by the Davenport Public Museum, the Tri-City Bird Club, and the Iowa Ornithological Union.

There were four half-day sessions devoted to papers and motion pictures, two general business meetings, and two meetings of the Executive Council. In addition to the business meetings and papers sessions, there was an informal reception in the Museum on Friday evening and the Annual Dinner on Saturday evening. At the reception, Cleveland P. Grant presented a motion picture and lecture, "Bighorn Sheep of the Rocky Mountains." An exhibit of bird paintings was held during the reception, and after the annual dinner the following night, a number of these pictures were auctioned for the benefit of the color-plate fund of the *Bulletin*. The auctioned paintings were made available through the generosity of the artists, W. J. Breckenridge, Richard Philip Grossenheider, Francis Lee Jaques, O. J. Murie, George M. Sutton, and Roger Tory Peterson.

Following the annual banquet, President Maurice Graham Brooks gave an address, "Ecology for Everyone."

Local leaders conducted field trips before the papers session on Saturday morning and, with the assistance of members of the refuge staff of the U. S. Fish and Wildlife Service, led an extended trip on Sunday, April 29, visiting Federal refuge areas north of Davenport along the Mississippi River.

Opening Ceremonies

Members and guests were welcomed to Davenport by Mr. Arthur R. Kroppach, Mayor of that city. President Brooks responded for the club.

First Business Session

President Brooks called to order the first business session on Friday morning, April 27. The minutes of the 31st Annual Meeting, as published in *The Wilson Bulletin* for September 1950, were approved.

The report of the treasurer, James H. Olsen, was presented, but action on it was deferred until after the report of the Auditing Committee at the final business session.

The secretary, Harold Mayfield, presented the recommendation of the Executive Council that the constitution and bylaws be changed to eliminate the associate membership class and raise the subscription price of the *Bulletin* to $3.00. The exact statement of the amendment and the procedure for voting on it appeared in the *Bulletin* for June, 1951.

The Executive Council accepted the invitation of Tennessee members to hold the 33rd Annual Meeting at Gatlinburg, Tennessee, at the entrance of Great Smoky Mountains National Park. The meeting will be held on Friday and Saturday, April 25–26, 1952.

The editor, George Miksch Sutton, reported that the Hilton family of Lincoln, Nebraska have donated $2,000 which is to be used for the publication of eight color plates on Mexican birds as a memorial to Dr. David Clark Hilton. These will appear in future issues of *The Wilson Bulletin*.

Report of Endowment Committee

Leonard C. Brecher, chairman, reported twelve new life memberships during the past year. The committee recommended that emphasis be placed upon gifts to the endowment fund with the life membership as an incidental recognition of gifts of $100 or more.

Report of Research Committee

John T. Emlen, Jr., reporting for Charles G. Sibley, chairman, recommended that the Louis Agassiz Fuertes Research Grant of $100 be awarded to Howard L. Cogswell, Museum of Vertebrate Zoology, University of California, for a study, "Territory Size and Its Relation to Vegetation Structures and Density Among Birds of the Chaparral." The committee felt that action with regard to the Chalif Grant for bird work in México should be deferred until the membership had had a chance to learn of the grant, through reading the March *Bulletin.*

Report of Membership Committee

The treasurer, James H. Olsen, reported for the Membership Committee (Seth Low, chairman; Ralph Edeburn, vice-chairman) a total membership in The Wilson Ornithological Club of 1740 on April 15, 1951. Included in this list are 161 institutional subscribers to the *Bulletin.*

Report of Illustrations Committee

Robert M. Mengel, chairman, reported on the assistance this committee has given the editor and authors in preparing illustrations, including color-plates, for *The Wilson Bulletin.* This committee assisted in making preparations for the bird art show held at the Davenport meeting and arranged the auction of selected bird drawings for the benefit of the color-plate fund.

The committee has suggested that, when authors want finished drawings prepared from sketches, this work be done by the committee at a charge of $1.00 per hour, with the money going entirely to the color-plate fund of the *Bulletin.*

Whether extensive assistance is required or not, authors planning to submit illustrations along with manuscripts are urged to consult with the chairman of this committee well in advance.

Report of Library Committee

George J. Wallace, chairman, reported that since the last annual meeting 63 people have contributed a total of 44 books, 278 reprints, 78 magazines and bulletins, and 62 volumes of magazines. Special thanks were expressed for generous gifts from Hustace Poor.

An analysis of the past use of the library has shown that there have been 170 separate loans in the period 1942–1949. Many of these loans have included several items each, and the majority of them have gone to people in areas where local library facilities have been limited. In addition, there have been a great many uses of this library by visitors to the Museum of Zoology at Ann Arbor, Michigan.

Consideration is being given to the publication of the entire list of books available in the library, but final decision on this matter has not yet been reached.

Report of Conservation Committee

Robert A. McCabe, chairman, reported that this committee has been attempting to keep members of The Wilson Ornithological Club informed about developments in the field of conservation through the pages of the *Bulletin.* Two reports have been published. The first, concerning the Dingell-Johnson Bill, was prepared by Henry Mosby and William Gunn. The second, dealing with conservation attitudes toward predaceous animals, was prepared by Charles Kirkpatrick and William Elder. A third appears in this issue.

Temporary Committees

The President appointed three temporary committees, as follows:

Auditing Committee
Leonard Brecher, Chairman
Burt Monroe
Dr. R. Allyn Moser
Resolutions Committee
Fred Pierce, Chairman
Thomas Morrissey
Herman F. Chapman
Richard Pough
Nominating Committee
Olin Sewall Pettingill, Jr., Chairman
Dr. R. Allyn Moser
John T. Emlen, Jr.

Second Business Meeting

The second and final business meeting was called to order at 9:00 a.m., Saturday, April 28, by President Brooks. All candidates for membership to the club were elected.

Report of Auditing Committee

The Auditing Committee reported that the books of the treasurer had been examined and had been found correct. Special thanks were expressed to James H. Olsen, the retiring treasurer, for his work during the past year.

Election of Officers

O. S. Pettingill, Jr., reporting for the Nominating Committee, proposed the following officers for election in 1951: President, Maurice Graham Brooks; First Vice President, Walter J. Breckenridge; Second Vice President, Burt L. Monroe; Secretary, Harold F. Mayfield; Treasurer, Leonard C. Brecher; Elective members of the Executive Council, W. C. Vaughan (term expires 1952), Fred T. Hall (term expires 1953), W. W. H. Gunn (term expires 1954).

The report of the Nominating Committee was accepted and the secretary was instructed to cast a unanimous ballot for these nominees.

Harrison B. Tordoff, of the Museum of Natural History, University of Kansas, was announced as the unanimous selection of the Council to become editor of *The Wilson Bulletin* beginning with Volume 64 (1952). He succeeds George M. Sutton, who had asked that his resignation take effect at the conclusion of Volume 63 (December, 1951).

Report of Resolutions Committee

WHEREAS, the members of The Wilson Ornithological Club, assembled in their annual meeting at Davenport, Iowa, April 27–29, 1951, wish to go on permanent record with the following resolutions, therefore

BE IT RESOLVED that we heartily thank the Tri-City Bird Club, the Davenport Public Museum, and the Iowa Ornithologists' Union, co-sponsors, for the fine welcome extended to us and the excellent entertainment accorded us in this, our second Iowa meeting. We sincerely appreciate the spirit of hospitality and the hard work of these local clubs in order to give us one of our finest meetings.

Noting with extreme regret the passing in February of one of our most loved and esteemed members, Dr. Lynds Jones, who was a founder, a past president, and for more than 30 years editor of *The Wilson Bulletin*, BE IT RESOLVED that we formally express our deep feeling over our loss, and that our Secretary transmit to the surviving widow, Mrs. Jones, our sincere sympathy in her bereavement.

Because of their value as scientific research areas for work in ornithology, ecology and the other natural sciences, BE IT RESOLVED that The Wilson Ornithological Club commend the Iowa State Conservation Commission for its efforts to preserve the State's remaining remnants of virgin prairie.

Because of their vital importance to the conservation of the waterfowl of the Pacific flyway, BE IT RESOLVED that The Wilson Ornithological Club urge the Secretary of the Interior and the Congress to take such steps as are necessary to insure an adequate and permanent supply of water for the National Wildlife Refuges of the Klamath Basin.

Papers Sessions

Friday, April 27

Thomas J. Morrissey, Davenport, Iowa, *An Introduction to the Davenport Area.*

Aaron Moore Bagg, Holyoke, Massachusetts, *Spring Migration in the Vicinity of a Warm Front*, slides.

William W. H. Gunn, Ontario Department of Lands and Forests, *Reverse Migration in the Pelee Region in Relation to Weather*, slides.

S. Charles Kendeigh, University of Illinois, *Effect of Temperature on Attentive Behavior in Birds*, slides.

Margaret M. Nice, Chicago, Illinois, *Behavior of a Hand-raised Meadowlark*, slides.

George M. Sutton, University of Michigan, *Fluctuations of Breeding Bird Populations on the Edwin S. George Reserve*, slides.

Haven H. Spencer, Ypsilanti, Michigan, *Observations on Nighthawk Behavior*, slides.

Winnifred W. Smith, Two Rivers, Wisconsin, *The Matin Song of the Eastern Kingbird*, slides.

L. E. Richdale, Dunedin, New Zealand, *Banding and Marking Penguins.*

Earle A. Davis, University of Illinois, *Seasonal Changes in the Energy Balance of the English Sparrow (Passer domesticus)*, slides.

Josselyn Van Tyne, University of Michigan, *Remarks on the Tenth International Ornithological Congress.*

Philip A. DuMont, U. S. Fish and Wildlife Service, *National Wildlife Refuges and Endangered Species of Birds*, slides.

W. J. Breckenridge, University of Minnesota, *The Duck Hunters' Dilemma*, sound motion picture.

Saturday, April 28

N. L. Cuthbert, Central Michigan College, *Some Nesting Habits of the Black Tern in Michigan*, slides.

Paul L. Errington, Iowa State College, *Some Newer Approaches in the Exploration of Population Cycles in Higher Vertebrates.*

Olin Sewall Pettingill, Jr., Carleton College, *A Hybrid Longspur from Saskatchewan.*

Arnold J. Petersen, University of Wisconsin, *Nesting Study of the Northern Cliff Swallow at Jackson Hole, Wyoming*, slides.

William W. H. Gunn, Ontario Department of Lands and Forests, *Wildlife in the High Arctic*, slides and motion pictures.

L. E. Richdale, Dunedin, New Zealand, *The Royal Albatross in New Zealand*, slides.

Dwain W. Warner, University of Minnesota, *Geographic Variation in the Singing Quail*, slides.

Harrison B. Tordoff, University of Kansas, *Developmental Failure of Red Color in Crossbills.*

Robert F. Vane, Cedar Rapids, Iowa, *Swan Lake Field Trip*, motion picture.

Bear River Refuge, filmed by W. F. Kubichek, U. S. Fish and Wildlife Service, motion picture.

Conservation in Action, A new Fish and Wildlife Service Film, sound motion picture.

Sunrise Serenade, filmed by Charles W. Schwartz, Missouri Conservation Commission, and Edgar M. Queeny, St. Louis, Missouri, sound motion picture.

ATTENDANCE

The exact number of people attending this meeting is not known, since many of those attending single sessions, particularly on Friday evening and Saturday afternoon, did not register. A registration fee ($1.00) was charged for the first time in the history of the club's meetings. The total number of members and guests registering was 164, from 20 states, one province of Canada, and two other countries.

From **Arkansas:** 1—*Fayetteville*, Howard Young.

From **Connecticut:** 1—*New Haven*, S. Dillon Ripley.

From **District of Columbia:** 1—*Washington*, Philip A. DuMont.

From **Illinois:** 23—*Blue Island*, Karl E. Bartel; *Champaign*, Earle A. Davis, Jr., S. Charles Kendeigh; *Chicago*, Alfred Lewy, Constance Nice, Margaret M. Nice, R. M. Strong; *Evanston*, Mr. and Mrs. Robert B. Lea; *Galesburg*, Harold M. Holland, Florence Merdian; *Highland Park*, Paul E. Downing; *Itasca*, F. J. Freeman; *E. Moline*, Elton Fawks; *Moline*, Rodney Robinder, O. Ruth Spencer; *Peoria*, Ferd Luthy; *Quincy*, T. E. Musselman; *Rock Island*, Rose Guite; *Springfield*, Virginia S. Eifert; *Urbana*, Harvey I. Fisher, Robert Pearson; *Ursa*, Mrs. Tom Sorrill.

From **Indiana:** 3—*Hanover*, J. Dan Webster; *Richmond*, Stephen W. Simon, Charles Thailer.

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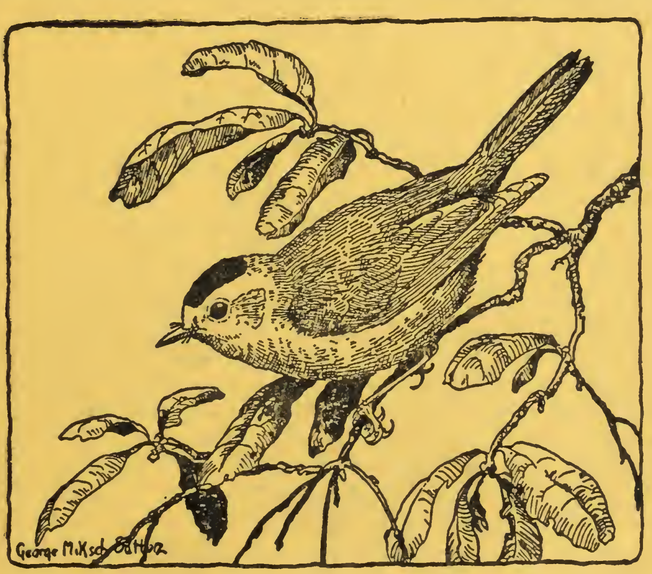

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The Wilson Bulletin

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THE PRESIDENT'S PAGE

It will probably not be news to many Wilson Club members that your President has a considerable degree of enthusiasm in matters pertaining to the Southern Appalachian Highlands. It is to me, therefore, a source of great gratification that the Club will soon be meeting, for the second time in three years, in this region of endless fascinations. Those who know the Great Smoky Mountains will need no urging to attend; those who will be coming for the first time have a rewarding experience in store.

Rich in scenic, historic, and biotic values, the Great Smokies are a fitting climax to the Appalachian system. Upon thousands of acres of mountain slopes the original forest is, perhaps, the finest deciduous stand in any mid-latitude area of the earth's surface. At the highest summits is the extreme southeastern outpost of boreal spruce-fir. In the foothills Yellow-throated Warblers nest, and Chuck-will's-widows call at dusk. Only a few miles away on the crests are Olive-sided Flycatchers, Brown Creepers, Golden-crowned Kinglets, and Winter Wrens.

For those bird students who look also at other vertebrates, the region is rewarding. The Smokies can claim a longer list of lungless salamanders than any other region, and the handsome red-cheeked Jordan's Salamander has been found nowhere else. Bears are abundant, and may be seen along the trails or at picnic and camping areas. Native Brook Trout and other cold-water fishes are found in the tumbling mountain streams.

From the breakfast table in Gatlinburg the visitor may look up an unbroken slope to the myrtle-clad summit of Mount Leconte five thousand feet above. Cars may be driven to within one-half mile of the top of Clingman's Dome, highest point in the range. Two miles beyond this parking area is Andrews Bald, one of the grassy openings whose presence in the Southern Highlands has aroused great ecological interest and controversy. The Appalachian Trail follows the highest ridge, and along it hikers may visit many scenic areas.

Late April is a season of blossoms in the mountains. On lower slopes spring will be well advanced, and its succession may be traced in reverse as one climbs. We shall be too early for the rhododendrons, but others of the heaths will be opening. Redbud, serviceberry, flowering dogwood, silverbell, and other showy plants should be blooming at some level on the mountains.

By no means least among the region's attractions are the people and their ways of living. For two centuries they were isolated, and, with low incomes, had to depend upon home crafts and arts. Some of these crafts persist. Handmade articles, useful and beautiful, are marketed in Gatlinburg, and there are still a few producing handicraft artists. On the eastern slope is the Cherokee Indian reservation, where traditional basketry is still a tribal craft.

This will be the first Wilson Club meeting in one of our national parks. Here we may see at work the program of preserving our forests, waters, wildlife, and other wilderness values. We are privileged to share in this great heritage.

Maurice Brooks

BLUE-HOODED EUPHONIAS
(Tanagra elegantissima)

A pair (male above) eating mistletoe berries. From a painting in water-color based on field-sketches made in the states of Hidalgo and Michoacán, México, in the early spring of 1949.

DISPERSAL OF MISTLETOE BY BIRDS

BY GEORGE MIKSCH SUTTON

THAT birds are an important agent in the dissemination of mistletoe (*Phoradendron*, *Loranthus*, and allied genera) has long been common knowledge; but the more I have seen of birds and mistletoe, and the more I have read concerning the relationships between the two, the more convinced I have become that the 'common knowledge' referred to is only half-knowledge at best. Weaver and Clements, in their standard work, "Plant Ecology" (Second Edition, 1938), sum up this half-knowledge thus: "Mistletoe, a parasite on trees, often of considerable economic importance, is disseminated by birds. After eating the enveloping fleshy rind, the slimy seeds which frequently stick to their bills may be wiped off upon the branches where they are perched and, hence, in places suitable for germination" (p. 128).

Some birds may, indeed, wipe slimy mistletoe seeds from their bills, but birds which I have watched while they were eating mistletoe berries certainly have not removed the enveloping fleshy rind; they have swallowed the berries whole. They may, I believe, occasionally regurgitate a berry and wipe it from the bill, but I have never observed this. Such regurgitated berries probably would not be very sticky. I am convinced that comparatively little dissemination of mistletoe is accomplished through bill-wiping; that most of it is, indeed, accomplished through defecation. What is more, there is a remarkable correlation between this whole process of dissemination-through-defecation and the digestive apparatus of at least some of the bird-disseminators. Serventy and Whittell, in "A Handbook to the Birds of Western Australia," have this to say about the Mistletoe-bird (*Dicaeum hirundinaceum*): "This bird, as its name implies, is intimately associated with mistletoe (*Loranthus*) and is its most active disseminator. As an adaptation to this specialized diet the muscular portion of the stomach . . . has virtually disappeared and the alimentary canal (including the oesophagus, glandular portion of the stomach and the intestine) appears superficially to be an even duct, with no enlargements" (p. 309).

Now for a brief discussion of my first Cedar Waxwing (*Bombycilla cedrorum*) specimen. I shot the bird near Fort Worth, Texas, many years ago. It was one of a large flock perched in the very top of an oak. As I picked it up I was greatly impressed with its sleek plumage and soft colors. Since I had, with my own eyes, seen it and its fellows gobbling mistletoe berries only a few minutes before, I was not surprised when two whole mistletoe berries dropped from its mouth. On skinning it later, however, I *was* surprised when I encountered more mistletoe berries—indeed what appeared to be only partly digested berries—long before I had removed the skin. These I squeezed, quite unintentionally, from the anus as I was wrestling with the problem of skinning over the tail.

The seeds were covered with a translucent pulp so viscous that it stuck first to the feathers (which I was trying hard to keep clean), then to my fingers. I had to wipe my fingers thoroughly in getting rid of the seeds and stickiness. After finishing the skin I opened the body and found many more of the slimy seeds in the large intestine. Most of the berries in the stomach proper were not slimy for their outer covering was still intact.

I have collected several Cedar Waxwings since that early year. Without exception, I believe, specimens which I have taken in the southern United States have had partly digested mistletoe berries in their alimentary tracts. In recent years, in México, I have become acquainted with other confirmed mistletoe-eaters, notably the beautiful little stub-tailed 'tanagers' known as euphonias. Along the Río Sabinas, in southern Tamaulipas, the Bonaparte's Euphonia (*Tanagra lauta*) and slightly smaller Lesson's Euphonia (*T. affinis*) are common, and both are fond of the orange-colored berries of a *Phoradendron* which grows luxuriantly in the lowlands thereabouts. Small flocks of the birds bound along from clump to clump, eating gluttonously. So exclusively do they feed on these berries that, if one wants to observe them, all one has to do is wait a short while near a clump whose berries are ripe.

While collecting specimens of these euphonias in 1938, 1939 and 1941 I noted that invariably the lower intestine contained partly digested mistletoe berries and very little else. I did not, regrettably, examine the stomachs.[1] I made a point of frightening the feeding flocks with a sudden slapping of hands, causing them to fly off. Not badly alarmed, they alighted close by for an instant of chirping and defecating. Examining the droppings which fell, I found these to contain—again invariably—partly digested mistletoe berries. The phenomenon struck me as strange. There were mistletoe berries by the thousand in the vicinity, food enough for all the euphonias and to spare. But why this incomplete digestion? Why not half as much swallowing and twice as much digesting? The more I pondered the question the busier my mental image of the birds seemed to be. Their quest for this favorite food seemed to be little short of frantic.

[1] Wetmore (1914. *Auk*, 31: 458–461), in discussing the alimentary tract of the Puerto Rican Euphonia (*Tanagra musica sclateri*), calls attention to a "degeneration of the ventriculus into a thin membranous band and a straightening of the stomach to facilitate the passage of food . . ." Wetmore believes that these euphonias subsist entirely on mistletoe berries and that they break the "outer skin with their bills and swallow the single seed surrounded by its adhesive pulp." Euphonias which I have observed in México appeared to be swallowing the berries whole. Further observations are in order. Too, the possibility that the genus *Tanagra* belongs in the Dicaeidae rather than in the Thraupidae must be carefully investigated. This would seem to be a fantastic suggestion, to be sure, but the resemblance in size and proportions between *Tanagra* and some dicaeids is certainly close.

In Hidalgo, in 1939, and in Michoacán, in 1949, I became acquainted with another euphonia, the very beautiful Blue-hooded species, *Tanagra elegantissima*, the subject of our frontispiece. I was prepared to find this bird fond of mistletoe. The first individuals I ever saw (in the mature oak woods above Jacala, Hidalgo) led me to clumps of mistletoe within a few minutes after my encountering them. When I skinned them I found highly viscous, partly digested berries ready to leave the anus.

In Michoacán, the Blue-hooded Euphonias which lived near Roger Hurd's and my camp along the old Pátzcuaro trail in the early spring of 1949 shared their mistletoe with a larger bird—the elegant Gray Silky-Flycatcher (*Ptilogonys cinereus*). I watched these delightful birds gorging on mistletoe berries and was not in the least surprised, on skinning them, to find partly digested berries in their lower intestines. In addition to the many greenish white berries in their stomachs were a few large, elongate, dark blue berries which were wholly unfamiliar to me. These, I was later to learn, on seeing them in the woods, were mistletoe berries of a wholly different sort. Whether they ever passed through in a partly digested state, I cannot say. The only berries of that sort which I found in a Silky-Flycatcher were in the stomach and were wholly undigested.

In Michoacán, in 1949, I spent much of my time painting. Working, as I did, literally for hours under mistletoe-laden trees in which both Blue-hooded Euphonias and Gray Silky-Flycatchers fed, I was much impressed with the fact that their droppings only rarely seemed to reach the ground. I might never have been conscious of this had not caterpillar droppings at times become a great nuisance. Climbing up to investigate, I found the birds' droppings, dozens of them, some on the very tops of twigs or branches, some clinging to the sides, and all stuck fast to the bark, ready—I could but guess—to become little sprigs of mistletoe once germination was brought on by rain. The birds' tendency to keep high—to rest, after feeding, in the very treetops—must, I reasoned, be aiding the mistletoe in its 'struggle to survive,' for the higher the birds perched the less likelihood there was that one of those precious droppings would reach the ground.

I am no botanist, to be sure. What I have just said probably is a slight exaggeration, too. Surely further observations are to be made. But is it not remarkable—is it not, in the best sense of the word, *wonderful*—that the process of evolution should have brought about on the one hand an edible berry, and on the other a digestive apparatus and process which eliminates that berry's skin, but allows the viscous covering of the seed to remain until, out of the bird's body at last, it serves to attach that seed to the branch on which the plant is later to grow?

University of Michigan Museum of Zoology, Ann Arbor

THE REFRACTORY PERIOD OF TESTIS RHYTHM IN BIRDS AND ITS POSSIBLE BEARING ON BREEDING AND MIGRATION

BY A. J. MARSHALL[1]

According to Burger (1949: 222) the "problem of refractoriness is perhaps the greatest relatively unsolved problem in reproduction." Actually, except in ultimate detail, the problem may have been solved (Marshall, 1949a; 1950a). The "refractory period" of Bissonnette (1931; 1937) and certain other authors is here defined as that period of the avian testis cycle when the tubules are in a state of post-spermatogenetic lipoidal metamorphosis and before the newly regenerated Leydig cells of the interstitium have become sufficiently lipoidal and mature to respond to neurohormonal influences *initiated by natural factors in the environment.*

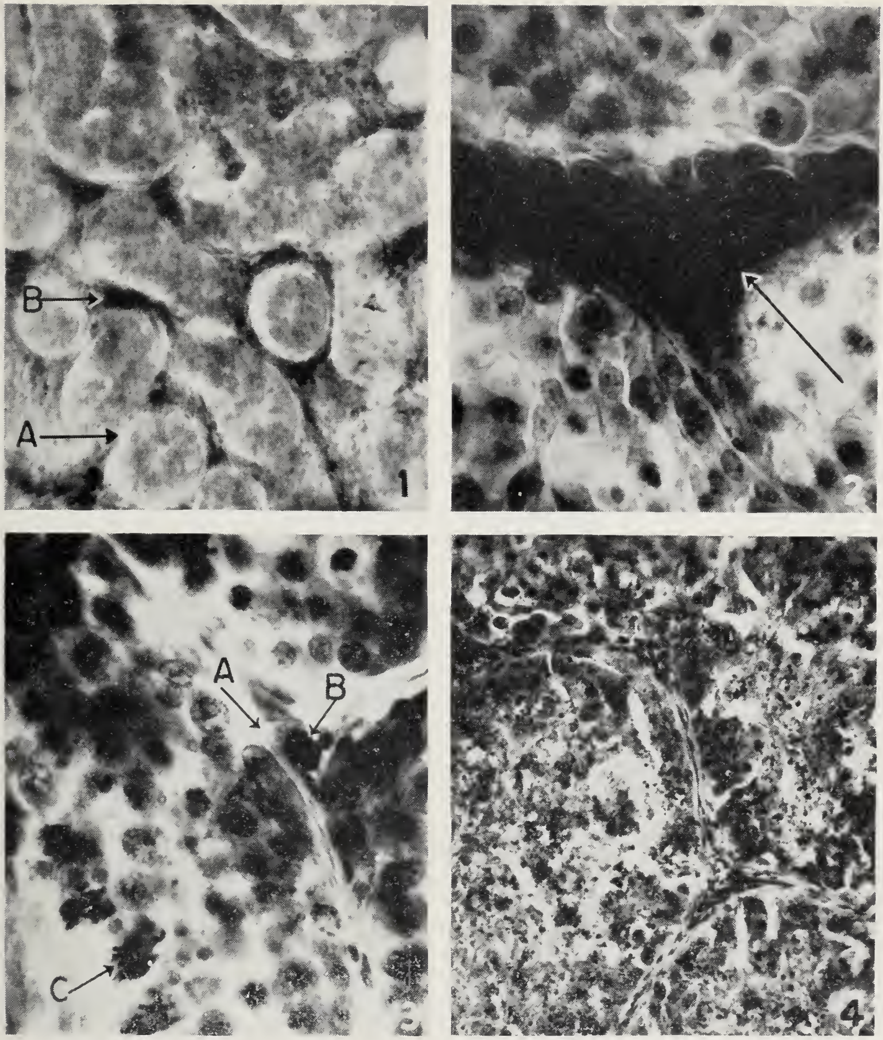
The term *neurohormonal* as used in this paper refers to the interaction of the exteroceptors, the hypothalamus, the anterior pituitary, and the gonads. The term *lipoid* has, of course, no precise chemical meaning, but used histochemically in its widest physical sense, it includes fats and all other animal substances that, in solubility, resemble fats (see Baker, 1946). It is hardly necessary to emphasize that the interstitial and tubule lipoids mentioned above have no direct connection with the gross deposits of peritoneal and subcutaneous fat that Wolfson (1942; 1945: 125) avers is a diagnostic concomitant of readiness to migrate.

The period of testis reorganization described above varies in duration from species to species. While it is in progress the post-moult summer and autumn sexual display, described for many passerines and other birds, occurs.

Internal Rhythm of the Testis

Before discussing in detail the refractory phase of the testis in relation to the breeding cycle and to light-experimentation which has been carried on since Rowan's (1925) remarkable pioneer discovery, it is best to see the phenomenon in its true perspective within the gonad cycle. In the young bird the inactive tubule contents are free of lipoids (Fig. 1). The interstitium contains juvenile Leydig cells that exhibit cholesterol-positive lipoid droplets which increase in quantity until many of the cells reach an almost maximum size at a time when the contents of the adjacent spermatogenetic tubules (and the bird's plumage in some species) also indicate approaching sexual maturity.

[1] Grateful acknowledgment is made to Dr. C. J. F. Coombs of Cornwall, and to Angus Robinson, Esq., of Coolup, Western Australia, for permission to use specimens collected for other purposes by them.



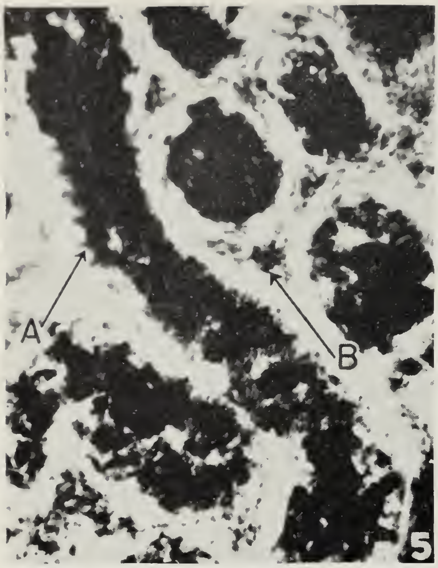
Photomicrographs of avian testis sections. (Formal-calcium fixation and Scharlach R. colouring with Ehrlich's haematoxylin counter-staining; 15μ.)

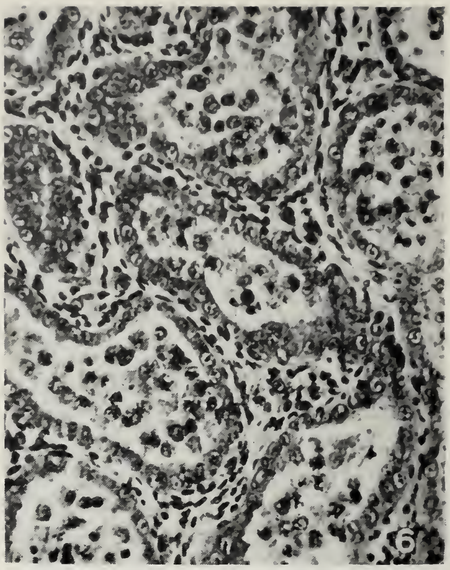
FIG. 1. Rook, aged 11 months. × 300. A. Inactive spermatogenetic tubule. B. Tract of Leydig interstitial cells gaining in lipoid content.

FIG. 2. Adult Rook taken at about the same season as Fig. 1. × 650. Arrow indicates typical wedge of heavily lipoidal Leydig cells at a time when the first mature spermatozoa appeared in adjacent tubules.

FIG. 3. Adult Rook approaching height of spermatogenesis. × 600. The great expansion of the seminiferous tubules has dispersed the Leydig cells, which are losing their lipoids and cholesterol. A. Leydig cell devoid of lipoids. B. Leydig cell still heavily sudanophil. C. Bunched spermatozoa.

FIG. 4. Adult Australian "Magpie" (*Gymnorhina dorsalis*) that has undergone interstitial exhaustion, shed spermatozoa, and entered the refractory phase. × 320. The small black spots within the tubules are the first evidence of tubule steatogenesis. Postnuptial tubule breakdown has begun.





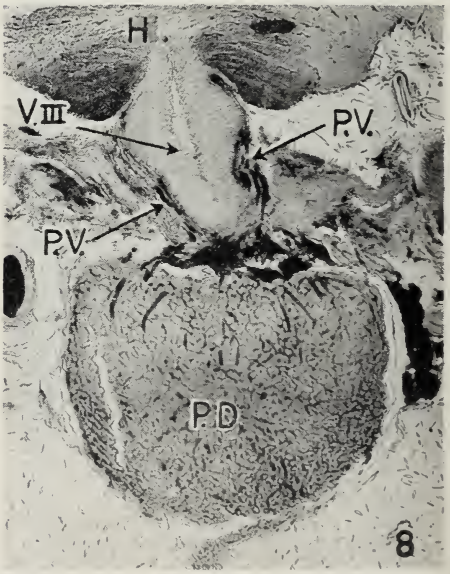


FIG. 5. Adult Rook testis in postnuptial phase of tubule metamorphosis and interstitial regeneration. × 350. A. Collapsed tubule full of cholesterol-positive lipoids. B. Group of juvenile, lipoidal, cholesterol-positive Leydig cells. (Technique as in Figs. 1–4.)

FIG. 6. Adult Rook testis as collapsed during refractory period. × 400. Note necrotic sperm debris within tubules. (Bouin fixation, iron haematoxylin, at 7μ.)

FIG. 7. Adult *Gymnorhina dorsalis* testis at stage comparable to that of Figs. 5 and 6. × 110. Arrow points to new testis wall inside old one. Testis regeneration is well under way and the refractory period is almost at an end. (Technique as in Fig. 6.)

FIG. 8. Hypophyseal portal system of adult Rook. × 25. H. Hypothalamus. V. III. Third ventricle. P. V. Portal vessels. P. D. Pars distalis of anterior pituitary. (Formal-calcium and Lepehne-Picworth method at 40μ.)

In the sexually quiescent adult the interstitium generally consists for the most part of comparatively small lipoid Leydig cells. These contain fuchsinophil elements which are readily seen after the soluble lipoids are removed by embedding in wax. As the sexual season heightens, the Leydig cells increase in size and lipoid content. Varying in quantity and arrangement from species to species, considerable aggregations of heavily lipoidal Leydig cells can now be seen (Fig. 2). The ripening spermatogenetic products expand the seminiferous tubules and this causes a wide dispersion of the clustered Leydig cells so that few are found in any given microscopic section. At the height of spermatogenesis, and at the beginning of lipoidal metamorphosis of the germinal epithelium, the Leydig cells become almost exhausted of their lipoid content (Fig. 3). An increase in the number of mitochondria may be seen in their cytoplasm (Benoit, 1927; 1929). Soon a fuchsinophil cell appears in which it is not possible to demonstrate the presence of cholesterol. There is a difference of opinion concerning the relative function of the lipoid and the fuchsinophil cell. Sluiter and van Oordt (1947; 1949) call the latter (which has also a vacuolated form) the "secretory cell" and declare that it manufactures the sex hormone. Marshall (1949a) on the other hand, considers the lipoid cell the site of hormone production and believes that the fuchsinophil cell is essentially a lipoid cell that has run its cycle and is about to disintegrate or to give rise to another generation of juvenile Leydig cells.

Concurrently, when the tubules have reached their maximum size and after spermatozoa are shed, some tubules undergo a lipoidal metamorphosis (Fig. 4). (This is quite distinct from the lipophanerosis observed during vertebrate spermatogenesis and described in all histology textbooks.) Soon the contents of all tubules become almost wholly lipoidal (Figs. 5 and 6). The tubules rapidly collapse as the necrotic spermatozoa and other debris clear away. Meanwhile, a new generation of small juvenile Leydig cells arises in the spaces between the shrunken tubules (Fig. 5) and the interstitium is invaded by new blood vessels. There now arises a prolific growth of fibroblasts which build up a new *tunica albuginea* (Fig. 7) inside the distorted and fragile old wall; the new Leydig cells become meagerly lipoidal and fuchsinophil; and eventually these become sufficiently mature to respond to external stimuli via the pituitary gland: the refractory period is ended.

The reorganization referred to above is often associated with the postnuptial moult and is probably responsible for the brief period of sexual quiescence that now ensues. Further, experimental birds cannot now be forced into spermatogenesis by increased illumination. It is not yet known to what extent testis rehabilitation is influenced by the secretion of pituitary gonadotrophins in free-living birds. Miller (1949), for example, has shown that in late October (long after the initial stages of rehabilitation) large daily injections (1 cc. = 50 international units) of pregnant mare serum quickly caused testis enlargement in wintering Golden-crowned Sparrows (*Zonotrichia coronata*) that were probably still refractory to photostimulation. Among free-living birds the tubule-lipoids disappear and the new interstitium matures at different rates from species to species. Although this writer believes that the gonad is the primary organ of periodicity, the anterior pituitary too may have a refractory phase. However, no anatomical evidence that such is the case has yet been adduced.

The postnuptial tubule lipoids are cholesterol-positive. In many bird species a sustained period of autumnal display, song, and territorial behavior begins as the postnuptial tubule lipoids disintegrate and the new interstitium develops. The tubule lipoids may, during their postnuptial existence, have an endocrine function, but this has not yet been proven.

The above metamorphosis, even though it involves testis collapse, cannot be termed simply a "regression" since it involves the rehabilitation of the interstitium, the tubules and the testis tunic. Until the tunic has been rebuilt and the Leydig cells renewed, the next spermatogenesis cannot, of course, occur. The metamorphosis, in addition to the subsequent "spring" development of interstitium and seminiferous tubules, constitutes the physical basis of the internal rhythm postulated by F. H. A. Marshall (1936) and Baker (1938a) in their classical reviews on sexual periodicity and the evolution of breeding seasons.

It should be mentioned that interstitial Leydig cells appear to be present throughout the life of the bird. Authors have sometimes considered these cells absent because inappropriate techniques have removed the cytoplasmic lipoids and thus rendered the cells unidentifiable.

Experimental Photostimulation and the Refractory Period

Since Rowan's epochal discovery that photostimulation led to testis-response in the Junco (*Junco hyemalis*), many other birds have been found to respond in the same way. It is unnecessary here to refer specifically to the several excellent reviews of the work on the effects of light duration, light intensity, and the components of light on captive birds, or to the various ingenious experiments of Benoit in trying to determine the neural pathway by which light from the environment finally leads to the activation of the hypophysis. There seems no reason to believe that sunlight and other external stimuli conducive to breeding do not achieve a nervous threshold which leads to the stimulation of the anterior pituitary via the hypophyseal portal system that is present in birds (Fig. 8) as well as in various other animals (Popa and Fielding, 1930; Houssay, *et al.*, 1935; Wislocki and King, 1936; Green and Harris, 1947; Harris, 1948). Avoiding the "light versus metabolic activity" controversy, we can say, in general, that if seasonal birds are subjected to additional rations of artificial light outside the refractory period their testes will enlarge.

In the light of the above demonstration of the anatomical basis of the refractory period, several previously puzzling aspects of photostimulation can be readily understood. Bissonnette and Wadlund (1932: 345), commenting on the "failure of the sex mechanism to maintain a high rate of germ-cell multiplication and maturation beyond a definite period," state that "the more stimulating the effect of the illumination, the more quickly is the mechanism thrown out of gear." There seems little doubt that the above workers, and many others, experimentally drove the birds through their spermatogenetic and interstitial cycles to sexual exhaustion and, not understanding the mechanism involved, called the subsequent period of reorganization (when the testis was temporarily unresponsive to further stimuli) the refractory period. It is interesting that both Rowan (1929) and Bissonnette (1930), who worked with traditional wax-section techniques, remarked on the presence of tubule vacuoles at the post-spermatogenetic stage. Rowan in particular mentioned that these "vacuities" appeared as though artificially produced; but he emphasized that they were not artifacts. He was, of course, correct: they are the empty spaces left where the metamorphosed fats have been dissolved out of the sections after wax embedding.

It will be recalled that Riley (1936; 1937) found that the testes of adult House Sparrows (*Passer domesticus*), though unresponsive to photostimulation in September were responsive in November. By November (in the Northern Hemisphere) postnuptial reorganization has proceeded sufficiently to allow the testis to respond. Likewise, Riley's success in stimulating juvenile birds in September is understandable when we realize that their tubules, never having produced spermatozoa, have not metamorphosed, and their lipoid Leydig cells are still developing and are therefore receptive to the stimuli of additional lighting. It becomes clear, too, that there is nothing remarkable in the experimental production of more than one spermatogenesis in a year; and the histophysiology of the ancient practices of *yogai* (Miyazaki, 1934) and *mewing* (Damsté, 1947) can be readily understood.

Seasonal Stimuli after the Refractory Period

We can now consider birds as free-living animals in touch with all of the varied stimuli that keep their breeding cycles in step with the seasons and ensure for their young an arrival time suitable for survival.

After the breeding season there is among some British birds an almost general recrudescence of singing, courtship display, and other forms of sexual behaviour which may continue into autumn and winter (Morley, 1943). Again, in North America, the Mockingbird, *Mimus polyglottos* (Michener and Michener, 1935), Song Sparrow, *Melospiza melodia* (Nice, 1937), White-crowned Sparrow, *Zonotrichia leucophrys* (Blanchard, 1936), Wren-tit, *Chamaea fasciata* (Erickson, 1938), Ring-necked Pheasant, *Phasianus colchicus* (Hiatt and Fisher, 1947), and other species have been reported to exhibit varying degrees of sexual activity in the autumn. In some British species, notably the House Sparrow, Starling (*Sturnus vulgaris*), Wood Pigeon (*Columba palumbus*), Stock Dove (*C. oenas*), Robin (*Erithacus rubecula*), and Blackbird (*Turdus merula*), this characteristic post-moult activity may occasionally lead to autumn reproduction (Witherby, *et al.*, 1948) if weather and food conditions remain propitious. It is noteworthy that some of these occasional autumn breeders exhibit pronounced autumnal sexual activities in North America (Witschi, 1935; Allard, 1940).

Bullough (1942) has shown that in England testis-size in the Starling begins to increase in September. This is accompanied by autumnal sexual activity. Höhn (1947) has histological evidence that autumnal interstitial development in the Mallard (*Anas platyrhynchos*) is followed by mating behaviour.

In three British species—the Rook (*Corvus frugilegus*), Robin, and House Sparrow—the relation of autumnal sexual activity to internal testis rhythm has been studied. The Rook (Marshall and Coombs, unpublished) ovulates in March in Cornwall; the testis tubules rapidly metamorphose and the interstitium begins to regenerate while incubation is still proceeding. Males shot whilst carrying food to the young in the nests possessed collapsed tubules heavy with lipoids and an interstitium already regenerated with Leydig cells meagerly lipoidal and correspondingly responsive to the Schultz test for cholesterol. After this rapid testis reorganization there appears to be a comparative lull in development. The tubules lose their lipoids very slowly and the Leydig cells appear not to develop further. Meanwhile moult has begun. By the end of June the young birds flock separately and require no further attention from the parents. With the testis tubules still lipoidal and with moult proceeding, a new *tunica albuginea* is being laid down in readiness for the next enormous expansion of the organ. By the end of August wing and tail feathers have been replaced and the new testis wall is complete. There are still plenty of metamorphosed lipoids in the tubules but a new growth of spermatogonia is present beneath them and almost all of the necrotic sperm debris has been eliminated. Also, there is a slight increase in the size and lipoid content of the Leydig cells.

It is now that the Rooks renew their "mating flight" and many start carrying sticks to their old nests. Most, if not all of the characteristic spring courtship behaviour occurs, including, occasionally, copulation (Morley, 1943). In a small number of males, testis development begins in September and culminates in complete spermatogenesis in October. It is remarkable that in the great bulk of a given rookery there is no considerable change in the testes. Despite the extraordinary—and regular—sexual resurgence described above, Rooks almost never actually reproduce in the autumn. During a normal winter the testes that do develop begin to metamorphose when sexual activity dies down in November. "Spring" gonad development begins in December at about the winter solstice or a little later. The time of onset varies among individuals and also from year to year according to the weather. Study of the female sexual cycle is still in progress.

The above detailed data about a single species are given here because they have an important bearing on the question of the validity of photoperiodic stimulation of birds in nature. Among many species sexual behaviour occurs after the regeneration and partial development of the interstitium, whether the days are lengthening or shortening. When the moult is concluding and the young are able to care for themselves (or even before), postnuptial sexual behaviour may become very pronounced depending upon the weather and the traditional habit of the species. This appears to be essentially controlled by the internal rhythm of the gonad. In southwest Britain both the Robin and the Rook breed earlier than in the north, the former also beginning its autumnal song and territorial aggression (Lack, 1939), the latter also its autumnal sexual display, earlier. If autumn weather conditions (especially sunshine) and food supply are good, autumnal sexual behaviour is extremely pronounced. In the Robin it may lead to reproduction in a few individuals (Lack, 1946). The chief point to be emphasized is that though light is decreasing sexual activity is increasing. It is not until November, when the sun is rarely seen, when weather conditions are worsening considerably and food is becoming scarce, that sexual activities are inhibited. It has been suggested that autumnal sexual activities are depressed when day-length falls below a certain number of hours, but there appears to be no good evidence that mere shortness of day is responsible. Other environmental factors seem to be far more important.

Again there seems to be no sound evidence, apart from that obtained through photostimulation experiments in cages, that the onset of "spring" sexual activity is correlated directly with any precise day length. There has been no widespread histophysiological investigation of the gonads in the winter period when many spring-breeding species begin their seasonal spermatogenesis. Data about to be published reveal that at Oxford, England, the Robin, a spring-nesting bird, exhibits an interstitial rearrangement and a sudden growth of Leydig cells in the first week of January. There is at the same time a marked revival of song. Pairing takes place. This occurs after a light-increase of approximately 12 minutes from the winter solstice, when day-length is increasing at the rate of about one minute per day. Before it can be unquestionably accepted that light fluctuation causes the above prenuptial sexual recrudescence, far more elegant experimental techniques than those used in the past will have to be devised.

The Starling, on which much photostimulation work has been done, is of great interest here because of the detailed histological study by Bullough (1942). Burger (1949) reports that the minimum day-length required by this species for the rapid production of spermatozoa is about 12.5 hours, and that days 10.5 hours long produce only the multiplication of spermatogonia. But under unusually mild winter conditions in Britain, Starlings will not only produce spermatozoa but will nest, ovulate and bring out viable young when the days are little more than nine hours long. Further, an analysis of Bullough's data shows that under natural conditions a "great burst" of testicular growth occurs at the beginning of February when the days are only about 9.3 hours long, and that by the end of the month the first sperms have appeared when the days are about 10.6 hours long. Spermatogenesis is reported to have continued rapidly although day-length was still little more than that which Burger was later to claim could produce only the multiplication of spermatogonia. These facts are brought forward to show how far from reality can be the most carefully planned and regulated photoperiodicity experiments.

So much for light and the *initiation* of the prenuptial part of the breeding cycle. What, now, of ovulation? Summarizing an important survey (which of necessity dealt with selected species having wide geographical ranges) Baker (1938b: 578) stated: "6. Much egg-laying occurs when days are getting shorter, and indeed it often proceeds rapidly while they are decreasing in length and only between 11 and 12 hours long.

"7. There is, however, little egg-laying when the day is shorter than 11 hours, and almost none when it is less than 10.

"8. Under natural conditions birds exhibit no tendency to start breeding everywhere when the days reach a certain length nor when they are becoming longer particularly quickly."

There is ample evidence that the timing of ovulation in a given species, even in the same locality, has no direct relationship with day-length. Records kept by the Marsham family in Norfolk, England, for the past two centuries reveal that the first appearance of young Rooks varies from 23 March to 2 May (Williams, 1949). There are numerous published data (*cf.* Marshall, 1949b) indicating that the breeding season fluctuates according to the mildness or severity of the weeks preceding nesting. When it became known that the British winter of 1946–47 was one of the coldest on record it was thought worthwhile to collect the gonads and stomach contents of a small series of four common Oxford passerines—the Robin, Chaffinch (*Fringilla coelebs*), Great Tit (*Parus major*), and Blue Tit (*P. caeruleus*)—in mid-March in the hope that the following winter would be normal and the same species might be obtained in precisely the same wood exactly one year later. The winter of 1947–48 was unusually mild; the proposed second collection was made. The experiment was designed to rule out day-length as a factor and to test the effects of possible weather fluctuation.

There proved to be a great disparity between the gonads taken after the "hard" winter and those collected after the mild one. From March 13 to 15, 1947, none of the four species showed a greater development than primary spermatocytes in synizesis, whereas those collected exactly one year later had all reached secondary spermatocyte stage, and three of the four species had developed spermatids or spermatozoa. Analysis of weather and breeding records showed that the hard winter was followed by an abnormally bright spell (after the collection date) and that the surviving birds of at least three species bred at about the normal time! It is, of course, extremely difficult to evaluate such factors as sunshine, temperature and food abundance. Great care was taken to provide an adequate food supply for all birds collected in both winters. So, unless some special food component was operative, it seems that sunshine and temperature must have been particularly influential in the timing of the cycle.

Evolution and Timing of the Breeding Cycle

The ultimate factor (Baker, 1938a; 1947) in the evolution and timing of the breeding season is reproduction at a time of year propitious for the rearing of the young and thus also for the survival of the species. Secondly, there are *proximate* or immediate factors in the animal's environment acting as regulators and operating through the exteroceptors, thus keeping the breeding rhythm anchored to the seasons. Animals that do not respond to the appropriate stimuli may continue to lose their offspring and thus pay the death penalty as species.

The above regulation may be achieved in either of two ways or through a combination of the two ways:

1. The sexual cycle, once the period of postnuptial reorganization (or "refractoriness") is over, is under the control of a complex of regulating factors that occur at approximately the same times every year and so, ultimately, the young are launched at about the same beneficial period each year.

2. There is a possibility that in many species (particularly migratory ones) the male cycle is timed principally by a fixed rate of gonad reorganization, i.e., the clearance of last season's metamorphosed lipoids from the spermatogenetic tubules and the building up of the secretory component of the interstitium. If this be so, migration and breeding activity could begin, irrespective of light duration, weather, or geography (e.g., among birds on the equator), after the Leydig cells had reached a certain threshold of hormone production. The sexual cycle, then, must be finally timed by the external immediate factors (presence of appropriate nesting sites, food, etc.) that permit successful reproduction when migrants or dispersive species reach their breeding grounds. The breeding cycle is still under the more or less rigid control of the environment and thus keeps step with the sun.

This second matter can be dealt with first. Bissonnette (1937: 257) has suggested that the breeding cycle and migration in some species might be governed by "inherent rhythms of the anterior pituitary more or less fixed in the absence of, or without responsiveness to, external, usually stimulating, factors like light cycles." Previously, however, Baker and Baker (1936: 517) had expressed their belief that "if in any plant or animal there were an internal rhythm controlling an annual cycle, and if this rhythm were incorrect even to the minute extent of six minutes in the year, then if it were breeding in the spring at the end of the last glacial epoch in the northern hemisphere it would be breeding at precisely the wrong season of the year (autumn) now!" From what is known of the time factor in biological reactions any such exactitude is inconceivable; furthermore, there is as yet no evidence that the anterior pituitary is autonomous in its activity. F. H. A. Marshall (1936; 1942) and Baker and Ransom (1938: 103–105) have, however, pointed out that certain Southern Hemisphere birds appear to adhere to their southern breeding times after transportation across the equator even though the majority soon adjust to the new environment. Thus, it would seem clear that some birds possess an internal rhythm of reproduction. Baker (1938a) has suggested briefly that some such rhythm may prevent migratory European Swallows (*Hirundo rustica*) from nesting in the South African summer and that it may be influential in timing the return of migrants to their breeding grounds. The present writer, in view of material presented in this paper, suggests that a fixed rate and period of gonad reorganization may be influential in timing the departure of spring migrants. The testis tubules of certain waders in northern Africa are clear of lipoids and their Leydig cells are fairly constant in lipoid content at the time of their departure northward (Marshall, 1950b). The same is true of the Hooded Crow (*Corvus cornix*) before it leaves eastern England for its Scandinavian breeding grounds (Marshall and Coombs, unpublished). Passerine birds of eight species[2] so far investigated contain spermatozoa when they kill themselves against St. Catherine's Lighthouse, Isle of Wight, on their spring migration from Africa and southern Europe. This evidence reinforces Rowan's contention (see also Rowan and Batrawi, 1939) that the northern migratory journey is essentially sexual in motivation. It is difficult to see how the day-length hypothesis can explain the northern movement of birds that "winter" near the equator. Thus, of two individual Golden Plovers (*Pluvialis apricaria*) of the same subspecies, one may winter a little to the north, the other a little to the south, of the equator: the former exists under an increase of light, the latter under a decrease, yet both apparently arrive at their northern breeding grounds at approximately the same time. And if light is not influential, what other environmental factors are sufficiently constant over a wide area to be considered at all?

It seems certain that the urge to move towards the traditional breeding ground is inherent within each species, even as is the appreciation of the environmental pattern that allows for mating, ovulation and nidification when the birds get there. Even if migratory birds "winter" with potential mates in an area of abundant food, sunshine and prolonged day-length, other environmental factors essential for reproduction (e.g., traditional nest sites) are not present and therefore the cycle cannot be stimulated vigorously enough to bring about an unseasonal "autumnal" or postnuptial breeding condition. It seems possible, then, that in many migratory species there is a genetically fixed rate of testis recovery, and that when the rhythm has proceeded to a certain threshold any environmental stimuli (including behavioural interactions between the sexes) that influence the anterior pituitary can then be

[2] Whitethroat (*Sylvia communis*), Blackcap (*S. atricapilla*), Willow Warbler (*Phylloscopus trochilus*), Pied Flycatcher (*Muscicapa hypoleuca*), Spotted Flycatcher (*M. striata*), Wheatear (*O. œnanthe*), Redstart (*P. phœnicurus*), and Sedge Warbler (*Acrocephalus schœnobaenus*).

operative on the now once more responsive gonads. Storr (1951) has recently described display in flocking Sharp-tailed Sandpipers (*Erolia acuminata*) in tropical Queensland (at Lat. 15° 22′ S.) in March and early April shortly before their departure for their arctic breeding ground. In the case of young birds, a fixed maturation rate may be the essential timing factor: once a certain sexual maturity is reached, environmental factors may be able to operate and to achieve a neurohormonal threshold sufficient to cause departure for the breeding ground. It will be recalled that when Emlen and Lorenz (1942) implanted sex-hormone pellets in free-living, sexually inactive California Valley Quail (*Lophortyx californica*), neighbouring, untreated birds also showed accelerated mating behaviour. In regard to this kind of sexual and social stimulation, F. Fraser Darling's "Bird Flocks and the Breeding Cycle" (1938) should be consulted.

The breeding rhythm of stationary Sooty Terns (*Sterna fuscata*) which are reported to breed about four times every three years on tropical Ascension Island (Murphy, 1936) is of outstanding interest. Here, apparently, the ocean environment contains sufficient quantities of food to allow more frequent successful reproduction than is usual in seasonal birds. Were this species an arctic migrant, such a rhythm would carry it north into an unpropitious climate and natural selection would operate swiftly and disastrously.

When migrants arrive at their traditional breeding grounds, the presence of an appropriate pattern of environmental stimuli allows them to breed and their reproductive cycle thus keeps step with the sun. In this respect the Great Skua (*Catharacta skua*) is noteworthy. It breeds widely throughout antarctic and sub-antarctic seas but a separate northern subspecies nests in Iceland (Huxley, 1950. *Discovery*, 11: 73–78). Although probably non-migratory, the Great Skua wanders north and south from its sub-polar breeding stations (James Fisher, personal communication). Both Huxley and Fisher have suggested that the northern population was established by nomads from the south. Thus we can visualize trans-equatorial wanderers covering thousands of miles of ocean and islands before finding northern quarters with an environment sufficiently like that at home to enable them successfully to breed and to found an arctic race.

A fixed rate of gonad recrudescence may explain some of the cases where, in certain restricted localities, two populations of the same species (sometimes, apparently, the same subspecies) co-exist and yet retain different breeding rhythms. Serventy and Whittell (1948) have reported separate winter and spring breeding populations of several species of sea-birds on islands off the west coast of Australia. In the case of the Silver Gull (*Larus novae-hollandiae*), two groups breed at different times on one small island. All colonies of Pied Cormorants (*Phalacrocorax varius*) but one breed in autumn and winter; the exceptional colony, on the Abrolhos Islands, breeds in the spring. On the other side of the continent, Barrett (1910) long ago noted that large numbers of

White-capped Noddies (*Anoüs stolidus*) on one Great Barrier Reef atoll had eggs on a certain date, while a second population, on a very similar island only 15 miles away, had not begun to lay.

In North America Blanchard (1941) and Blanchard and Erickson (1949) have shown that the gonads of two subspecies of *Zonotrichia leucophrys* living part of the year in the same area and exposed to the same day-lengths begin to enlarge at different times. Wolfson (1942) has interesting data of the same sort concerning races of *Junco oreganus;* and Bullough (1942) has shown that in Britain migratory populations of Starlings have different breeding cycles from those of non-migratory populations.

It seems probable that in temperate zone species such as the above there are environmental factors operating near the ovulation date and allowing of a successful mating when the habitat becomes seasonally appropriate for reproduction. Thus, too, it may be found that the external stimuli governing nidification and ovulation are the really important factors that keep the individual sexual cycles in step with the seasons rather than a long-range factor, such as day-length which is generally held to be the chief factor that anchors the sexual cycle in time.

Among certain birds inhabiting countries where the winter sky is usually overcast it seems that a principal long-range environmental influence is sunshine rather than mere length of day. An unseasonable burst of sunshine in winter will stimulate birds to sing; a spell of dull cold weather in spring will depress song and sexual activity. Inhibitory influences which prevent animals from wasteful unseasonal matings are sometimes as valuable biologically as stimulatory ones. A long succession of days suitable to reproductive development will heighten sexuality irrespective of day-length; and a period of adverse weather, even when days are lengthening, will depress it, thus delaying the sexual season. Sunshine may not play a great part in the timing mechanism of birds inhabiting countries whose winters are sunny; but the Oxford open-air experiment described above should make it clear that in dull-winter areas sunshine is important and that, furthermore, sunshine and day-length are not precisely the same thing. Much as an anthropomorphic parallel may be deplored, it is natural to cite *Homo's* feeling of exhilaration and general well-being in a mountainous or arctic region—even in subzero temperature—when the sun shines. The results of much of the photostimulation work can be explained in this way. If birds that have evolved a neurohormonal response to sunshine are subjected to electric or candle light (*muit, yogai*) it is understandable that the mechanism will be set in operation and that hypophyseal hormones will eventually reach and activate the gonads. In this context it can be recalled that the introduction of all sorts of alien substances into various parts of an animal will stimulate reproductive activity (F. H. A. Marshall, 1936). In the course of an investigation of a chicken disease, Asplin and Boyland (1947) observed that sulphonomide administration was followed by spermatogenetic activity and precocious sexual development (e.g., comb-growth) and sexual behaviour in week-old chicks.

Neither sunshine nor light-increase can be said to possess a stimulatory effect in the cycle of the Emperor Penguin (*Aptenodytes forsteri*), which brings out its young during the darkest, coldest, most tempestuous period of the year. On the other hand, the Adélie Penguin (*Pygoscelis adeliae*) of the same latitude hatches its egg during the lightest and warmest month, December. Levick (1914) has described the astonishing differential growth-rate of the two species—the "mushroom-like" development of the Adélie, which enables it to mature sufficiently to survive the following winter, and the slow growth of the Emperor chicks, which are carried about and warmed by their parents until the approach of better weather. We can only assume that *if* day-length has any influence on the rhythm of the Emperor Penguin, *decrease* in day-length is what stimulates its development. In this respect the carefully controlled investigation of Yeates (1949) demands consideration for it appears to prove (under very "natural" experimental conditions) that the autumnal reduction in daylight over a long (13–16 weeks) period somehow stimulates the oestrus cycle of Suffolk ewes to activity and to actual reproduction. Autumnal mating in sheep and in certain other mammals leads to a beneficial spring parturition.

Most birds hatch their young at a period when the days are long enough for obtaining the stupendous amount of food needed by the developing young. Also, when days are long the weather is so mild that the comparatively naked young are not frozen to death. Further, during the season of long mild days the food necessary for the young is at its maximum (Marshall, 1951: 270). But most of the evidence is against the probability that each species has evolved an exact relationship with its environment whereby, when the day reaches a certain length or when the sun arises at a certain time, its breeding cycle "ticks over" to launch the young at a specific time of the year. That daylight increment, allied with other factors, may be partly influential in timing the breeding cycle of some species cannot be denied; but the influence of this daylight increment has been grossly over-emphasized, and many of the photoperiodic manipulations designed to test its importance have been made under conditions having little correspondence with normal events in the lives of the birds involved.

We now know that most of the old travellers' tales of equatorial animals "breeding all the year round" are untrue. Individual tropical birds seem to have breeding seasons as sharp as those of the same families living in Tasmania, Sussex or Vermont. The Oxford University Expedition that established a laboratory for one year in the remarkably unvarying climate of the New Hebrides proved conclusively that the endemic race of the Golden Whistler (*Pachycephala pectoralis*) has as sharp a breeding season as that of another race in southern Australia (Baker, Marshall and Harrisson, 1940). In the New Hebrides (below the equator) the species ovulates when the days are growing shorter. In southern Australia (below the equator) it ovulates when days are growing *longer*. The same applies to other Australian birds living in approximately the same latitude as the New Hebrides. There is much other, though histologically less conclusive, evidence that birds living almost precisely astride the equator have sharp breeding seasons (Moreau, Wilk, and Rowan, 1947). Notable, too, is the fact that individuals of species which inhabit both sides of the island of Ceylon breed at different times of the year. The monsoon that brings rain to the southwestern side of the island comes at a different time from that bringing rain to the opposite side (Wait, 1931). The wide variation in breeding periods may be correlated with the monsoons.

A further argument against light in any form as an overall regulator is provided by the irregular cycles of many species of birds in countries where rainfall is scanty or spasmodic. Here, quite often, breeding dates are indubitably geared to rainfall or its immediate effects.[3] Carnaby (1946) states that northwestern Australian birds can be divided into several groups. Some (certain pigeons and quail and many passerines) breed at any time of the year following heavy rain. The seed-eating Budgerigar (*Melopsittacus undulatus*) and Zebra Finch (*Taeniopygia castanotis*) breed after the growing of grass following such rain. Certain species ovulate in a particular calendar month, but only if conditions are normal for the period. Finally, a few large birds of prey have a regular breeding time irrespective of environmental fluctuation. Serventy (1946) has an important account of spring-nesting Western Australian species breeding in autumn after heavy unseasonable rainfall. A little farther south, beyond the area of rainfall, there was no indication of unusual breeding. Robinson (1933) reports that the Dusky Wood-Swallow (*Artamus cyanopterus*) nests in the Western Australian autumn (when light is decreasing) if rain falls, and nests again in mid-winter if it rains again. Roberts (1937: 51) has collected evidence that in central Queensland Plum-headed Finches (*Aidemosyne modesta*) lay only when heavy rain brings on a good crop of grass with seeds; the finches begin building immediately the grass becomes long. Scrub-turkeys (*Alectura lathami*) in the same area begin raking rubbish onto their old incubators only after the first rains of the season. If the "wet" continues they will lay. In one season of abnormal rainfall these megapodes laid in wintertime. They rely, of course, on heat generated by the damp, decaying vegetation of their incubators to hatch the eggs. Makin informs the writer that in southwestern Queensland, where wet winters are exceptional, she observed several kinds of spring-breeding birds nesting before the winter solstice after unseasonable rain. In this respect, Orr's (1945) evidence concerning Galápagos finches (*Geospiza*) is of importance. Members of this genus apparently breed from mid-December to April during the wet season when in a wild state near the equator. In captivity in California, however, they generally nested from March

[3] A. R. Phillips has reported that the Rufous-winged Sparrow (*Aimophila carpalis*) does not breed in Arizona in spring, but delays "until the summer rains" (see page 323 of this issue).

to November, the breeding period of most North American birds. If the captive equatorial finches had been, in fact, native species their breeding during March–July would no doubt be ascribed to day-length. It would seem that some xerophilous or other species, which have of necessity evolved a neuro-endocrinal cycle to respond to rain or its effects will breed at any time of year after a short postnuptial period of testis reorganization. A long, fixed period of reorganization would be fatal—the species would, perhaps, be refractory to external stimuli until long after the next rainfall and the passing of its beneficial effects. The above Australian references are mentioned because they are unfamiliar to most people; comparable data are available from other continents. Baker (1938a) in particular has gathered observations suggesting that the timing of breeding seasons is dependent on a wide variety of factors. There seems little reason to doubt that various species (or different populations of one species) have evolved a breeding reaction to entirely dissimilar environmental complexes and so enabled themselves to breed in all manner of habitats quite independently of the movements of the sun *per se*.

An invaluable method of inquiry into the causes of breeding season—and one that has not been seriously exploited—is the examination of environmental factors, or lack of factors, that inhibit breeding. Spasmodic non-breeding in birds and other animals is extremely common in all habitats subject to violent environmental fluctuations. Berney (1927) reported the complete inhibition of breeding of most species for 16 months in central-west Queensland. Manniche (1910) noticed that during one period many North Greenland birds failed to reproduce. He correlated the non-breeding of the Long-tailed Skua (*Stercorarius longicaudus*) with the absence of its normal food, the lemming. The observations of Schaanning (1916) in Novaya Zemlya, and of Pedersen (1930) and Løppenthin (1932) in East Greenland indicate that inhibition of breeding in the Long-tailed Skua, Pomatorhine Skua (*S. pomarinus*), and Snowy Owl (*Nyctea scandiaca*) is closely related to the lemming cycle which, as Elton (1924; 1942) has shown, occurs in a regular 3–4 year rhythm. When lemmings fail there is a widespread non-breeding among lemming-feeders. Marshall (unpublished) found that on the bleak, foggy island of Jan Mayen (east of Greenland) non-breeding in some species appeared to be caused by the lack of nesting sites safe from fox-persecution. Certain species that show no great conservatism in site-selection elsewhere nested almost entirely on lofty cliffs and pinnacles on this fox-infested island. Passage waders touched down in thousands but only a few remained through the summer and these did not breed. No wader has ever been recorded breeding on this island. Stomachs of the many waders shot by us contained only vegetable matter. The testes of summer males collected contained spermatozoa, so failure to breed may well have resulted from inability of the females to find the sort of food characteristic of the traditional nuptial area. Land and lake birds of many species have been reported from Jan Mayen by various expeditions, but only a very few breed there even though every day at the summer's peak provides 24 hours of light. The sun, however, rarely penetrates the heavy blanket of fog surrounding the island and most migratory and dispersive species do not find there an environmental pattern appropriate to their traditional reproductive needs. The only birds that breed freely are the cliff-nesting seafowl that can escape the fox population (which is confined to the island except during winters when the pack-ice allows egress across the sea to the Greenland coast) and that can find unlimited food in the surrounding sea. The testes of non-breeding species underwent the same spermatogenetic cycle as those of the breeding species, but in development lagged behind those of paired breeding birds. It seemed that both sexes of birds in a flock became potentially capable of reproduction but that lack of suitable external stimuli (e.g., those provided by a satisfactory breeding site and/or appropriate food) inhibited the final stages leading to fulfillment.

There is now abundant evidence that once the gametogenetic cycle of many birds is started off it is "kept on the rails" by a variety and a succession of immediate factors such as weather, display, food supply, nest-site availability, and so on. For example, the Australian Satin Bowerbird (*Ptilonorhynchus violaceus*) takes up territory and builds a bower and a display ground on which it places numerous decorative objects at about mid-winter (June) when light is decreasing or increasing at the rate of a few seconds per day (Marshall, 1950c). Within a month the male gonad has increased in size a hundredfold and bunches of spermatozoa have appeared. But the male continues to display to the female at the bower until late in September or early in October when the female goes off to build her nest. Nidification thus takes place when the forest becomes full of flying insects. It has been shown experimentally that bowerbirds are unable to seek out small insects that they do not see moving and that the fruit diet on which the adults largely subsist is inadequate to bring nestlings to maturity. Here, then, we have a complex mechanism involving an early taking up of territory but an actual nidification at a time suitable for survival of the young.

Another bird whose breeding cycle seems to be timed to culminate with the appearance of specialized food is the British Robin. As mentioned previously, this species pairs and its gonads begin their "spring" development in January. Spermatozoa appear within a month provided the winter is not excessively cold and sunless. Yet the female usually does not ovulate until April. Lack (1946) and Lack and Silva (1949) observed that at the time young Robins hatched the woods became full of food in the form of caterpillars. After the hard winter and subsequent abnormal sunshine of 1946–47, two broods that appeared before the bulk of the caterpillar harvest died "much below weight after a few days." In Oxford woods the leaves swarm with these caterpillars; and certain other species of birds which use them for their young also ovulate in time to take advantage of the harvest which ends in pupation about 12

June, plus or minus some days according to seasonal vagaries (John Gibb, personal communication). Species that feed on adult insects breed later. It seems certain that as the ecology of more species of birds is worked out in detail it will be discovered that a great number of them have cycles so timed that the incubation period ends when large amounts of animal food for the young are most easily obtainable. It is probably very significant that the various British birds that occasionally breed successfully in winter—e.g., the Wood Pigeon, Stock Dove, Robin, Blackbird, House Sparrow and Starling—get much of their food from human sources and have therefore become partially independent of the natural supply.

In many cases it may be found that the factors that time the production of the food also influence the sexual cycle of the potential breeders. These complex ecological relationships, including especially display and other behavioural interactions, present an exciting challenge to zoölogists of the future. It is clear that each vertebrate has its reproductive rhythm "anchored" in time by stimuli and inhibitors that are various and highly specific (Marshall, 1947). These will be determined only by the collaboration of workers in both laboratory and field. Both spheres of labour are equally important.

Summary

The refractory period in the testis cycle of seasonal male birds is that during which the seminiferous tubules are in a state of post-spermatogenetic lipoidal metamorphosis and before the newly-regenerated Leydig cells of the interstitium have become sufficiently mature and lipoidal to respond to neurohormonal influences initiated by environmental factors.

At the termination of spermatogenesis, most of the epithelial contents of the tubules metamorphose and disintegrate. The tubules themselves become reduced in diameter and the whole testis collapses. Concurrently, the exhausted Leydig cells of the old generation (almost denuded of their cholesterol-positive lipoids during the last stages of the sexual season) disappear. A new generation now arises in the spaces between the shrunken tubules. Fibroblasts appear in great numbers and rapidly build up a new *tunica albuginea* just inside the old testis wall (which has become thin, distorted and fragile). Thus, the period of testis collapse is also one of rehabilitation and not merely a "regression." *Postnuptial metamorphosis* is a more suitable term. The period during which the above profound changes take place is one of sexual quiescence. It is also the period of the postnuptial moult.

In late summer and autumn, after testis reorganization has proceeded to some degree and while the tubule lipoids are disappearing and the new interstitium is becoming lipoidal, many species have a characteristic postnuptial display. This behaviour seems to be initiated by events within the testis cycle. Environmental stimuli (including interactions between the sexes) may sometimes lead to a second reproduction when light is decreasing in duration and intensity.

It is known that the sexual cycles of some species are carried forward by sunshine and depressed by its absence. After their postnuptial metamorphosis, birds that have evolved a neurohormonal response to sunshine will respond sexually to candle and electric light—hence the ancient practices of *yogai* and *muit*, as well as some results of recent experimental photostimulation. While it is not denied that day-length *per se* may be partly influential in the timing of the breeding seasons of some temperate zone species, more refined techniques than those used in the past must be designed to prove it. Much photo-experimentation has been carried out under conditions that correspond but little with normal events in birds' lives. The exteroceptor/hypothalamus/pituitary/gonad mechanism of male birds may be easily jolted into activity by photostimulation, but the current theory that day-length is the most important factor in the initiation of the "spring" spermatogenesis (which often occurs at about, or shortly after, the winter solstice) is far from satisfactory.

The author believes that the internal gonad rhythm is the most important single factor in the timing of breeding seasons and the migration that is part of them. Thus, after varying periods following birth or reproduction, many species seem to be physiologically capable of reproduction. Courtship and other breeding activity is not carried forward to culmination, however, because the external environmental factors needed to bring about breeding response are lacking. Thus, certain xerophilous species breed only when it rains, irrespective of day-length, and may skip a whole year when it does not. Rainfall and its effect appear to control the breeding of many tropical species. Among temperate zone species cold and comparatively sunless and foodless winter conditions may be far more important as inhibitors than mere shortness of day *under natural conditions*. Conversely, Sooty Terns on Ascension Island breed four times every three years in an equable oceanic island environment that apparently produces sufficient food to enable the survival of young at any season.

The migratory journey to the breeding grounds (e.g., that taken by charadriiform birds that "winter" on equatorial islands) may be timed in part by a genetically fixed rate of gonad recrudescence. When the gonads of both young and adults reach a certain developmental threshold they may be then, and then only, in a condition to respond to environmental influences that stimulate the exteroceptors and anterior pituitary. Thus would the gonads become even more active, leading to behavioural reactions between the sexes, until the birds reached a condition that caused them to depart for the place where they were bred. The same may occur in migrants that "winter" in temperate zones and may partly control the breeding seasons of the many tropical birds that do not ovulate during the monsoon. It is not yet known whether the anterior pituitary, too, has a refractory phase.

After the "spring" initiation of spermatogenesis, the sexual cycles of many species are modifiable from week to week by environmental events such as weather, food availability, and, finally, the presence of safe nesting sites. Each species has evolved its breeding response to a particular set of stimuli (including interactions between the sexes) and inhibitors. *No single over-all factor such as day-length or light-increment is responsible for the timing of avian breeding seasons. The breeding season is kept in step with the sun essentially by the external factors that permit nidification, ovulation and the survival of young on the habitual breeding ground. Of these, the most important may be a safe nesting site, mild weather, and an abundance of the food on which the young are traditionally fed.*

APPENDIX: A SIMPLIFIED TECHNIQUE FOR QUICK ROUTINE DEMONSTRATION OF INTERSTITIAL AND TUBULE LIPOIDS OF THE AVIAN GONAD

By "lipoids" are meant any of the chemically diverse fatty substances that colour with Sudan Black or Scharlach R. (Scarlet R; Sudan IV) after formalin fixation. Sudan Black was first used in cytology by Lison (1934) and its use has been recommended strongly by Baker (1944), who stresses its much greater efficacy (in comparison with Sudan III and Sudan IV) in colouring lipoids other than triglycerides. Scharlach R., which was introduced by Michaelis about fifty years ago, and Sudan Black both colour fats in a purely physical way by entering and dissolving in the lipoid globules where they are more soluble than they are in 70% alcohol or other similar vehicles. Thus they do not act in the manner of dyes, and partly because of this they show little tendency to alter the appearance of cells or their inclusions. Sudan Black is of incalculable value for detailed histochemical investigation of lipoids in that it "unmasks" certain lipoids that remain unrevealed by treatment with Sudan III or IV. But for the purpose of simple and inexpensive demonstration of the total lipoid content of the organ at different stages of its cycle the following method is recommended.

Fixation should be carried out if at all possible immediately after death, at most within two hours. Immerse the testis in formal-calcium (Baker, 1944). Commercial formalin diluted to about 5% HCHO is also adequate provided prolonged storage is not contemplated. Although formalin-penetration is fast, careful snipping, first, of the tunic of any organ more than 3 mm. in diameter is advisable. Fixation should be continued for 24 to 36 hours.

Next, the tissue should be washed in running water for at least four hours to make absolutely sure that all formalin has been removed. For most satisfactory results gelatine embedding for 24 hours at 37°C. is advised. After this the tissue and embedding medium should be chilled, *not* frozen, for a few minutes in a refrigerator. The gelatine can now be trimmed into a small block and hardened in formal-calcium (or formalin as above) for another 24 hours and washed for about 30 minutes. Then it can be cut on the freezing microtome at about 10μ.

Colouring procedure: 1. Stand sections for about 30 seconds in 70% alcohol. 2. Transfer for about three minutes to solution of Scharlach R. 3. Dip in 70% alcohol. 4. Dip in water. 5. Transfer for about three minutes to Ehrlich's haematoxylin. 6. Blue in tapwater. 7. Differentiate, if necessary, in 0.5 HCl in water. 8. Mount in Farrant's or similar medium. Slide-clips help flatten gelatine sections and express air bubbles on the hotplate.

Scharlach R. may be made up as follows: 70% alcohol, 50 mls., acetone, 50 mls., to which is added enough Scharlach R. to saturate. *Filter before use.*

The above technique, after a little practice, will bring lipoids into brilliant scarlet relief against the remaining familiar structures blued by Ehrlich's haematoxylin. The second testis, or a fragment of the first if one is damaged by shot, should be fixed in Bouin's, Flemming's, or any other good general-purpose fixative, wax-sectioned (the lipoids are now lost) and stained with Masson's trichrome or other routine method to reveal more clearly the spermatogenetic stages, Leydig cell-size and nuclear detail, and the postnuptial rehabilitation of the *tunica albuginea*. If fixation must be carried out in the field, formal-calcium or formalin is fairly satisfactory for the wax-section material as well.

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Gertrude A. Nunnemacher was born in Milwaukee, Wisconsin, on August 11, 1888. She attended public school and high school in Milwaukee and spent one year at Smith College. On February 5, 1910, she was married to Henry J. Nunnemacher. Of the six children born of this union, four are now living. All her life Mrs. Nunnemacher was deeply interested in nature. She especially enjoyed passing on to others what she had learned from her years of bird-watching in the midwest. Often she lectured about birds and led bird-walks, giving of her time and energy unselfishly. She and Mr. Nunnemacher travelled widely, in the Old World as well as the New. Wherever she went she filled notebooks with detailed accounts of her observations of plants and birds. Beginning in 1940 she and her husband made several extended visits to México, and she became much interested in the birds of that country. Shortly before her death, which occurred in the fall of 1950, she made generous gestures in support of ornithological work in México. A donation from her made possible the Crimson-collared Grosbeak frontispiece in the December, 1950, issue of the *Bulletin*. The present issue of the *Bulletin*, which has been financed by several of her friends, and by Mr. Nunnemacher, is a memorial to her interest in birds, to her special interest in México—and to her.

BIRD NOTES FROM LA JOYA DE SALAS, TAMAULIPAS

BY C. RICHARD ROBINS AND WILLIAM B. HEED[1]

THE mountain village of La Joya de Salas, Tamaulipas, is about 65 kilometers south-southwest of Ciudad Victoria, 25 kilometers south-southeast of Jaumave, 50 kilometers east-northeast of Tula, and 20 kilometers northwest of Gómez Farías. It is built around a small sink-hole lake in the center of a roughly circular valley five to seven miles across.

The valley, except for the sloping eastern part, is very flat. Its elevation probably is about 5200 to 5400 feet. Along the north, east and southeast edges small ridges and ravines lead radially to mountains which rise sharply to an elevation of at least 6500 feet (possibly considerably more). At the west rises West Mountain. At the south is a deep canyon whose bottom is about a thousand feet lower than the valley floor. Immediately beyond this canyon rise slopes as high as those to the north so that, in effect, La Joya valley is completely ringed by mountains.

Trails lead out from the valley in several directions—well defined ones to Jaumave, Tula and Gómez Farías, smaller ones to lesser villages closer by. The Gómez Farías trail leads eastward over the only ridge separating the valley from the Río Sabinas lowlands and the great coastal plain. From this trail a good side-trail leads down to Pano Ayuctle and the busy Laredo-to-Mexico City highway. The character and birdlife of the country about Gómez Farías and Pano Ayuctle already have been reported on by Sutton and Pettingill (1942. *Auk*, 59: 1–34) and Eaton and Edwards (1948. *Wilson Bulletin*, 60: 109–114).

A humid deciduous forest which has been called a 'cloud forest,' covers much of the east side of this ridge. Forest of the same sort grows in some of the ravines running out from La Joya valley. The presence of these wooded pockets and the nearness of the main 'cloud forest' explain the occasional appearance of the Crested Guan or *Ajol* (*Penelope purpurascens*), Singing Quail (*Dactylortyx thoracicus*), Ornate Eagle-Hawk (*Spizaëtus ornatus*), Bell's Warbler (*Basileuterus belli*), and Rufous-capped Atlapetes (*Atlapetes pileatus*) along the east side of the valley. All of these birds are common in the forest above Pano Ayuctle and Gómez Farías.

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[1] We are indebted to J. Van Tyne and R. W. Storer, of the University of Michigan Museum of Zoology, for many kindnesses shown us; to Paul S. Martin, for leading us so ably in our field-work; to Richard B. Fischer for making prints of the photographs illustrating this paper; and to Ernest P. Edwards for lending us his La Joya field notes. We are especially grateful to George M. Sutton for helping us to plan and carry out our trip, complete our taxonomic work, and prepare this paper.

The eastern part of La Joya valley is fairly well forested with pines and moss-draped oaks. Most of the valley is, however, open and grazed to the ground, the barren monotony being relieved only by an occasional rocky outcrop or small, thorny tree. The country beyond West Mountain appears to be decidedly montane and arid. The slopes are open and rocky, with a scattering of agave and yucca, and patches of forest, presumably oak and pine. This region, the eastern edge of the great central plateau, is separated from La Joya valley, West Mountain, and, indeed, the entire Guatemalan Range of the Sierra Madre Oriental, by a large canyon. That birds we presume to be more common in this arid country to the west occasionally reach La Joya valley is indicated by the following sight records (all made by us in 1949): a group of four Say's Phoebes (*Sayornis saya*), March 25–27; a mixed flock of Bush-tits (*Psaltriparus minimus*) and Verdins (*Auriparus flaviceps*), March 24; a Sage Thrasher (*Oreoscoptes montanus*), March 24; and five Phainopeplas (*Phainopepla nitens*), May 24.

The mountains north of La Joya valley we did not investigate. Their nature is not known to us.

One more area needs to be discussed: West Mountain. The crown of this mountain was, except for a few grassy meadows, densely covered with oak-scrub knee- to waist-high except about the numerous sink-holes, where it reached 10 feet. The meadows were surrounded by aspens, cedar, and a bush resembling English boxwood. Below the very top of the mountain were depressions—each an acre or so in extent—in which grew larger oaks. These trees sometimes reached a height of 30 feet, and they were covered heavily with Spanish moss and lichens, less heavily with bromeliads and orchids. These 'oak depressions' were very different from the surrounding scrublands. On entering them we sensed the shade and a certain dampness of vegetation, soil and atmosphere. They harbored a rich avifauna. Many of the birds listed by us we encountered only in them.

In 1949 we visited La Joya from March 23 to 29 and from May 24 to 30, listing 129 bird species and collecting 82 specimens (now in the Sutton collection). Heed and Byron C. Harrell visited the valley from the evening of June 25 to the morning of June 28, collecting four specimens and adding one species to the list. (In 1948, Ernest P. Edwards, Paul S. Martin, and Roger Hurd had visited La Joya from April 11 to 14. They had collected 26 specimens and recorded two species not on our list.)

No rain fell during our March visit in 1949, and the sky was almost cloudless. Not for months had there been an appreciable shower and the lake was critically low. Because of the drouth no one had planted crops. Temperatures were, however, moderate, ranging from lows at night of 55°–60°F., to highs of about 75° in the afternoon. Between our March and May visits rain fell several times and in late May we had thunder showers. From May 24 to 30 the temperature ranged from lows of 60°–72° in the morning to highs of 71°–80° in the afternoon. During Heed's and Harrell's visit in latter June the weather was continuously overcast and rainy.

Our La Joya list is largely of the breeding birds. The following forms seem to merit special discussion at this time:

Columba f. fasciata. Band-tailed Pigeon.

First noted May 25, when Heed collected a female, one of two birds seen near the village. On May 28, Robins found a nest (contents ?) in a large oak near a meadow on the top of West Mountain. An adult bird was on this nest, which was 20 feet up, well out on a side limb, and made of twigs, apparently, being like that of a Mourning Dove (*Zenaidura macroura*) but much bulkier. We saw hundreds of Band-tailed Pigeons along the trail between the mountain top and the village.

Rhynchopsitta terrisi. Maroon-fronted Parrot.

With George M. Sutton and Roger Hurd we made an attempt to find this species in the pines above Frank Harrison's farm, the Rancho del Cielo (between La Joya valley and Gómez Farías), on March 21, 1949. We heard the birds in the distance, but never saw them. This failure was really what prompted us to go to La Joya, for these *papagayos* were said to be common there from October to April (roughly the dry season). We heard a flock as we were climbing to La Joya on March 23, and later that day saw four flying high over the ridge east of the valley. On March 27, Robins saw a flock (50 to 100 birds) alight just out of range above him along the rim of a canyon. They were feeding on pine cones. They continued to fly back and forth over the canyon into the pines on either side. At a distance they sounded exactly like a noisy company of Acorn Woodpeckers (*Balanosphyra formicivora*), a species which breeds commonly in the region. They resembled Thick-billed Parrots (*R. pachyrhyncha*), but the red at the base of the bill was so deep (*cf.* Moore, R. T. 1947. *Proc. Biol. Soc. Washington*, 60: 27–28) that in the field it appeared to be black.

Irby Davis has commented that species of the genus *Rhynchopsitta* might properly be called macawlets. *R. terrisi* has not, so far as we know, been reported heretofore from Tamaulipas. We have no proof that it breeds near La Joya and suspect that it does not.

Hylocharis l. leucotis. White-eared Hummingbird.

On May 25 we found a nest (contents ?) of this species high on West Mountain. It was about 30 feet up in an oak, well out from the main trunk, on a twig which stuck straight down from a large horizontal branch. It was made of lichens, small bits of Spanish moss, and other plant materials, bound together with spider webs. An adult bird was on it. We would probably never have found it had we not noted the aggressive behavior of a White-eared Hummingbird which seemed to be driving all hummingbirds away from the nest-tree, returning at intervals to perch near the nest. A male specimen collected by Robins on May 27 has the measurements (wing, 55 mm.; culmen, 16) of the nominate race.

Atthis h. heloisa. Heloise's Bumblebee Hummingbird.

White-eared Hummingbirds occasionally visited flower gardens in the village of La Joya, but we found the Bumblebee Hummingbird only in the oak pockets on West Mountain. Here we saw it repeatedly May 24 to 30 and June 27. On May 27 and 28, Robins witnessed copulation several times. In each instance, the female was perched on a low bush, with her wings drooping at her sides. The male, hovering about five feet above her, moved toward her slowly. In his descent his wings appeared to beat at full speed, but as he drew close the pitch of his drone became markedly higher, as if a more rapid and less deep wing-beat were necessary to keep him from striking her. Not even momentarily did his wings stop their beating. The usual drone of the wings is rather high-pitched and beelike and carries a considerable distance. We could identify the birds not alone by the sound of their flight but by their custom of flying along the under side of the main oak branches. Here, with wings going full speed, they moved at a rate of a few feet per second, apparently hunting food among the lichens. Occasionally a White-eared Hummingbird fed in this way, but that species seemed to prefer probing the bromeliads. The 'song' of *Atthis heloisa* was an insectlike *zeee, eeee, eeee,* each syllable rising in volume and pitch at the end. In the two specimens collected (males, May 27 and 28) the outermost primary is decidedly attenuate, and the bills measure, respectively, 12 and 12.5 mm.

Trogon m. mexicanus. Mexican Trogon.

Fairly common in wooded ravines. On May 27, at about 6000 feet on West Mountain, Robins found a nest four feet from the ground in a hole in the main trunk of a small oak. The entrance measured 4 x $2\frac{1}{2}$ inches and the cavity was about an inch deep, so the two recently hatched young were readily visible. An adult male specimen (testes enlarged) collected March 27 is brassy green above, especially on the back, and not at all "blue or purplish" as Griscom (1932. *Proc. New England Zoöl. Club,* 13: 57) seemed to believe Tamaulipan birds to be.

Piculus aeruginosus. Bronzed Woodpecker.

We saw this species March 27 and 28—a single bird on each date. In May it seemed to be fairly common throughout the deciduous woodland. Robins collected a young bird (not long out of the nest, but by itself) on May 25. A little later that day he saw a family group, including three young of about the same age as the bird collected. The wide altitudinal range of this species, which has been reported only from Nuevo León, Tamaulipas, San Luis Potosí, Puebla, and northern Veracruz, is surprising.

Myiarchus tuberculifer. Dusky-capped Flycatcher.

We found this species in woodland wherever we went except near the village of La Joya. On June 27, Heed found a pair feeding young in a natural cavity in an oak about twenty feet from the ground.

Empidonax difficilis. Western Flycatcher.

Common all over West Mountain. During our May visit the birds were in pairs, and so strong was their attachment to the sink-holes in which they nested that we could easily locate the sink-holes merely by listening for the characteristic callnotes.

Catherpes m. mexicanus. Canyon Wren.

Common along the stone fences as well as about cliffs and scattered rocks. On May 26, in a small cave above the valley, we found a pair feeding young. On May 27, again in a cave, we found a nest containing four young almost ready to leave. We collected two adult males and a nestling, May 25–27.

Catharus aurantiirostris clarus. Orange-billed Nightingale-Thrush.

This bird we did not see at all in March, but in May it was the commonest species on West Mountain, especially in the oak-scrub. Although in almost constant song, it was difficult to observe because of its extreme shyness. The song, never loud, reminded us of a weak song of the Hermit Thrush (*Hylocichla guttata*). Among its various callnotes was a thin *me-aah,* reminiscent of a cry of the Catbird (*Dumetella carolinensis*); a nasal *ber-wink*; and a high squeal, audible only at close range and given near the nest.

We found ten nests, all in oaks, two to fifteen feet above the ground, on West Mountain. Six were empty, apparently just ready for eggs. One held two eggs, another three eggs (May 28), and two more probably held eggs, for a bird was sitting on each. The eggs were light green or blue-green, rather evenly spotted or blotched with lavender. The highest nests (one 12 feet up; two 15 feet up) were on sloping branches in about the sort of site a Wood Thrush (*Hylocichla mustelina*) might select. Three nests were largely of lichens, others of leaves, and all had some pine needles and moss in them.

So far as we know *C. aurantiirostris* has not before been recorded in Tamaulipas. Our three specimens (May 27–28), all males, have the pale gray under parts and not very rufescent upper parts of *clarus*.

Nest of Orange-billed Nightingale-Thrush (*Catharus aurantiirostris*) three feet above ground in scrub oak at about 6000 feet elevation above the village of La Joya de Salas, Tamaulipas, México. Photographed May 28, 1949, by William B. Heed.

Ptilogonys cinereus pallescens. Gray Silky-Flycatcher.

Not seen in March, but abundant in May on the steep hillsides, especially where weathering had bared the limestone or worn it into steplike cliffs. The birds perched on dead snags or the very tops of shrubs, darting out after insects. Their call was a hurried *chu-chup*, or a more slowly given *chup, chup, chup*. Infrequently they gave a lisping cry like that of a Cedar Waxwing (*Bombycilla cedrorum*). On May 27, several of them were carrying nest material and we found one nest—a neat, compact structure about twenty feet up on a small outer oak branch. We found several more nests on May 28 on West Mountain. Egg-laying apparently had not yet started on that date. All the nests were lichen-covered, like that described by Newman (1950. *Condor*, 52: 157–158). A male and two females collected May 26 appear to represent the not very strongly marked race *pallescens*.

Cyclarhis gujanensis. Rufous-browed Pepper-Shrike.

This species has been called a "humid forest" bird by Eaton and Edwards (1948. *Wilson Bulletin*, 60: 111), but it certainly is not restricted to the humid forest about the Rancho del Cielo or above the Río Sabinas, and it may possibly not breed there at all. We observed a singing bird well up on West Mountain in brushy, distinctly arid country. Twice we saw this bird carrying food, but when we tried to follow it to its nest we lost it among the large flocks of Abeillé's Grosbeaks (*Hesperiphona abeillei*) and numerous Gray Silky-Flycatchers.

Geothlypis nelsoni. Hooded Yellow-throat.

This shy warbler we first encountered on May 27 in the low oak-scrub on West Mountain. Here it was fairly common, though we did not find a nest. The males sang from the tops of the small oaks. The song was a distinctive *wichy wichy wichy chee chee chee chee wich* or *wichy wichy wichy bitsy bitsy bitsy brrrrr* (trilled). The note of alarm was a sharp *chip*. Occasionally one rose in air some 20 feet and gave a longer version of one of the above songs. In flight the tail appeared to be very long. Three males taken (two, May 27; one, June 27) vary considerably, one of them having no gray at all on the crown. This species has not heretofore been reported from Tamaulipas.

Tanagra e. elegantissima. Blue-hooded Euphonia.

Uncommon in March. In May abundant on the oak-covered slopes down to the very edge of the valley. It fed exclusively on mistletoe, which was common everywhere in the oaks. The males sang their loud, bubbling songs in the tops of the highest trees.

We found several nests in May—the first among the heavy leafage of a branch which had fallen from the top of an oak and lodged about 20 feet from the ground. The birds had bound the dead leaves together loosely with Spanish moss, placing the nest inside. Our climbing to this nest so disturbed the birds that they abandoned it and started another in a clump of Spanish moss in the same tree. Three other nests were all in Spanish moss. A small entrance hole led in through the moss to the nest proper, which was made of plant fibers, pine needles, and some moss. No nest examined by us held eggs, but a female taken May 26 had a well defined brood-patch and four ruptured ovarian follicles, and a female taken May 29 had a well defined brood-patch. The four males and three females collected (March and May) represent the nominate race. The females are readily identifiable as *elegantissima* because of the bright yellowish-olive tone of their under parts.

Piranga flava dextra. Hepatic Tanager.

Fairly common in higher woods. A nest, apparently just ready for eggs, we found May 28 in an oak seven feet from the ground on the top of West Mountain. It was made of plant fibers and grasses principally, with a few twigs. We collected a stub-tailed male in juvenal plumage on May 30. Three adult specimens (female, March 24; male and female, March 28) collected by Robins we have identified as *dextra*.

Pheucticus melanocephalus. Black-headed Grosbeak.

Not seen in March, but recorded often in May. Heed found a nest (three eggs) in a mesquite-like tree on a steep, brush-covered slope above the valley on May 27. The measurements (wing, 101 mm.; tail, 80; culmen, 20) of our only specimen, a male, seem to indicate intermediacy between the nominate race and *maculatus*.

Tiaris olivacea. Yellow-faced Grassquit.

To our great surprise we found this species nesting along the edges of the oak pockets at about 6300 feet elevation on West Mountain. We saw several adults on May 27 and 28,

Entrance to nest of Blue-hooded Euphonia (*Tanagra elegantissima*) in Spanish moss in an oak, fifteen feet above ground, at an elevation of about 5000 feet, near the village of La Joya de Salas, Tamaulipas, México. Photographed May 26, 1949, by William B. Heed.

one of them carrying food. We heard a young one being fed, too, but failed to find it or the nest. This species breeds rather commonly in the Río Sabinas bottomlands and along the edges of the marshes at Tampico.

Aimophila r. rufescens. Rusty Sparrow.

Heed collected one of several singing males encountered on West Mountain among oak-scrub at about 6000 feet elevation on June 27, 1949. The wing of this specimen measures 75 mm., the tail, 80. The species has not, apparently, been reported heretofore from Tamaulipas.

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NEW LIFE MEMBER

Ralph Milton Edeburn was born on a farm in Mercer County, Pennsylvania, on January 4, 1905 He received his B. S. degree from the State Teachers' College at Slippery Rock, Pennsylvania, and both his M.S. and Ph.D. degrees from Cornell. After teaching in high school for a number of years he accepted a position in the Zoology Department of Marshall College, where he now holds an Associate Professorship. He has always been interested in classroom teaching, and has devoted most of his energies to that work. He is the co-author of a laboratory manual in general Zoology for college students. His profession is pre-medical education. His interest in birds was fired many years ago by a student, and he has spent much time since collecting data on the birds of the local communities in which he has taught. At present he is particularly interested in the Nighthawk (*Chordeiles minor*) and its nesting behavior at Huntington, West Virginia. He is president of the active Huntington Bird Study Club and an associate member of the American Ornithologists' Union. He joined The Wilson Ornithological Club in 1947. He is now the Chairman of our Membership Committee. Our photo shows him holding a magpie collected by him near Huntington.

THE SAN GERONIMO SWIFT IN HONDURAS

BY MARJORIE H. CARR AND J. C. DICKINSON, JR.

THE beautiful, but little known, San Gerónimo Swift (*Panyptila sancti-hieronymi*) has long been considered to have a very restricted range. Partly because it has been difficult to collect, it has been poorly represented in collections both in this country and abroad. In the British Museum are the type pair, taken in 1862, and a third specimen, obtained in 1888 and labelled "Guatemala. J. Rodriguez. B. M. Reg. No. 1888. 7. 30. 75." Two specimens mentioned by Ridgway (1911. *Bull. U. S. Natl. Mus.*, 50: 592) are in the collection of the U. S. National Museum. They were taken at the type locality, San Gerónimo, Vera Paz, Guatemala, by Henry Hague, in 1867. Salvin and Godman (1893. Biologia Centrali-Americana. Aves, 2: 372) discuss a sixth specimen, a bird taken near Antigua, Guatemala, by Don Vicente Constancia. This specimen, which was deposited in the Museum of the Sociedad Económica de Guatemala, was destroyed in the earthquake which wrecked Guatemala City in 1925. For a long time the species thus was known from a total of six specimens and from a very few published accounts of birds seen. Notable among the sight records were those of A. W. Anthony, whose manuscript comments were quoted in full by Griscom (1932. "Bird-Life in Guatemala." *Bull. Am. Mus. Nat. Hist.*, 64: 193). Anthony saw flocks of the swifts repeatedly in May on the eastern slopes of Volcán de Agua, near Antigua, Guatemala. In the absence of specimens or records from elsewhere the range of *Panyptila sancti-hieronymi* has been believed to be restricted to the "mountains of western Guatemala" (*cf.* Peters, Check-List of Birds of the World, 4: 253). Griscom, in a recent letter to J. Van Tyne, stated that he and W. DeWitt Miller were sure they had seen the species in the mountains of north-central Nicaragua in April, 1917. They did not, however, obtain a specimen.

In the light of the paucity of definite information concerning this swift, a collection of them made recently at the Escuela Agrícola Panamericana in the republic of Honduras, Central America, is of interest if for no other reason than that it extends the known range considerably to the southward and eastward of western Guatemala. The Escuela Agrícola Panamericana is in the Yeguare River valley, in the Department of Francisco Morazán, in the mountainous south-central part of Honduras. Its altitude is 2600 feet. Field observations on the birds thereabouts were made by Carr over a period of four years. For a detailed description of the area see "Outline for a Classification of Animal Habitats in Honduras," by A. F. Carr, Jr. (1950. *Bull. Amer. Mus. Nat. Hist.*, 94: 580–585).

The large, graceful *Panyptila* was to be seen nearly any evening during the year circling at altitudes of 4500 to 5000 feet above the mountain sides surrounding the valley. Another swift, the much smaller *Chaetura vauxi richmondi*, was observed and collected in the cloud forest capping a peak in the vicinity by Dickinson (1951. *Wilson Bulletin*, 63: 201–202). In the valley proper, *Panyptila* appeared only after the first heavy showers of the rainy season. Its descent to this lower altitude appeared to be in response to the emergence of enormous swarms of termites following the rains. At such times large numbers of San Gerónimo Swifts, in company with at least two other swifts, the Chestnut-collared (*Chaetura rutila brunneitorques*) and the Black (*Nephoecetes niger costaricensis*), as well as Barn Swallows (*Hirundo rustica*) and Violet-green Swallows (*Tachycineta thalassina*), often gathered in the valley to forage above the pastures and among the palms and buildings of the school grounds. Even at this low altitude their wariness and swift, erratic flight made collection difficult. From June 16 to July 4, 1948, we took six specimens. These have been

TABLE 1

Measurements of Honduras Specimens of *Panyptila sancti-hieronymi*

Collection*	Sex	Age	Wing	Tail	Exposed Culmen	Tarsus	Toe	Locality
UMMZ	♂	Juv.	187.0	86.5	7.0	14.5	8.0	Yeguare River
MCZ	♂	Ad.	178.5	85.7	7.5	14.0	8.1	Yeguare River
DBUF	♂	Ad.	181.0	89.0	7.0	13.7	8.1	Yeguare River
UMMZ	♀	Ad.	180.0	84.5	7.6	13.5	8.2	Yeguare River
MCZ	?	Ad.	184.0	88.5	7.7	13.9	8.0	Yeguare River
DBUF	♀	Ad.	187.0	87.5	7.5	14.0	8.0	Yeguare River
DBUF	?	Juv.	171.5	84.0	7.1	13.1	8.0	Cerro del Chile
DBUF	?	Juv.	181.0	85.6	7.2	13.5	8.4	Cerro del Chile
DBUF	?	Juv.	183.0	88.0	7.0	13.5	7.9	Cerro del Chile

* Abbreviations used are as follows: UMMZ, Museum of Zoology, University of Michigan; DBUF, Department of Biology, University of Florida; MCZ, Museum of Comparative Zoology, Harvard University.

carefully compared with specimens of the much smaller *Panyptila cayennensis*. Among the stomach contents of two specimens were the remains of large numbers of the winged form of an unidentified termite and a single adult female of the pentatomid bug *Solubea pugnax*.

We have every reason to believe that the San Gerónimo Swift breeds in the Yeguare valley. On several occasions late in the afternoon, observers saw swifts flying into an abandoned mine shaft in the precipitous scarp on the east face of Cerro Uyuca at an altitude of about 2600 feet. All attempts to reach this spot were unsuccessful. Although there were numerous such shafts at similar altitudes around the valley, this appeared to be the only one inhabited by *Panyptila*. Perhaps this was because all the other shafts were near settled areas.

We offer the following tangible proof that *Panyptila sancti-hieronymi* breeds in Honduras. On June 22, 1949, Sr. Juan Landaverde, a prospector and able woodsman from a valley some twenty miles east of the Escuela, brought to Carr three living young swifts. They were well feathered, but as yet unable to fly. They had been found by Landaverde in an old mine shaft on Cerro del Chile, Department of El Paraíso, at an altitude of about 4800 feet. Landaverde described the opening of this shaft as easily accessible. Worth noting, however, is the fact that the Chile area is wild and sparsely inhabited. The young swifts were not timid. For several days they clung to and crawled about the sides of a tall straw basket, feeding readily on yolks of eggs and mashed ripe bananas. When the basket was touched, all three usually uttered high chittering squeaks, very similar to the call of the adults, and climbed upward with mouths open and wings vibrating.

We are indebted to Dr. Pierce Brodkorb for his tentative identification of the ornithological material upon which this report is based. Dr. J. Van Tyne kindly compared our *Panyptila sancti-hieronymi* specimens with those available in the U. S. National Museum, commenting as follows: "They seem to be identical. The old skins, of course, show their age in a yellowing of the white feathers and a browning of the black ones. I noted no other differences." Dr. Van Tyne also assisted in checking collections here and abroad for additional specimens. Mr. Jon Herring furnished the identification of the insect material. Skins in the Dickinson collection have been deposited in the Museum of Comparative Zoology at Harvard University and the University of Michigan Museum of Zoology.

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CONVERGENCE IN THE COEREBIDAE

BY WILLIAM J. BEECHER[1]

EXTENSIVE efforts of the writer to find a sound anatomical basis for determining the phylogenetic relationships of passerine families leave it clear that the hazard of adaptive convergence in bird systematics has been underestimated. The present analysis of convergence in the neotropical Honey Creepers (family Coerebidae) offers evidence that this is an artificial group. It appears to be composed, in fact, of nectar-adapted warblers (Parulidae) and nectar-adapted tanagers (Thraupidae) that have evolved convergently because of similarity of diet.

The Convergence Hazard in Taxonomy

Sound systematic work in the higher categories demands sound criteria for clearly distinguishing between adaptation and phylogeny. The investigator at this level sees phylogeny through a screen of food and niche adaptations which often obscure true relationships. Such classic cases of convergence between Old and New World groups as were recently reviewed by Friedmann (1946) are obvious and constitute no hazard. But convergence between members of closely related groups occupying the same range may be such that the most expert taxonomists are unable to decide the true affinities on the basis of external characters alone (Beecher, 1950). This is no reflection on the taxonomists, who have generally been the first to recognize the problem, referring such moot groups as the Coerebidae to the comparative anatomist for additional evidence.

But internal characters are not necessarily more reliable than external ones for indicating phylogeny. They are merely additional clues, often of a very conservative sort, but sometimes capable of adaptive changes as rapid as those known for any external features. Sclater (1886: 1) long ago observed that it was "in some instances difficult to distinguish" the Coerebidae from warblers on the one hand and tanagers on the other. Lucas (1894: 299–309) made an anatomical survey of several of the most important coerebid genera; though he considered his findings confusing and inconclusive, they nevertheless confirmed an opinion many times expressed that the group needed study and was probably heterogeneous. Ridgway (1902: 377) obviously regarded the Coerebidae as close to the Parulidae and Thraupidae. He even removed the

[1] The writer is greatly indebted to the United States National Museum, the American Museum of Natural History, and the Chicago Natural History Museum for lending material. For use of specimens in their care or for information or advice, he wishes to thank Alexander Wetmore, Herbert Friedmann, John T. Zimmer, Ernst Mayr, Dean Amadon, Charles O'Brien, Josselyn Van Tyne, D. Dwight Davis, Emmet R. Blake and Melvyn A. Traylor, Jr.

genera *Conirostrum* and *Ateleodacnis* to the Parulidae, whence Lucas (1894: 309–310) had earlier removed *Certhidea*. Both Sclater (1886: 47) and Ridgway (*loc. cit.*) placed *Glossiptila* (*Euneornis*) in a monotypic subfamily under the Coerebidae. Hellmayr (1935: 218–331), however, placed all these genera, except *Certhidea*, in the Coerebidae without subfamilial distinction. Thus there has been a difference of opinion as to the status of certain genera, but a consensus that the family belongs close to the warblers and tanagers.

Convergence in the Coerebidae

It is axiomatic that a family must be erected on a basis of characters common to the included genera, and the assumption is that these characters will be fundamental, expressing a common phylogenetic origin. As pointed out by Mayr (1942: 276) and Simpson (1945: 17), any higher category must be monophyletic. The Coerebidae do not appear to satisfy these requirements.

Examining the characters of the group we find none that really distinguish it. Some species are brilliant in plumage, others dull. The bill is extremely variable—long, short, straight, curved, notched, even hooked—and this diversity of form extends to the tongue and to the head as a whole. The only feature common to all members is the adaptive trait of nectar-feeding. This trait is naturally suspect as a character if the birds involved are to be classified *according to common origin*. Lucas (1894), in attempting to determine the origins of the family, seized principally upon those features most strongly modified by the nectar-feeding adaptation—bony palate, tongue, and intestine. Ridgway (1902: 375) erred, however, when he stated that Lucas considered the Coerebidae "apparently more nearly related to the Australasian family Meliphagidae (Honey-eaters) than to the American families Mniotiltidae and Tanagridae. . . ." What Lucas did say (1894: 309) was that "the Coerebidae do not form a homogeneous group. . . ." His principal reference to the Meliphagidae (*loc. cit.*) concerned the tongue of *Certhiola*, which he believed to resemble "that of some of the Meliphagidae. . . ."

Evidence of convergence is to be obtained through a careful study of morphology, especially through study of parts of the animal not likely to be modified by the selection pressure bringing about convergence. It is well known that different parts of an animal evolve at different rates (Simpson, 1944). The hind limb is very similar in muscle pattern throughout the order Passeriformes and seems to have become relatively static after attaining a high level of general efficiency. The syringeal musculature, slightly less conservative, has served to divide this large order into suborders. But there is evidence (Beecher, 1951) that the bill and skull are still rapidly evolving in passerines—leading the way in evolution. Having dissected to date nearly a thousand specimens of oscinine birds in all families (over six hundred species), the writer finds that the more rapidly-evolving jaw muscle-patterns are clearly different for each family. When used with the several additional lines of evidence indicated later in this paper they seem to delineate an evolutionary sequence based on adaptation to various food types.

Evidence of Convergence from Jaw Muscle-Patterns

To recognize the family differences in jaw muscle-pattern it is necessary to distinguish between two basic types of skeletal muscle—pinnate and parallel (Pfuhl, 1936). In the parallel type all fibers run the full length of the muscle and exert pull, upon contraction, directly between the points of attachment. The vireos (Vireonidae) typify this pattern (Fig. 1) with nearly the entire

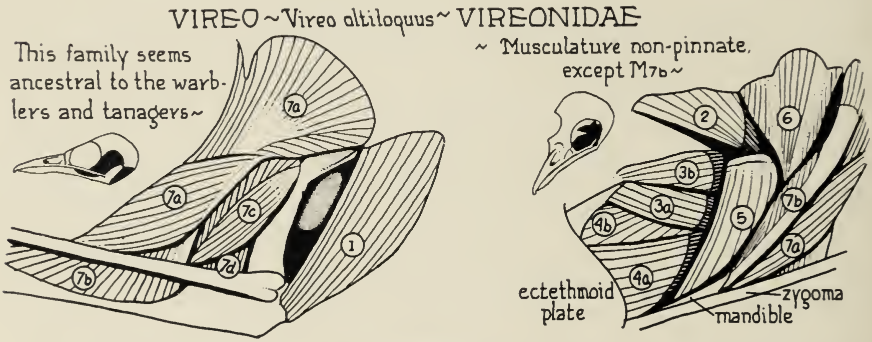

FIG. 1. Jaw muscle-pattern of *Vireo altiloquus* broken down into functional groups. In gaping, *M. depressor mandibulae* (1) depresses the lower mandible, while *M. protractor quadrati* (2) elevates the upper mandible.

The combined action of the palatine retractors 3, 4, and 5 draws the upper mandible downward. The palatine retractors are:

3. *M. pterygoideus dorsalis* (a) *anterior*; (b) *posterior*
4. *M. pterygoideus ventralis* (a) *anterior*; (b) *posterior*
5. *M. pseudotemporalis profundus*

The combined action of the mandibular adductors 6 and 7 draws the lower mandible upward. The mandibular adductors are:

6. *M. pseudotemporalis superficialis*
7. *M. adductor mandibulae* (a) *externus superficialis*; (b) *externus medialis*; (c) *externus profundus*; (d) *posterior*

jaw musculature parallel. The pinnate type is one in which the tendon or raphe runs the length of the muscle and the short fibers originate from it as the barbs originate from the shaft of a feather. The warblers show this pattern in *M. pseudotemporalis superficialis* (*6*) *and M. adductor mandibulae externus superficialis* (*7a*) as seen in Figure 2 (*Oporornis*). Grant (1942: 384) has pointed out that such a muscle is more efficient, having "a much greater functional cross section for its bulk."

It has appeared to the writer, on the basis of both skull structure and parallel

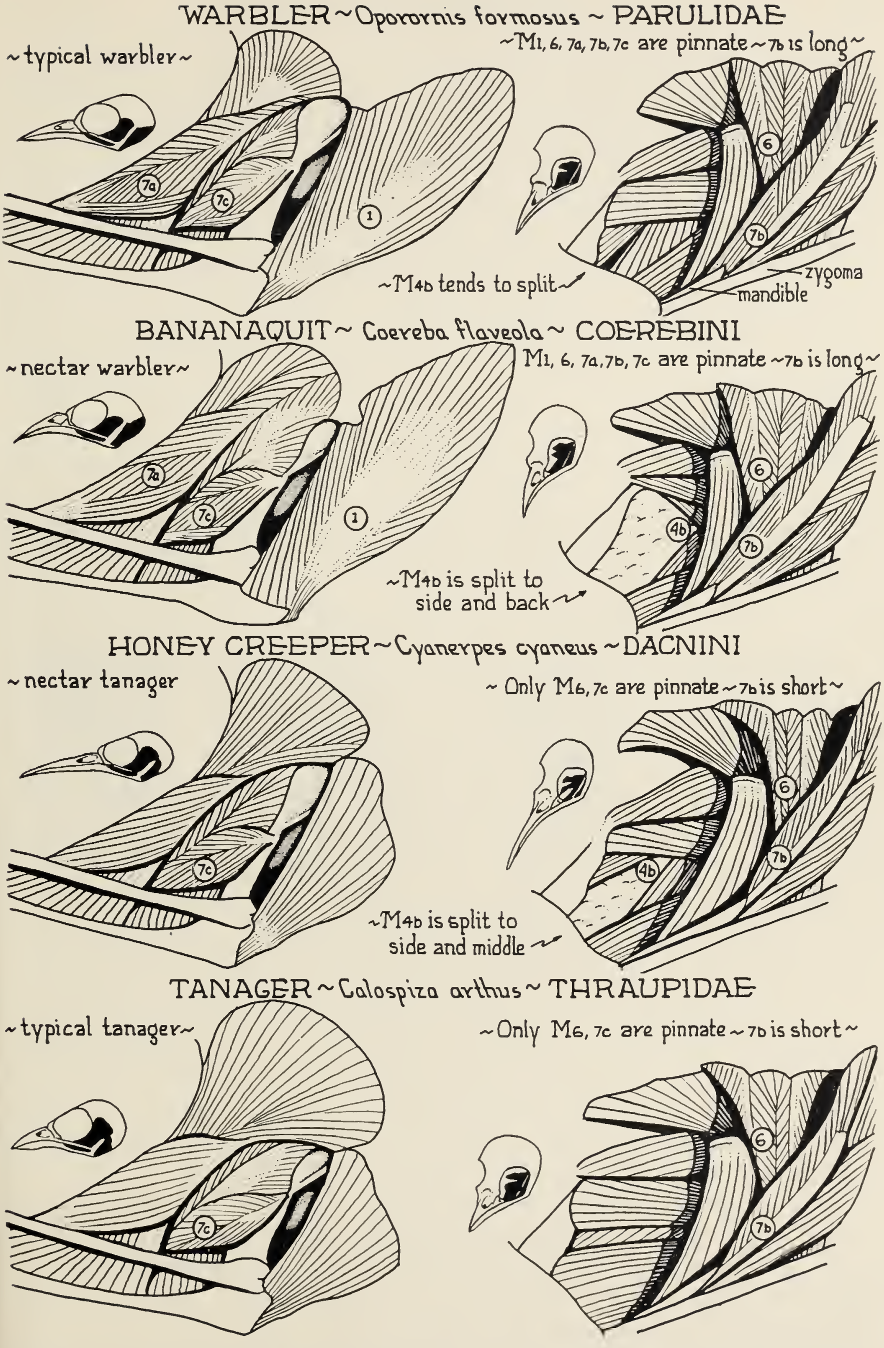

Fig. 2. Comparison of jaw muscle-pattern in typical warblers (Parulidae) and tanagers (Thraupidae) with that of their nectar-adapted forms.

jaw muscle-pattern, that the Vireonidae, like the Old World Monarch flycatchers from which it stems, is composed of phylogenetically primitive insect-eaters (Beecher, unpublished). Distribution patterns suggest that such a type may have existed even prior to the origin of flowering plants in the Upper Cretaceous and that all of the nine-primaried American families stem from ancestral vireos. The lighter, more agile Parulidae appear to have arisen with pinnate adductors of less mass and greater efficiency—a more adaptable group of insect-eaters. The heavier Thraupidae—a group adapted to feed on the abundant fruit of flowering plants—appear to have arisen with somewhat less pinnate adductors. The Parulidae and Thraupidae are, in fact, to be regarded as real adaptive branches on the phylogenetic tree, each having arisen in response to intense selection pressure on the primitive insect-eaters. The importance of the huge food supply furnished by the origin of flowering plants in producing this pressure cannot be over-emphasized. Logically it should come to bear similarly on warblers and tanagers, independently producing nectar-adapted and seed-adapted groups with ever-increasing tendency toward pinnate adductors.

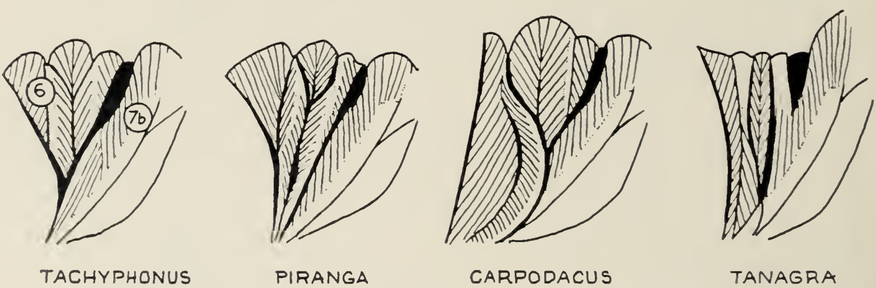

FIG. 3. An apparent shift of muscle fibers from *M7b* to *M6* (from left to right) with increased adducting power in the cardueline line of tanagers.

To argue the question whether the increase in pinnate musculature is phylogenetic or adaptive is academic. It is both, but there is every indication that such advances in jaw muscle-pattern are conservative enough to have phylogenetic value for taxonomic diagnosis at the family level of category. The blackbird family (Icteridae) which appear to have arisen from the emberizine finches via the finch-like Cowbird, *Molothrus* (Beecher, 1951), retains pinnate adductors despite all the food adaptations and accompanying bill changes for which its genera are noted. The muscle-patterns of tanagers and warblers differ from each other and offer a sound basis for taxonomic separation; but, before presenting evidence of convergence in the Coerebidae, it is necessary to emphasize some unusual features of the Thraupidae.

This family, as outlined below, is very large and diverse. Two main lines are distinguishable, leading almost without disjunction to the finch subfamilies

Carduelinae and Richmondeninae. On the basis of jaw muscle-pattern these lines stem from a relatively primitive tanager group comprising *Calospiza*, *Thraupis* and *Ramphocelus*, of which the large genus *Calospiza* is considered by the writer to be the simplest, anatomically, and *Ramphocelus* the most advanced. The latter continues the series into the Richmondeninae in the sequence *Ramphocelus—Hemispingus—Spindalis—Saltator—Pitylus—Pheucticus—Richmondena*. This is not necessarily a direct evolutionary sequence, although it moves in the direction of increasing finch character, especially in the bill and in the heightened pinnate character of *M. adductor mandibulae externus superficialis* (*M7a*), the latter beginning in *Hemispingus* and increasing in the series. There is also good plumage agreement, especially in females, and the horny palate shows an increased tendency to develop a subsidiary lateral ridge, additional to the one so prominent in all tanagers (see *Calospiza*, Fig. 4).

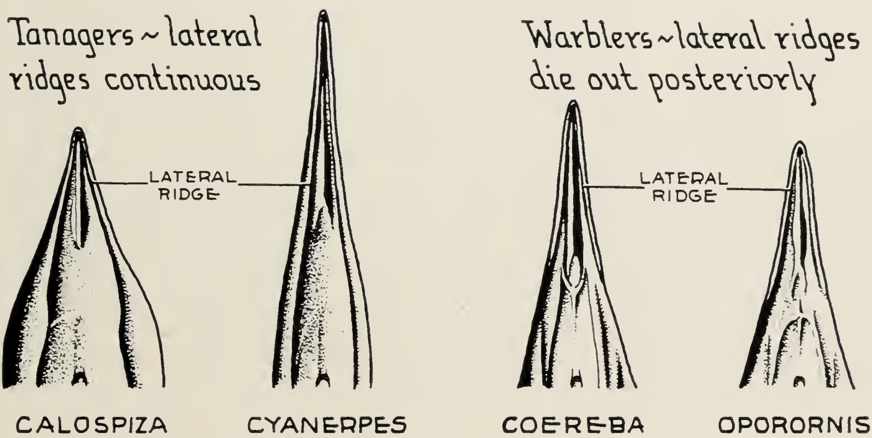

Fig. 4. Comparison of relief pattern seen in the horny palate of typical warblers (Parulidae) and tanagers (Thraupidae) with that of their nectar-adapted forms.

Ramphocelus might, because of its apparent close relationship with *Tachyphonus*, be considered a point of origin for the Carduelinae also—a group quite different in its muscular emphasis. *Tachyphonus* lies at the base of this line. The muscle-pattern of the weak-billed *T. surinamus* is like that of *Ramphocelus*, hence also of *Calospiza* (Fig. 2); but in the heavier-billed *T. rufus* the orbital slip of *M. adductor mandibulae* (*M7b*) is pinnate (Fig. 3). This appears to be correlated with increased adducting power, but with still further increase in the series *Tachyphonus—Piranga—Habia—Tanagra—Chlorophonia—Stephanophorus—Carpodacus* (Fig. 3) there appears to be a shift in emphasis from *M7b* to *M6*. The series terminates in the tremendous forward advance of the latter in *Carpodacus*, which is typical for the Carduelinae as a whole. That this shift involves a transfer of fibers to *M6* is suggested in the sketch of these two muscles for *Tanagra chlorotica* (Fig. 3), where transfer seems to be taking place. The horny palate in this series agrees closely with that of *Calospiza* (Fig. 4), and plumage generally supports the thesis of close relationship.

This digression on the complexities of the Thraupidae is necessary. In no other of the sixty-odd oscinine families do such variations in the muscle-pattern occur. It points up the peculiar fact that the richmondenine finches arise so uninterruptedly out of the tanagers that ornithologists have had to draw the dividing line between the two groups arbitrarily. Now we find the cardueline ("Old World") finches arising also without disjunction from another line of tanagers. *Chlorophonia cyanea*, with a muscle-pattern like that of *Carpodacus*, has a flattened tanager bill. The horny palate of *Stephanophorus diadematus*, a form internally almost identical with *Carpodacus*, has crenulated lateral ridges like those of the plant cutter *Phytotoma*—a further adaptation for bud-eating, so common in the Carduelinae.

Apparently it will be necessary to declare these two groups of tanager-finches subfamilies of the Thraupidae, maintaining another subfamily for the more typical tanagers. It would hardly do to extend the Richmondeninae and Carduelinae to include the two generic series cited above as stemming from *Ramphocelus*. Such a grouping would be as arbitrary as the one currently followed and the writer contemplates no change other than the including of the finch groups in the Thraupidae. But it is necessary to recognize that the anatomical modifications terminating in these finch groups have their roots deep in the typical tanagers, the Thraupinae. For this reason the basic muscle-pattern for tanagers is regarded by the writer as that found only in *Calospiza*, *Thraupis* and *Ramphocelus*, though genera not yet dissected by him may be included later. It is this pattern that the writer uses in his present re-examination of the Coerebidae.

A survey of the Vireonidae, here considered as ancestral to both the Parulidae and Thraupidae, reveals a muscle-pattern that is notably non-pinnate. In *Vireo altiloquus* and *V. olivaceus* a suggestion of pinnate character appears in *M. adductor mandibulae externus medialis* (*M7b* in Fig. 1), and this muscle, along with *M7a*, *c*, and *M6*, becomes fully pinnate in the shrike-like *Cyclarhis* and *Smaragdolanius*. But *Vireo griseus* and *V. flavifrons* lack this suggestion, as do *Hylophilus olivaceus*, *H. hypoxanthus* and *H. decurtatus*. This muscle is short and non-pinnate in the basic muscle-pattern for tanagers such as *Calospiza* but is always long and pinnate in such warblers as *Oporornis* (Fig. 2), *Setophaga*, *Basileuterus*, *Myioborus*, *Granatellus*, *Dendroica*, *Protonotaria*, *Geothlypis*, *Parula*, *Seiurus*, *Mniotilta* and *Icteria*. Thus we see a segregation on the basis of *M7b* that is diagnostic of warblers and tanagers.

Warblers differ from the basic tanagers in having a far more pinnate muscle-pattern, this in spite of the fact that they have much more slender bills and much lighter muscle mass. The pattern seen in *Oporornis* is typical. Pinnate muscles are *M. depressor mandibulae* (*M1*), *M. pseudotemporalis superficialis*

(*M6*), and three slips of *M. adductor mandibulae*, viz., *externus superficialis* (*M7a*), *externus medialis* (*M7b*), and *externus profundus* (*M7c*). In the basic tanagers only *M6* and *M7c* are pinnate. *M. depressor mandibulae* (*M1*) is always more highly developed in warblers than in tanagers (Fig. 2).

It was at first puzzling to find both tanager and warbler muscle-patterns appearing in different members of the family Coerebidae. The jaw muscle-pattern of *Coereba flaveola* (Fig. 2) corresponds perfectly, in fact, with that of *Oporornis formosus*, a typical warbler, while that of *Cyanerpes cyaneus* corresponds perfectly with that of *Calospiza arthus*, a typical tanager. It is true that *Coereba* and *Cyanerpes*, in adaptation to nectar-feeding, have an enlarged palatine salivary gland which causes the insertion of *M. pterygoideus ventralis posterior* (*M4b*) to split into two slips. Even here, however, the manner of the muscle's division is different: in *Coereba* it is split laterally and posteriorly—in *Cyanerpes*, laterally and medially. That this is not simply coincidental is borne out by the fact that, wherever this muscle is split by an enlarged palatine gland in coerebid genera, the disposal of the divided slips is either as in *Coereba* or as in *Cyanerpes*. Intermediate arrangements do not occur.

On the basis of muscle-pattern, then, it would appear that *Coereba* is nothing but a nectar-adapted warbler, and *Cyanerpes* a nectar-adapted tanager. The differences in muscle-pattern and -arrangement may be interpreted as the slightly different ways of achieving the same adaptation by two slightly different, converging stocks. Confidence in this interpretation is encouraged by the fact that a complete and sharp dichotomy of the Coerebidae is possible on the basis of the above differences. Those members which appear to be warblers are *Coereba*, *Conirostrum* and *Ateleodacnis*. Those which appear to be tanagers are *Cyanerpes*, *Chlorophanes*, *Iridophanes*, *Diglossa*, *Hemidacnis*, *Dacnis* and *Euneornis*.

Evidence of Convergence from Plumage Pattern

The writer has not examined *Xenodacnis* or *Oreomanes*, but he presumes them to be nectar-adapted tanagers. Such a presumption is plausible because the suggested dichotomy of coerebid genera is supported by plumage differences. *Coereba*, *Conirostrum* and *Ateleodacnis* have a warbler type of plumage, the other genera a tanager type of plumage, most of them with the same iridescent blues and greens observable in *Calospiza*, a few tending toward the plumbeous blues of *Thraupis*. The bizarre bill of *Diglossa* and unique tongue of *Euneornis* might cast doubt on this simple picture but the division is supported by muscle-pattern and the relief pattern of the horny palate. Moreover, there is no reason to think either that a single warbler genus and a single tanager genus gave rise to nectar-adapted warblers and tanagers, or that the nectar-adapted forms are all equally adapted to the same flowers. As will be shown beyond, the adaptation has apparently occurred in far-removed cases (*Hylophilus poicilotis* is a nectar-adapted vireo that escaped inclusion in the Coerebidae) and it is partially achieved in warblers and tanagers never included in the Coerebidae.

Regarding the reliability of plumage as an indicator of relationship, studies of the American orioles (Beecher, 1950) show that species are not generally under strong selection pressure to change plumage pattern once this pattern has reached a state of adaptive adjustment to the environment. If the environment changes greatly, plumage tends to evolve rapidly in re-adjustment. Applying this to the present group, there appears to be no reason why tanagers taking up nectar-feeding should change the plumage facies drastically. Since they have not, despite structural changes in the head region accompanying diet specialization, changed their environmental niche, there is no reason for expecting this plumage to change much. The same applies to nectar-specialized warblers: they may logically be expected to retain warbler plumage patterns. Only when change in feeding habit requires change in habitat, as in the derivation of buntings (Emberizinae) from the Parulidae, may rapid and drastic plumage changes be expected.

Evidence of Convergence from the Horny Palate

Sushkin (1927: 3) was impressed with the value of the relief pattern of the horny palate in diagnosing large groups. This character, not to be confused with the bony palate as seen in cleaned skulls, is apparent in the roof of the upper mandible of bird skins prepared with the bill open or in alcoholic specimens. As shown in Figure 4, there are three distinct ridges on the horny palate of both warblers and tanagers, and the differential emphasis on these in the two groups permits separation of their convergent representatives in the Coerebidae. In tanagers and their nectar-adapted forms the lateral ridges are strongly emphasized and continuous to the back of the tomium, whereas in warblers and their nectar-adapted forms they are little emphasized and die out posteriorly. The palate, posterior to the central ridge, is flat and virtually without relief in tanagers, vaulted and sculptured in warblers. These features, especially the condition of the lateral ridges, are diagnostic of warblers and tanagers and support the same dichotomy of coerebid genera as has been indicated above by muscle-pattern and plumage.

Evidence of Convergence from the Tongue

If more than one warbler genus and more than one tanager genus evolve nectar-adapted forms, and if these in turn are specialized for particular flower types rather than for all flowers, convergent overlap of bills and tongues is to be anticipated. It is clear that diagnostic distinctions in external bill structure do not occur among the warblers and tanagers feeding on nectar, even though the horny palate and muscle-pattern have in each case passed through this adaptation without loss of their basic characters. In the tongue, which varies considerably even among closely related species of warblers, we should expect least of all to find conservatism, particularly if there are special adaptations for special kinds of flowers. Here, in fact, we find the least satisfactory means for distinguishing between nectar-adapted warblers and nectar-adapted tanagers because basic distinctions are apparently obliterated by convergent "overlap" of these too-plastic characters.

In general the Hawaiian Drepanididae,[2] which are almost certainly of tanager origin (Beecher, unpublished), have progressed farther in tongue modification than any coerebid genus. As Lucas (1894: 306) has observed, the tongues of *Himatione*, *Hemignathus* and *Vestiaria* are perfectly tubular, the fimbriated edges actually overlapping. If the bifid tongues of *Cyanerpes* and *Dacnis* continued to curl, instead of simply forming a highly fimbriated half-curl, the result would be the twin tubes of the *Diglossa* tongue, and this tends to draw all nectar-adapted tanagers together. But there is apparently no sound basis for completely separating the nectar-adapted warblers with their bifid tongues from this broad and variable pattern. It is, however, noteworthy that the whipped out tongue of *Coereba* is remarkably similar to that of the oriole

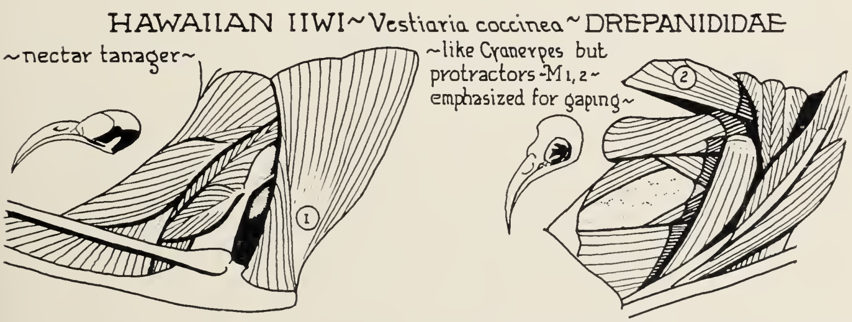

FIG. 5. Jaw muscle-pattern of *Vestiaria coccinea* of the Drepanididae, showing similarity to *Calospiza* and *Cyanerpes* despite development of *M1* and *M2* for gaping.

Bananivorus cucullatus (Beecher, 1950). Both are believed to arise from the warbler phyletic line, the emberizine finches being ancestral to the blackbirds (Icteridae), so this is apparently a case of common stock accomplishing the same adaptation twice in about the same way. The tongue of *Euneornis* is unique and, without histological sections, it is not even quite clear how it functions. But the bird is a tanager on the basis of jaw muscles and horny palate, and probably closely related to *Loxigilla*, which it resembles in these features and even in plumage pattern. Both genera occur in Jamaica, to which *Euneornis* is restricted, and it is possible that the finch *Loxigilla* arose from this tanager. Plumage change might not be expected since Gosse (1847) states that both inhabit the same niche (forest) there.

[2] Spelled also Drepaniidae and Drepanidae. See review of Amadon's "The Hawaiian Honeycreepers (Aves, Drepaniidae)" in this issue of the *Bulletin*, and also the comments of Ernst Mayr (1943. *Condor*, 45: 46) on the matter.—Editors.

Evidence of Convergence from the Bill Notch

The bill notch is so widespread in passerines that one is forced to conclude that this is a general adaptation for grasping slippery prey and, therefore, not likely to persist in flower probers. In vireos the bill is strongly notched, its shrike-like cast reaching full expression in the tribe Cyclarhini. In tanagers, which may well have arisen from ancestral vireos, the bill is also strongly notched, becoming shrike-like in *Lanio*. But in the warblers, also apparently evolved from vireos, it is weakly notched or un-notched. In *Coereba*, *Conirostrum* and *Ateleodacnis*, here regarded as nectar-adapted warblers, the bill is warbler-like and in the nectar-adapted tanagers—*Dacnis*, *Chlorophanes*, *Cyanerpes*, *Hemidacnis* and *Euneornis*—the bill is tanager-like, generally. But in some of the latter it is doubtfully notched and there is so much individual variation that one cannot safely say a particular genus is notched or not.

Again we find adaptive overlap of too-plastic characters, susceptible to obliteration by the suspected convergence, and it is plain that the bill-notch cannot be used to segregate warblers and tanagers in the Coerebidae. In support of the view that the notch easily disappears in nectar-adapted tanagers we have the evidence that it has done so in some species of the nectar-adapted vireo, *Hylophilus*.

Discussion

Is submergence of the family Coerebidae and the assignment of its genera among the warblers and tanagers justified? Here it should be appreciated that —if both warblers and tanagers arose from vireos—the two families would no sooner have established distinctions through evolutionary divergence than they would, through adaptive convergence, have begun to lose them. The differences to be looked for will not, therefore, be very dramatic and convergent obliteration may be expected especially in the very plastic bill and tongue which fall strongly under selection pressure in nectar-feeding.

The considerable within-the-genus differences of tongues in both the Parulidae and Thraupidae (Gardner, 1925) and of tongues and bills in the Icteridae (Beecher, 1950; 1951) suggest the unreliability of these characters. On the other hand, the constancy of the jaw muscle-pattern in the Icteridae, despite great modification of bill and tongue among the genera, and the conservatism of the pattern of the horny palate, inspire confidence. The latter characters have not only permitted the linking of tanagers to richmondenine and cardueline finches but also of warblers to emberizine finches and the latter to the Icteridae. This is not the place to detail these relationships, but characters capable of retaining their essential features through such adaptive transformations of skull and bill can be used with assurance in the present problem.

It is these highly dependable characters of jaw muscle-pattern and horny palate relief that accomplish the division of the genera of the Coerebidae among the warblers and tanagers—and this in good agreement with plumage pattern. The variable bill and tongue characters overlap adaptively. It is therefore concluded that, in view of the relatively meager diagnostic differences expected in convergent genera arising from groups as closely related as warblers and tanagers, the evidence is sufficient to justify submerging the family Coerebidae.

This seems entirely reasonable. Nectar-feeding has been acquired independently in many American passerine groups: vireos, warblers, tanagers, blackbirds and even finches—not to mention derived groups like the geospizids of the Galápagos and the drepanidids of the Hawaiian Islands. Various degrees of adaptive modification for the trait are seen, not only in the bills and tongues but also in relative development of jaw muscles. In fact two distinct mechanical adaptations may be distinguished in the nectar-feeders of the Thraupidae and Parulidae and this may be regarded as an additional diagnostic difference.

The nectar-adapted warblers are "gapers" (Beecher, 1950; 1951). As noted for *Coereba* in Figure 2, *M. depressor mandibulae* (*M1*) is highly developed in both *Conirostrum* and *Ateleodacnis*. The bill is apparently plunged into a flower closed, then opened forcefully to spread the flower parts and permit the tongue to reach the nectar—or possibly a hole is pecked in the side of a flower and enlarged in this manner. Functionally it is the same adaptation noted in the Icteridae and in the Old World Sturnidae, with a lever-like posterior extension of the mandible. In Figure 2 *Coereba* is compared with *Oporornis*, which shows the same adaptation, though not all warblers are gapers in this degree.

The Neotropical nectar-adapted tanagers are non-gapers. In none of them is *M1* more highly developed than in *Cyanerpes* (Fig. 2), and it is apparent that these species simply insert the bill into flowers and sip nectar. *Diglossa* has been observed by Moller (1931: 292) to tear a hole in the side of a tubular corolla with its short, hooked bill to get at the nectar it could not otherwise reach.

However, the tanager stock apparently can produce gapers. In the nectar-adapted drepanidids, *Vestiaria coccinea* (Fig. 5), *Himatione virens*, and *Hemignathus lucidus*, the origins of protractors *M1* and *M2* are greatly expanded for gaping in tubular corollas, and the adductors *M6* and *M7* are greatly reduced. Otherwise these birds are very similar to *Calospiza* or *Cyanerpes*. That the drepanidids have a tanager origin is supported also by the identity of muscle-patterns in the Hawaiian finch, *Psittirostra cantans*, and the cardueline finch, *Carpodacus mexicanus*. This may be interpreted as two independent origins of nearly identical finches from a common tanager ancestor.

As for *Spodiornis rusticus*, Wetmore and Phelps (1949: 378) observed that "the form of the tail and of the tongue suggest affinities with the Coerebidae, . . . the family in which P. L. Sclater originally described *Spodiornis*." The palate of *Spodiornis* suggests relationships with primitive emberizine finches like *Phrygilus*, however, and this may be one of those rare compromises—an intermediate between nectar-adapted warbler and emberizine finch. The highly angulated commissure of nectar-feeders, correlated with forward vision, is thought to pre-adapt them for seed-cracking before the bill becomes too long.

This paper has concerned itself with the submergence of the family Coerebidae as an unnatural category and the re-assignment of its genera among the warblers and tanagers. Some ornithologists will wish to retain this family name for some part of the group. There appears to be no valid reason for so doing, though the nectar-adapted warblers might be known as the tribe Coerebini and the nectar-adapted tanagers as the tribe Dacnini.

But nectar-feeding in the American nine-primaried assemblage should not be over-emphasized. Numerous references to the sucking of fruit and flower juices by warblers and tanagers never included in the Coerebidae could be cited. In the present state of our knowledge it would be difficult to know which ones to include in these tribes—unless we settle upon the genera dealt with above for the time being. Nectar-feeding is a general trait of the Thraupidae, Parulidae, Vireonidae, Icteridae, and even the polyphletic "Fringillidae." No useful purpose is served by giving it too much recognition in the classification of these higher categories.

Summary

An attempt is made on the basis of anatomical material, to show that the neotropical Honey Creepers (Coerebidae) are an artificial group composed of nectar-adapted warblers and nectar-adapted tanagers that have become convergently similar due to similar diet. Considerable care is taken to select for comparison anatomical characters likely to have been modified but little by such convergence. This precaution is necessitated by the close relationship of the warbler and tanager families due to their apparent common origin from ancestral vireos. Evidence from jaw muscle-pattern and horny palate relief is given special weight because of the constancy of these features in other passerine families studied anatomically. Tanagers and warblers have distinctly different patterns for both characters and it has been found that a clean separation of the Coerebidae into nectar-adapted warblers and nectar-adapted tanagers is possible. This dichotomy is in good agreement with plumage differences, the latter group having tanager plumage, the former, warbler plumage. A functional difference in the manner of feeding on nectar is also in agreement with this division. Such characters as bill shape and tongue specialization overlap convergently and are unreliable.

On the basis of this analysis it is concluded that the family Coerebidae should be submerged as an unnatural group, and its genera distributed among the warblers and tanagers. The genera *Coereba*, *Conirostrum* and *Ateleodacnis* could be regarded as a nectar-specialized tribe of the Parulidae—the Coerebini. The genera *Diglossa*, *Cyanerpes*, *Chlorophanes*, *Iridophanes*, *Hemidacnis*, *Dac-*

nis and *Euneornis*, and probably also *Xenodacnis* and *Oreomanes*, could be regarded as a nectar-specialized tribe of the Thraupidae—the Dacnini.

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CHICAGO NATURAL HISTORY MUSEUM

NOTES ON BIRDS OF THE VERACRUZ COASTAL PLAIN

BY DWAIN W. WARNER AND ROBERT M. MENGEL

FROM July 15 to 21, 1942, we collected and studied birds in the Mexican State of Veracruz, mostly in the vicinity of Boca del Río, a small fishing village at the mouth of the Río Jamapa, about 20 kilometers south of the city of Veracruz. We made a few observations at other localities, mainly along the Mexico-Veracruz highway.

We were accompanied by Mrs. Warner and by John Gerber, of Mexico City. Simultaneously with our arrival, a party of four from the Agricultural and Mechanical College of Texas, students of Dr. William B. Davis, established a camp a short distance up the Río Jamapa. This group (David Donaldson, R. E. Stone, J. W. McKamy, and M. Whisenhunt) remained in the area from July 15 to 28. Dr. Davis has generously made available to us the notes and specimens secured near Boca del Río by these students.

The country about Boca del Río lies in the flat coastal plain of tropical Veracruz, the "*tierra caliente*." Though marshy, it is arid compared with the eastern slopes of the mountains 40 or 50 miles inland. Vegetation is very dense and mostly low and scrubby, but along the river grow strangling figs, tall palms, and other tropical trees.

Comparatively little ornithological work has been done along the coast of Veracruz. Most collectors have concentrated on mountainous areas farther inland, a fact apparent from even a cursory inspection of the exhaustive bibliography in "Ornithology of the Mexican State of Veracruz," the unpublished doctoral thesis (Cornell University) completed by Frederick W. Loetscher, Jr. in 1941. This work, to which we refer as "Loetscher (MS)," presumably covered all birds known to occur in Veracruz, the status of each being set forth as completely as information available at the time of writing permitted.

The following 92 species were recorded between July 15 and 28. The order and nomenclature through the Formicariidae follow Peters. For the rest of the paper, except where departures are mentioned, we have followed Cory, Hellmayr, and Conover in scientific nomenclature and order of genera and species within families; the order of families is that of Wetmore. We have taken the common names from various sources in attempting to employ the most appropriate ones available. A few suggested by George M. Sutton, who is much interested in this problem, are here used for the second time. These are marked by an asterisk. We have omitted subspecific common names altogether.

We are indebted to W. B. Davis for his afore-mentioned generosity, to Alexander Wetmore for comparing certain specimens, to George M. Sutton for many helpful suggestions, and especially to O. L. Gerber of Mexico City, who made our visit to Veracruz possible. William C. Dilger made the photograph of the Chachalacas. Finally, our thanks are due to J. Van Tyne for a critical read-

ing of the manuscript. The specimens taken by Warner and Mengel are in the Sutton collection; the rest are at the Agricultural and Mechanical College of Texas.

List of Species

Pelecanus occidentalis. Brown Pelican. We observed one July 16, and one July 17, near Boca del Río.

Phalacrocorax olivaceus mexicanus. Olivaceous Cormorant. Common along the Río Jamapa, July 16–25; 3 to 30 birds seen flying toward the ocean late each evening. A female shot by Donaldson, July 23, was not in breeding condition.

Fregata magnificens. Man-o'-war Bird. One to three seen daily, July 16–21, at Boca del Río.

Ardea herodias. Great Blue Heron. Mengel saw one July 16. The Texas party observed one on the Río Jamapa. Loetscher (MS: 187) lists no records between April and October.

Butorides virescens. Green Heron. Three or four noted daily along the Río Jamapa near the coast, July 16–21.

Florida caerulea. Little Blue Heron. We saw a few white immature birds in the wet lands near Boca del Río.

Casmerodius albus. Egret. We noted 10 to 20 daily along the Río Jamapa.

Guara alba. White Ibis. An immature female shot from a flock of 20 near the Río Jamapa, July 23 (Whisenhunt), has a few white feathers on the back and wings.

Dendrocygna autumnalis. Black-bellied Tree Duck. Mengel saw two just south of Boca del Río on July 20.

Coragyps atratus. Black Vulture. Abundant about all towns in the low country, especially on the beach where fish nets were dumped. Noted twice in western Veracruz above Jalapa, at elevations of more than 7,000 feet.

Cathartes aura. Turkey Vulture. Common about Boca del Río and the city of Veracruz, but less so than the Black Vulture.

Elanus leucurus. White-tailed Kite. On July 19 Mengel watched one flying over the marshes south of Boca del Río.

Buteo magnirostris griseocauda. Roadside Hawk.* Common in the brushy, semi-arid lands around Boca del Río. Our four specimens (males, July 16 and 18; females, July 18 and 19) are in various stages of molt. They are slightly paler, perhaps due to fading, than a small series from Tamaulipas, but typical of *griseocauda* in size.

Buteogallus a. anthracinus. Mexican Black Hawk. At dusk, on July 18, Warner took an adult female as it came to roost in coconut palms with several Black Vultures. Mengel saw two others a mile south of Boca del Río on July 20.

Polyborus cheriway. Caracara. We noted several along the Mexico-Veracruz highway, July 15, all on the low coastal plain, and a few flying over the marshes near Boca del Río, July 15–25.

Ortalis v. vetula. Chachalaca. Many of these birds inhabited the dense brush south and west of Boca del Río, where Warner took an adult male and female and saw nearly grown young on July 19. The birds called for a very short time in morning and evening, and on several occasions just after showers during the day.

The nomenclature and relationships of the Chachalacas of eastern México have attracted considerable attention recently (*cf.* Wetmore, 1943: 244–246). Since our Boca del Río specimens are virtual topotypes of *vetula* as restricted by Miller and Griscom (1921: 455), they are of particular interest. Compared with a series from southern Tamaulipas, San Luis Potosí, and northern Veracruz, they are markedly darker below and a richer olivaceous above, and the tips of the rectrices (nearly clear white in Texas and Tamaulipas birds) are dingy grayish buff. Thus they seem to belong with the southern population, further supporting use of the name *vetula* for that population. The accompanying plate illustrates these characters.

Six *Ortalis vetula* specimens from México. The two at the left, from Boca del Río, Veracruz, are *O. v. vetula*; the four at the right, from San Luis Potosí and Tamaulipas, are *O. v. mccalli*. Note, in particular, the difference in tail-tipping.

Colinus virginianus. Bob-white. Fairly common in the fields about Boca del Río. Concerning an adult female taken by Stone on July 22, Dr. Wetmore (letter: March 15, 1943) states: "It is near *Colinus v. pectoralis* but also approaches *godmani*. It differs from our two females of *pectoralis* in having definite chestnut markings on the upper back and lower hindneck, and in being paler above. Below it is like *pectoralis*."

Porphyrula martinica. Purple Gallinule. Apparently not recorded previously from Veracruz. Loetscher (MS: 956) includes it in his "Conjectural List" with the following statement: ". . . apparently unrecorded . . . unquestionably is of regular occurrence." We saw seven or eight on July 21, at close range in marshes near the city of Veracruz, and McKamy collected a male (enlarged testes) in fresh water marshes eight kilometers southwest of the city, July 26.

Heliornis fulica. Sun-Grebe or Finfoot. Loetscher (MS: 290) lists three Veracruz localities for this bird: Río Coatzocoalcos, Buena Vista, and Isla, all in the extreme southern part of the state. Wetmore (1943: 248) states that it is "fairly common" along the Río San Agustín below Boca San Miguel "and through the channels to . . . Tlacotalpam," and records it also from Hueyapa. Donaldson took an adult male, not in breeding condition, in the dense mangrove swamp along the Río Jamapa on July 23. Davis (1950: 379) reported this same specimen from "Boca del Río . . . July 23, 1941, in the tidal waters of the Río Moreno." The year should have read 1942. He describes the Río Moreno (letter: October 23, 1950) as a branch of the Río Atoyac, stating that the two join a short distance west of Boca del Río. He evidently overlooked Wetmore's records mentioned above. Boca del Río is about 50 miles northwest of Tlacotalpam. Mengel saw one near Boca del Río, July 16, 1942.

Jacana spinosa gymnostoma. Jacana. Fairly common in the marshes. Specimens taken at Boca del Río July 17 (male), July 18 (female), and July 20 (female). On July 27, a male was secured eight kilometers southwest of Veracruz. The gonads of all were enlarged.

Charadrius collaris. Collared Plover. Fairly common along the beach. Donaldson took a female near Boca del Río, July 18, and Mengel secured a male and female there, July 19.

Actitis macularia. Spotted Sandpiper. Mengel saw one, July 19, at the mouth of the Río Jamapa.

Erolia minutilla. Least Sandpiper. Near Boca del Río Stone collected a female on July 18, and Mengel saw two, July 19. All were in worn breeding plumage.

Sterna albifrons. Least Tern. At the mouth of the Río Jamapa, Mengel and Gerber collected a male (testes 2 × 4 mm.) from a flock of seven on July 19. This appears to be the first Least Tern to be taken in Veracruz. Dr. Wetmore has referred the specimen to *browni*, but this race is not strongly characterized and we can not help feeling that the specimen is from an eastern population.

Thalasseus m. maximus. Royal Tern. Gerber and Mengel took a female from a flock of 15 on July 19, and Stone shot a female from a flock of 25 on July 18. All were in winter plumage.

Columba flavirostris. Red-billed Pigeon. We saw from a few to over one hundred of these pigeons daily in the brushlands and mangroves near Boca del Río.

Scardafella inca. Inca Dove. Common; seen and heard frequently around Boca del Río, where Stone took a male (testes somewhat enlarged) July 21.

Columbigallina passerina. Ground Dove. Seen on several occasions at Boca del Río, but not as common as the following.

Columbigallina talpacoti rufipennis. Ruddy Ground Dove. Warner and Mengel, respectively, took a male (testes enlarged) and a female (egg in oviduct), July 16. Donaldson took a male, July 19.

Leptotila verreauxi. White-fronted Dove. Warner saw one on July 15, near the town of Rinconada just above the coastal plain, and one on July 20, near Boca del Río. Davis (1945: 275) refers specimens taken somewhat farther inland to the race *fulviventris*.

Aratinga holochlora. Green Parakeet. We noted several pairs along the Río Jamapa, July 17, and observed flocks of up to 12 birds during our stay.

Aratinga astec. Aztec Parakeet. Mengel saw two late in the evening of July 17, about a mile up the Río Jamapa from Boca del Río.

Piaya cayana thermophila. Squirrel Cuckoo. Warner saw two in heavy brush near Boca del Río, July 20, collecting one of these (molting female).

Crotophaga sulcirostris. Groove-billed Ani. Common in the brush and mangrove swamps about Boca del Río. Three males taken respectively on July 16 (Donaldson), July 18 (Donaldson), and July 20 (Mengel). The testes of all of these were somewhat enlarged.

Tapera naevia excellens. Striped Cuckoo. Mengel collected a female in badly worn plumage, July 20, just south of Boca del Río.

Tyto alba pratincola. Barn Owl. Gerber shot a female (ovary not enlarged) on July 18, at Boca del Río. Few Barn Owls have been taken in Veracruz. Davis (1945: 275) identified a female taken at Jalapa on August 6, 1942, as *guatemalae*. Brodkorb (1948: 33) identified a specimen taken June 22, 1939, at Potrero Viejo, as *pratincola*.

Glaucidium brasilianum ridgwayi. Ferruginous Pygmy Owl. Seen daily at Boca del Río, July 16–21. Its monotonous whistle could be heard most often in the evenings. Mengel took an apparently mated pair near a hole about 25 feet above ground in the trunk of a palm, July 16. Stone shot a female, July 21.

Rhinoptynx clamator. Striped Horned Owl. July 20, near Boca del Río, Mengel saw one of these owls in a thicket at such close range that he was unable to shoot. This is apparently the third published record of the species for México, the second being Brodkorb's record (1948: 33) of a specimen taken at Potrero Viejo, Veracruz, in January, 1939.

Chordeiles minor aserriensis. Nighthawk. Seen and heard every evening over Boca del Río. An immature female taken there by Stone, on July 23, has been identified by Dr. Wetmore, who says (letter of March 15, 1943): "We have only two females of this race and your specimen is not exactly like either of them; in fact it resembles in color some females of *sennetti* but differs in distinctly smaller size. This is one of the characters of the race in question [*aserriensis*] and with available material it seems proper to identify it as indicated . . ." The only race of this species listed for Veracruz by Loetscher (MS: 380) is *C. m. chapmani* (on the basis of a female collected " . . . off a nest with two eggs on the beach within sight of the city of Veracruz. This specimen, now in the Princeton Museum of Zoology, has been identified as *chapmani* by Dr. Oberholser, Mr. Rogers, and the writer . . . "). The bird referred to was collected by Charles H. Rogers on July 5, 1930. The possibility that breeding Nighthawks of this region actually belong to the race *chapmani* seems to us remote. It seems more probable that the breeding form is (1) *aserriensis* or (2) an undescribed subspecies. The breeding of *C. minor* at the city of Veracruz is surprising and constitutes a considerable extension of the known breeding range of the species.

Nyctidromus albicollis yucatanensis. Pauraque. Donaldson shot an immature male near Boca del Río, July 22.

Streptoprocne zonaris mexicana. Collared Swift. We saw several flocks near Boca del Río. Gerber shot a male and a second bird (sex?) from a flock of 20 on July 20.

Anthracothorax p. prevosti. Prevost's Mango. Mengel collected an immature male on July 16. Warner saw an adult perched on a telephone wire, July 19.

Chlorostilbon c. caniveti. Canivet's Emerald. Warner collected one at Boca del Río on July 16. It could not be sexed positively, but is very much like female specimens examined.

Amazilia yucatanensis cerviniventris. Yucatán Hummingbird. Mengel and Gerber secured male and female specimens typical of this form at Boca del Río on July 17. Warner saw others on July 16, 18, and 19.

Trogon citreolus. Citreoline Trogon. Fairly common in the mangroves and brush near Boca del Río.

Megaceryle t. torquata. Ringed Kingfisher. At least two pairs inhabited a mile-long stretch of the Río Jamapa. One pair frequented the vicinity of a clay bank just upstream from Boca del Río. Stone collected a female on July 25.

Chloroceryle amazona. Amazon Kingfisher. On July 18, Warner observed one near the clay bank referred to above.

Chloroceryle americana septentrionalis. Green Kingfisher. We saw six or eight Green Kingfishers along the Río Jamapa every day. Gerber collected a male, July 16. Females with reduced ovaries were taken July 16 and 23 (Stone).

Melanerpes aurifrons grateloupensis. Golden-fronted Woodpecker. Fairly common about Boca del Río, where a number of specimens were taken July 16 to July 19. All were molting. Dr. Wetmore has referred one of these to the present race.

Dryocopus lineatus similis. Lineated Woodpecker. Mengel collected an adult female one mile south of Boca del Río, July 20.

Dendrocopos scalaris ridgwayi. Ladder-backed Woodpecker. A juvenal-plumaged male (July 16) and a very worn adult female (July 19; reduced ovary) have been identified as *ridgwayi* by Dr. Wetmore.

Synallaxis erythrothorax furtiva. Rufous-breasted Spinetail. Heard frequently in the dense thickets near Boca del Río, but seldom seen. Warner succeeded in collecting two singing males and a worn female (with a fully formed egg in the oviduct) on July 20. These specimens are typical *furtiva*.

Thamnophilus doliatus intermedius. Mexican Ant-shrike. Common in dense brush near Boca del Río, where Warner took an adult male, July 18.

Platypsaris aglaiae sumichrasti. Rose-throated Cotinga. Common at Boca del Río. Two adult males, an immature male, and three females, although quite worn, are recognizable as this dark race.

Pyrocephalus rubinus. Vermilion Flycatcher. Recorded at Boca del Río on four occasions by the Texas party. A juvenile female taken July 17 (Whisenhunt) is not, in our opinion, subspecifically identifiable.

Tyrannus melancholicus chloronotus. Olive-backed Kingbird. Usually found with Derby and Social Flycatchers. Five adult specimens (three males, two females) secured near Boca del Río were in various stages of molt. Stone took an immature female in fresh plumage, July 17. One of our specimens, sent to Dr. Wetmore, he identified as this race.

Legatus leucophaius variegatus. Pirate Flycatcher. We took a female (wing, 92 mm.) on July 17, when two were seen. A second female (wing, 87 mm.) was secured on July 18.

Myiodynastes l. luteiventris. Sulphur-bellied Flycatcher. Seen at Boca del Río July 16, 18, and 19. Warner collected a male on July 17.

Myiozetetes similis texensis. Social Flycatcher. Common at Boca del Río. Warner took a female there, July 16.

Pitangus sulphuratus guatemalensis. Derby Flycatcher. Common along the Río Jamapa near Boca del Río. We saw several nests, some of them apparently occupied, and two newly fledged young. Concerning a male (July 16) and female (July 18) taken at Boca del Río, Wetmore has written (letter: December 8, 1947): ". . . definitely intermediate but appear closer to *guatemalensis*. They agree with this form in extent of white on the forehead. Below they are paler colored, like *texanus*, but I believe that this lighter color is due in part at least to fading . . . ."

Myiarchus tyrannulus nelsoni. Mexican Crested Flycatcher. According to Loetscher (MS: 540) this species has not been recorded as breeding in Veracruz. He gives only six records for the state. We found it common at Boca del Río. Ten specimens, all in very worn plumage and with gonads of moderate size, were collected by the two parties.

Elaenia flavogaster subpagana. Yellow-bellied Elaenia. Warner saw a single individual in the town of Boca del Río, July 16. Mengel took a female there July 17.

Camptostoma imberbe. Beardless Flycatcher. Mengel saw one on July 16, just west of Boca del Río.

Progne c. chalybea. Gray-breasted Martin. Common near Boca del Río. Male collected July 17 (Mengel).

Iridoprocne a. albilinea. Mangrove Swallow. Common at Boca del Río. Male collected July 17 (Mengel).

Psilorhinus m. morio. Brown Jay. Seen at Boca del Río July 16, 18, and 20. McKamy took a female of this race on July 21.

Campylorhynchus z. zonatus. Banded Cactus Wren. Groups of from three to five encountered frequently in palms near Boca del Río. We took males July 16 and 18, and McKamy collected another, July 20.

Campylorhynchus r. rufinucha. Rufous-naped Cactus Wren. Although this wren was less common than the preceding species, we saw it almost daily in the more open areas about Boca del Río, where we took a juvenal-plumaged male on July 20. Mengel collected an adult on July 15, near Rinconada, just above the coastal plain.

Pheugopedius m. maculipectus. Spotted-breasted Wren. Quite common in the low, dense growth around Boca del Río. Warner and Mengel each collected a singing male on July 18.

See Wetmore (1943: 300) for the name used here.

Turdus grayi tamaulipensis. Gray's Robin. Seen several times July 16–20. A female taken at Boca del Río on July 16 (Warner) is intermediate in coloration of underparts, but much closer to *tamaulipensis* than to *grayi*.

Polioptila c. caerulea. Blue-gray Gnatcatcher. Warner saw three gnatcatchers at Boca del Río on July 20. A female (?) specimen he secured that day we have called *caerulea* on the basis of size (wing, 50 mm.) and coloration.

Vireo olivaceus flavoviridis. Red-eyed Vireo. Two males taken respectively on July 16 (Warner) and July 20 (Donaldson) at Boca del Río. We agree with Sutton, Lea, and Edwards (1950: 53–54) that *olivaceus* and *flavoviridis* are conspecific.

Dendroica petechia bryanti. Yellow Warbler. According to Loetscher (MS: 739) a specimen taken by Fuertes at Tamiahua Lake in extreme northern Veracruz on April 16, 1910, is the only one "... undoubtedly taken within the state which the writer has seen." This specimen, now at Cornell University (No. 16180), is labelled female. We took single females at Boca del Río on July 17 (Mengel) and July 20 (Warner). These are in fresh fall plumage. One is much yellower than the other. We saw other individuals on July 17, 19 (two), and 20.

Chamaethlypis poliocephala palpebralis. Thick-billed Yellow-throat.* Common and singing constantly. Our two groups collected seven specimens, all males with enlarged testes, in the marshes near Boca del Río, July 16–22.

Amblycercus holosericeus. Yellow-billed Cacique. We saw one close to the Mexico-Veracruz highway near Rinconada, July 15.

Tangavius a. aeneus. Red-eyed Cowbird. The Texas party saw several small flocks at Boca del Río and collected two adult males (one with enlarged testes).

Cassidix m. mexicanus. Great-tailed Grackle. One of the most abundant birds along the Río Jamapa. Warner shot a female (ovary reduced) July 18, and Donaldson took a male (testes enlarged) July 16.

Dives d. dives. Sumichrast's Blackbird. Six specimens taken near Boca del Río July 18–27. One of these (July 18) was a male in juvenal plumage (Donaldson).

Icterus spurius. Orchard Oriole. Warner took a molting immature male, July 16. We saw three others the same day, two immature males and one presumed to be a female. Mengel saw three on July 17, and McKamy collected an adult male (testes reduced), July 18.

Icterus prosthemelas. Black-cowled Oriole.* Mengel took a molting male, July 18, and Warner saw one on July 20. Loetscher (MS: 805) regards this species as rather rare in Veracruz.

Icterus m. mesomelas. Yellow-tailed Oriole. Noted once, when Stone took an adult female in worn plumage, July 21.

Icterus g. graduacauda. Black-headed Oriole. Recorded once: a female in worn plumage shot on July 18 (McKamy). According to Loetscher (MS: 809) this bird is rare on the coastal plain.

Icterus gularis tamaulipensis. Black-throated Oriole.* Common in the vicinity of Veracruz City and Boca del Río. Gerber, McKamy, and Whisenhunt secured specimens, July 16 and 18. We saw a number of nests, and the Texas party observed two young just out of the nest.

Agelaius phoeniceus richmondi. Red-wing. Common along the lower reaches of the Río Jamapa and in the coastal marshes near the city of Veracruz. Five males and a female collected. We saw young being fed on July 18.

Thraupis episcopus diaconus. Blue-gray Tanager. Rather common in the vicinity of Boca del Río, although Wetmore (1943: 327) did not find it common at Tres Zapotes. Our two parties took two males and four females, July 16–20. We suggest that the common name used here is more appropriate than "Gray Tanager" or "Blue Tanager"—names previously applied to the species.

Thraupis abbas. Yellow-winged Tanager. Fairly common near Boca del Río, where we saw individuals and small groups every day. Gerber and Warner took two immature specimens, July 16 and 17, respectively. Whisenhunt collected a female (molting) on July 19.

Saltator coerulescens grandis. Gray Saltator. Common in brushy fields. Daily we heard its clear, whistled song which was suggestive of a Cardinal's. Two males secured: July 16 (Warner); July 17 (Mengel).

Richmondena cardinalis coccinea. Jalapa Cardinal. Moderately numerous along edges of fields near Boca del Río. Warner, Mengel, and Donaldson took three males, July 18–20.

Passerina v. versicolor. Varied Bunting. According to Loetscher (MS: 883–884), the only records for Veracruz are "unsatisfactory" ones from Orizaba and Jalapa. Mengel took a singing male (testes enlarged) on July 15, near Rinconada, just inland from the coastal plain. Davis (1945: 285) and Brodkorb (1948: 38) have reported specimens from the state.

Passerina ciris pallidior. Painted Bunting. Loetscher (MS: 884) lists this bird as "a rather common transient and winter visitant." He gives no spring date later than May 5 and states that fall arrival dates are lacking. Warner took an adult male (testes somewhat enlarged) one mile north of Boca del Río, July 20 (wing, worn, 74 mm.; tail, worn, 56).

Sporophila torqueola morelleti. Collared Seedeater. One of the most numerous birds at Boca del Río, where it sang throughout each day in the brush. Mengel shot a male, July 20. Whisenhunt, Stone, and McKamy collected two males and a female, July 17–19.

Volatinia jacarina splendens. Blue-black Grassquit. Quite common near Boca del Río: three males taken there—July 16 and 18 (Whisenhunt); July 18 (Warner). Stone took one eight kilometers southwest of the city of Veracruz on July 26.

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THE TRACHEA OF THE HOODED MERGANSER

INCLUDING A COMPARISON WITH THE TRACHEAE OF CERTAIN OTHER MERGANSERS

BY ELIZABETH B. BEARD[1]

AMONG the many gaps in our knowledge of the Anatidae, as pointed out by Delacour and Mayr (1945: 34), are those regarding the tracheae of certain species. The following description of the trachea of the Hooded Merganser (*Lophodytes cucullatus*) will supplement both the first account written by William MacGillivray (1852: 227) and a later brief account by John C. Phillips (1926: 249).

Prepared, unstretched adult male Hooded Merganser tracheae used in this study had an overall length (including the tympanum) of 102 to 138 mm. This wide variation is at least partly the result of using both alcoholic and dried specimens for measurement. A dried trachea is shorter. (This is very likely because of shrinkage caused by the disappearance of the membrane between the osseous rings.) Even when measuring fresh material, a variation in results is possible. For example, one fresh female trachea when relaxed measured 110 mm., but when stretched to its fullest measured 155 mm. However, measurements of the bony part of the structure are not affected by this shrinkage and consequently show only slight variation. Furthermore, it is to be remembered that discrepancies in total length measurements found in the literature may be the result of age differences; of the condition of the specimen—whether fresh, alcoholic, or dry; and/or of differences in measuring technique (i.e., overall length measurements may have been based on either a fully extended or a contracted trachea).

For about three-quarters of its length the diameter of the tube in the male Hooded Merganser varies little from $\frac{3}{16}$ of an inch (5 mm.). At the commencement of its lower quarter it flattens and dilates to a width of about $\frac{1}{2}$ inch (12 mm.). Joined to this enlargement by a short length of tube is an asymmetrical, irregularly-shaped tympanum, a hollow, bony structure about as wide as long, possessing two openings on the ventral and one on the dorsal side, each covered by a tight membrane. The major protuberance (or chamber) is on the left side. Two bronchi arise from the posterodorsal edge.

The tracheal rings are of several kinds. Most of those in the upper third of the tube are complete and nearly uniform in width. All are of osseous tissue and have little membrane between them. Those of the middle third also are bony; some are complete, but most of them are tapered at the ends, and by a

[1] The writer is greatly indebted to F. H. Kortright, E. B. Chamberlain, Jr., Philip Humphrey, and the Royal Ontario Museum of Zoology for furnishing the material on which this description is based.

regular staggered arrangement produce an interlocking or shingled effect. There is very little membrane between these rings. The rings of the dilated, lower third of the tube are tapered, staggered, and quite variable in width. They are osseous on the ventral side but completely membranous on the dorsal side. The approximately ten bony rings which connect the enlarged portion of the tube with the tympanum are of peculiar structure. On the dorsal side they are flat and somewhat tapered in width. On the ventral side, each ring becomes extremely narrow and rises to a small peak in the center. The 'peaks' of eight of the ten rings form an acute midline carina. Membrane separates each of these narrow rings ventrally.

Table 1 presents data on the tracheae of four male Hooded Mergansers.

The measurements of the tracheae of female Hooded Mergansers were from

TABLE 1

Tracheal Measurements in Millimeters of Four Male Hooded Mergansers

	1 (dried)	2 (dried)	3 (alcoholic)	4 (alcoholic)
Overall length, dorsal, from posterior edge of glottis to posterior edge of tympanum	—	89	98	124
Overall length, ventral, from posterior edge of glottis to posterior edge of tympanum	—	102	109	138
Diameter at base of glottis	6	6	6	6
Diameter at narrowest part of tube	4	4	4	4
Diameter at beginning of dilation	6	5	5	6
Diameter between dilation and tympanum	6	5	5	6
Length of dilation	13	13	13	13
Greatest width of dilation	12	11	12	12
Length of tympanum, dorsal	10	9	9	10
Length of tympanum, ventral	22	21	21	21
Greatest width of tympanum	19	20	20	20
Length of bronchi	10	—	13	24
Diameter of bronchi at base	4	—	3	4

TABLE 2

Tracheal Measurements in Millimeters of Three Female Hooded Mergansers

	1 (dried)	2 (dried)	3 (fresh)
Overall length from posterior edge of glottis to posterior edge of simple tympanum	—	107	110
Diameter of tube	5	5	5
Greatest width of simple tympanum	8	8	8
Narrowest width of simple tympanum	5	5	5
Length of simple tympanum	5	5	5
Length of bronchi	13	13	13
Diameter of bronchi at base	3	3	3

one fresh and two dried specimens (Table 2). The overall length of the trachea of a female Hooded Merganser is between $4\frac{1}{4}$ (107 mm.) and $4\frac{3}{8}$ inches (110 mm.). The tube is nearly uniform in diameter, averaging $\frac{3}{16}$ of an inch (5 mm.). The tympanum is a simple, symmetrical, hollow structure, roughly trapezoidal in shape, about $\frac{3}{16}$ of an inch (5 mm.) in length, and formed by fusion of the tracheal rings. Two bronchi arise from its posterior aspect. The tracheal rings are osseous and are quite uniform in size and shape, showing little tapering.

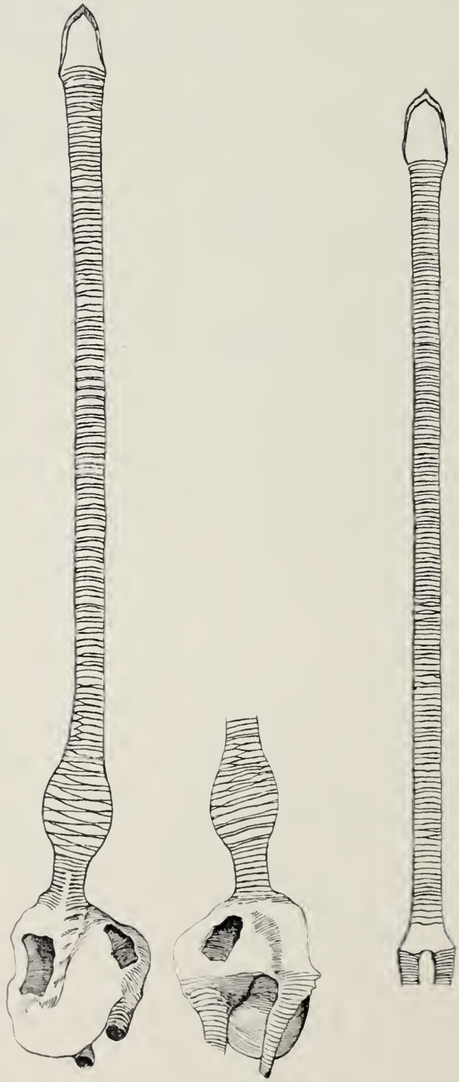

FIG. 1. Left, trachea of adult male Hooded Merganser, ventral aspect, showing tympanum at bottom. Middle, the tympanum, dorsal aspect. Right, trachea of adult female Hooded Merganser, ventral aspect. All drawings a little under natural size.

As an aid toward better understanding of the relationship of the monotypic genus *Lophodytes* to the two other genera of Mergansers (*Mergellus* and *Mergus*), a comparative review of the tracheae of *Lophodytes cucullatus*, *Mergellus albellus*, *Mergus merganser americanus*, and *Mergus serrator* is herewith presented. Measurements for these species (with the exception of the Hooded Merganser) were obtained from published accounts and/or published natural-sized drawings.

Male American Merganser (*Mergus merganser americanus*).—In the male American Merganser the trachea is $10\frac{1}{2}$ inches long (Audubon, 1838: 270), 12 inches long (Yarrell, 1843: 296), or "about a foot in length, when moderately extended" (MacGillivray, 1852: 209). It is, therefore, from five to eight inches longer than in *Lophodytes cucullatus*. In the American Merganser, the tracheal tube possesses two rounded enlargements, the first (maximum width: $\frac{8}{12}$ of an inch) in the upper third of the tube, and the second (maximum width: $\frac{7}{12}$ of an inch) in the middle third of the tube. The lower third of the tube is of uniform width, with an average diameter of $\frac{3}{12}$ of an inch.

The tympana of the two species are similar in structure—both being hollow, bony, of irregular shape, with the major protuberance on the left, and possessing three membrane-covered fenestrae, one dorsal and two ventral. The greatest diameter of the tympanum of the male American Merganser is $2\frac{1}{6}$ inches, while that of the male Hooded Merganser is $\frac{13}{16}$ of an inch. The bronchi arise from the posterior edge on the dorsal aspect nearly one inch apart in the American Merganser and about $\frac{1}{4}$ of an inch apart in the Hooded Merganser.

Female American Merganser.—The trachea of a female American Merganser is 9 inches long, or about $4\frac{3}{4}$ inches longer than that of the female Hooded Merganser. Both have tracheal tubes of uniform size: $\frac{1}{3}$ of an inch in the American Merganser and $\frac{3}{16}$ of an inch in the Hooded Merganser. The simple tympanum formed by fusion of the lower tracheal rings is of similar shape and structure in both species. The bronchi stem from its posterior aspect, $\frac{5}{12}$ of an inch apart for the American and $\frac{1}{8}$ of an inch apart for the Hooded Merganser.

Male Red-breasted Merganser (*Mergus serrator*).—The trachea of the male Red-breasted Merganser measures $11\frac{1}{2}$ inches (Audubon, 1849: 99), or about 11 inches (MacGillivray, 1852: 218); in other words between $5\frac{1}{2}$ and $7\frac{1}{2}$ inches longer than that of the male Hooded Merganser. There is one enlargement just above the midpoint of the tracheal tube. This dilation is two inches long and $\frac{11}{12}$ of an inch wide. The male Hooded Merganser likewise has one dilation in the tube but this is in the lowest quarter of the tube and is $\frac{1}{2}$ of an inch wide at its widest point and $\frac{1}{2}$ of an inch long. In each species the diameter of the remaining portion of the tracheal tube is quite constant, being between $\frac{1}{4}$ and $\frac{1}{3}$ of an inch wide in the Red-breasted Merganser and $\frac{3}{16}$ of an inch wide in the Hooded Merganser.

The tympanum of the male Red-breasted Merganser is irregularly heart-shaped and has a maximum diameter of two inches. In the Hooded Merganser this structure is asymmetrical and has a maximum diameter of $\frac{13}{16}$ of an inch. According to Latham (1798: 122) and MacGillivray (1852: 218), the tympana of both species have three membrane-covered fenestrae, two ventral and one dorsal; Audubon (1849: 99) mentions but "two lateral membranous spaces." In the Red-breasted Merganser the bronchi arise $\frac{3}{4}$ of an inch apart on the posterodorsal edge of the tympanum.

Female Red-breasted Merganser.—No exact measurements of the length of the trachea were found, but since Audubon (1849: 99) states that the trachea has 150 rings, the same number as in the female American Merganser (Audubon, 1838: 270), the length is probably similar, i.e., about 9 inches long, or about $4\frac{3}{4}$ inches longer than that of the female Hooded Merganser. The tracheal tube is nearly uniform in diameter throughout and ends in a very simple symmetrical tympanum from the posterior aspect of which two bronchi arise.

Male Smew (*Mergellus albellus*).—The trachea of the male Smew is about nine inches long (Yarrell, 1843: 281; MacGillivray, 1852: 235) or from $3\frac{1}{2}$ to 5 inches longer than that of the male Hooded Merganser. The tube is narrow (about $\frac{3}{16}$ of an inch) at the anterior end, but it gradually increases to a diameter at midpoint of about $\frac{3}{8}$ of an inch, this being maintained for the rest of its length. There is no dilation.

The tympanum of the male Smew possesses, according to Latham (1798: 124), one round fenestra covered by a drum-like membrane and, on the opposite side, a smooth, oval, hollow bone which is united with the membrane. Yarrell (1843: 281) mentions "spaces in the bone supplied with tympanic membranes." MacGillivray (1852: 235) states that there are "two lateral membranes of which the posterior is largest." The drawing accompanying Bloch's paper (1779, Tab. 18, Fig. 7) seems to show but one opening. The tympanum is displaced to the left and measures $1\frac{1}{4}$ inches at its widest point and $\frac{3}{4}$ of an inch long. The bronchi arise about $\frac{1}{2}$ of an inch apart.

Female Smew.—No information was obtainable regarding the length of the female Smew's trachea, but a life-size drawing of a portion of the trachea (Yarrell, 1843: 281) shows it to be uniform in width, with a diameter of $\frac{3}{16}$ of an inch, the same as for the female Hooded Merganser. The simple tympanum measures $\frac{1}{2}$ by $\frac{3}{16}$ of an inch, that of the female Hooded Merganser $\frac{5}{16}$ by $\frac{3}{16}$ of an inch. The bronchi arise $\frac{3}{16}$ of an inch apart in the Smew.

Summary

The trachea of the male Hooded Merganser is from $3\frac{1}{2}$ to 8 inches shorter, and much narrower, than that of the male American Merganser, Red-breasted Merganser, or Smew. It possesses but one dilation, this being in the posterior quarter. The trachea of the male Red-breasted Merganser also has a single dilation, but it is much larger than in the Hooded Merganser and is just anterior to the midpoint of the trachea. In the male American Merganser there

are two dilations. In the male Smew there is none. The tympanum, which is present in the male in all four species discussed, varies in configuration and dimensions. In the Hooded Merganser it differs decidedly in proportions and in the number of fenestrae from that of the Smew; and while somewhat similar in shape and number of openings to those of the American Merganser and the Red-breasted Merganser, it is but half as large.

The trachea of the female Hooded Merganser is shorter and smaller than in the female American Merganser, Red-breasted Merganser and Smew. In all these species, however, the trachea of the female is much the same.

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SUMMER BIRDS OF AUTLAN, JALISCO

BY DALE A. ZIMMERMAN AND G. BRYAN HARRY[1]

THE city of Autlán, Jalisco, is about one hundred miles southwest of Guadalajara, and not far from the Río San Pedro. Its elevation is about 3000 feet. Mountains rise all about it—to the north and west the Sierra de Perote, to the southeast the Sierra de Autlán and the Nevado de Colima, and to the southwest lesser ridges which step down gradually to the coastal plain. The highest mountain of the region is the Nevado de Colima (elev. 14,000 feet). Autlán is only 50 miles from the Pacific.

The area immediately about Autlán is arid tropical. Its summers are hot and its winters warm. In general, precipitation is light, though occasional torrential rains in summer subject the slopes to heavy erosion. Farming is carried on only during the rainy season, for there is no irrigation. In cultivated districts fence-rows and scattered thickets provide cover for quail and other ground birds. Uncultivated areas are largely scrubland covered with an open shrubby growth of giant cacti (*Lemaireocereus*), thorny bushes, and trees of the genera *Prosopis*, *Acacia*, *Pouzolzia*, *Croton*, *Bursera*, and *Plumeria*. We refer to this habitat as "scrub forest" where the trees form a fairly dense canopy 20 to 30 feet high.

Most of the area about Autlán is heavily over-grazed. There is abundant evidence of destructive land-use. Much of the topsoil has been eroded from even the gentlest slopes, and where it has been deposited in the valleys agriculture is intensively practiced. The clumps of grasses and ground-clinging vines left by grazing animals provide refuge for numerous lizards and ground squirrels. We saw coyotes occasionally.

There are no swamps or lakes in the immediate vicinity of Autlán, but between Autlán and Guadalajara are a few marshy areas where herons and other water birds fed. We did no collecting in these marshes.

The only passable road leading southward from Autlán soon leaves the scrubland, and winds up oak-covered slopes to an elevation of about 4000 feet. We did some collecting in these oak groves nine miles south of the city. From here the road drops gradually to areas of luxuriant vegetation at 2000 feet. Twenty miles from Autlán (two miles north of the village of La Resolana), at an eleva-

[1] This paper is based on field work done from June 26 to August 7, 1949. We wish to thank H. H. Bartlett, of the University of Michigan Botanical Gardens, for financial aid; J. Van Tyne, of the University of Michigan Museum of Zoology, for ammunition; Rogers McVaugh and Robert Wilbur, of the University of Michigan Department of Botany, for assistance in identifying plants; the Dirección General Forestal y de Caza in México for a scientific collecting permit; J. L. Peters, of Harvard, for making certain comparisons for us at the Museum of Comparative Zoology; officials of the U. S. National Museum for lending specimens; and H. O. Wagner, for his interest and help.

tion of about 1500 feet, the road penetrates a dense, tropical, deciduous forest. This area is hot and humid, being subjected to daily downpours during the rainy season. Here, trees of the genera *Ficus*, *Hura*, *Calliandra*, *Enterolobium* and *Acacia* flourish. On the slopes directly above the densely wooded bottomlands *Curatella* is the dominant tree, and shrubs of the genera *Piper*, *Corchorus*, *Triumfetta*, *Tournefortia*, *Acalypha* and *Solanum* are common. Deer, coati-

Cultivated bottomland surrounded by scrub-covered slopes eight miles northeast of Autlán, Jalisco, México. Photographed August 4, 1949, by G. Bryan Harry.

mundis, and cougars are among the larger mammals of the area. Ticks and various biting and stinging insects are abundant, contributing their share to the discomforts of the country. We collected here for a week in early July and occasionally thereafter.

Harry spent 12 days (July 19–August 1) collecting in the Sierra de Autlán. His base camp there (elev. 7200 feet) was near a small mountain stream ten miles southeast of the village of Tecomatlán. Oak forests with herbaceous ground-cover are dominant in that area from 4000 to 5000 or 6000 feet. Higher still are open stands of tall pines with occasional firs, many trees being two or three feet in diameter. Beneath the pines is a ground-cover of grass, but the natives burn the slopes during the dry season. In protected moist pockets the oak forest is dense; the large trees are covered with a tangle of ferns, vines, bromeliads, mosses, and orchids. *Arbutus* trees and shrubs of the genera *Salvia*, *Cornus*, and *Castilleja* grow in both sheltered and unsheltered areas. Above the pines, between 8000 and 9000 feet, there are meadows. Here lupine grows with the dense, tough clumps of waist-high bunch grass, and there is a scattering of pines and shrubbery.

Podilymbus podiceps. Pied-billed Grebe.—Noted June 23: two adults and several immature birds on a pond 30 miles northeast of Autlán.

Ardea herodias. Great Blue Heron.—One was feeding with Egrets at a roadside pond 35 miles northeast of Autlán on August 7.

Casmerodius albus. Egret.—About 65 seen in recently flooded lowlands 15 to 35 miles northeast of Autlán on August 7

Anas diazi. Mexican Duck.—On June 23 we saw two on a temporary pond in a cornfield 20 miles northeast of Autlán. We noted the greenish bill of the male and the white lines bordering the speculums.

Coragyps atratus. Black Vulture.—Common in and about Autlán (up to 4000 feet) throughout our stay. On July 15 Harry saw 40 feeding on the carcass of a cow at 4000 feet elevation. The same day, at Autlán, Zimmerman saw one being pursued by a female Great-tailed Grackle (*Cassidix mexicanus*). Largest number seen during one day: 80 (July 25).

Cathartes aura. Turkey Vulture.—Less numerous than the above but noted at considerably greater elevations. Harry saw it repeatedly at 8000 to 8500 feet July 23 to 31.

Accipiter spp.—On June 30 Zimmerman saw what he took to be a Sharp-shinned Hawk (*A. striatus*) being pursued by a Sulphur-bellied Flycatcher (*Myiodynastes luteiventris*), 20 miles south of Autlán. On July 27, in the Sierra de Autlán (8300 feet), Harry saw what he believed to be an immature Cooper's Hawk (*A. cooperi*).

Buteo jamaicensis. Red-tailed Hawk.—Noted throughout our stay, at 3000 to 8500 feet, but not common. All seen clearly were adults. Two seen July 15, at 4000 feet, were soaring together (Harry).

Buteo albicaudatus hypospodius. White-tailed Hawk.—The most common hawk of the scrubland and agricultural areas. Often seen "hanging" in air, motionless save for occasional lowering and raising of the legs. Upon sighting prey, "hanging" birds folded their wings and dropped swiftly earthward. On June 23 we saw two birds capturing and eating large flying insects in midair, kitewise. On the evening of July 4 we saw one of two soaring birds suddenly dive at a passing Raven (*Corvus corax*) and pursue it for several hundred yards. Low-flying White-tails were frequently attacked by Olive-backed Kingbirds (*Tyrannus melancholicus*). We took an adult female White-tail in non-breeding condition on July 16, and an immature female on July 25.

Buteo nitidus. Gray Hawk.—Identified with certainty only on July 8 when we saw one flying low over the forest 21 miles south of Autlán.

Parabuteo unicinctus. Harris' Hawk.—Single birds recorded June 29 and July 21 flying over farmland south of Autlán.

Buteogallus anthracinus. Mexican Black Hawk.—Twenty miles south of Autlán, on August 5, we drove to within ten feet of a Mexican Black Hawk perched on a log beside the road. The cere and base of its bill were bright red-orange and its legs bright yellow. When it flew a single white tail band and the white tip showed. Black-looking hawks were seen flying in this tropical forest area several times, July 2 to August 5.

Polyborus cheriway. Caracara.—From July 27 to August 7 we saw several daily. Groups of four or five may have been family parties.

Ortalis vetula. Chachalaca.—Noted occasionally among large trees in the tropical deciduous forest and in wooded arroyos near Autlán.

Dendrortyx macroura. Long-tailed Partridge.—On July 2, in an open grove of oaks ten miles south of Autlán (5000 feet), Harry "squeaked" a covey of several birds to within ten yards and collected a female. The eyes of this bird were dark brown, the fleshy parts otherwise bright orange red.

Philortyx fasciatus. Banded Quail.—Fairly common in the arid scrub, coveys of 10 to 20 birds being seen almost daily. When running through the brush they often uttered a rapid, high-pitched *pip-pip-pip.* When they burst into the air a muscial *pee-pee-pee-eeeee* accompanied the whir of their wings. The crop of a female taken July 13 was filled with small beetles. Apparently the Banded Quail has not been previously recorded from Jalisco (see Friedmann, Griscom and Moore, 1950. "Distributional Check-List of the Birds of México," pt. 1, p. 75).

Colinus virginianus. Bob-white.—Coveys fed with small doves in the scrubland and plowed fields near Autlán. They were very wary.

Jacana spinosa. Jacana.—On August 7 we observed two birds in a pond (choked with water hyacinth) about 40 miles northeast of Autlán.

Actitis macularia. Spotted Sandpiper.—One record: a bird with spotted under parts seen at a roadside pool 30 miles northeast of Autlán on August 7.

Zenaida asiatica mearnsi. White-winged Dove.—Seen frequently (one or two a day) in the dry scrub throughout our stay. Our only specimen, a female with enlarged ovary taken July 11, measures: wing, 155.5; tail, 111 mm.

Scardafella inca. Inca Dove.—Up to five pairs seen daily in the scrubland. On August 4 we found a nest (with bird incubating two eggs) about ten feet up in a giant cactus. An adult and a juvenile were taken July 27.

Columbigallina passerina pallescens. Ground Dove.—A few observed almost daily in the scrubland. We did not find a nest, but the oviduct of a female taken July 26 held an egg nearly ready for laying.

Leptotila verreauxi. White-fronted Dove.—Recorded only on July 15 when Zimmerman took an immature male northeast of Autlán. The irides of this specimen were pale yellow, the bare circumorbital region dull lavender-pink, the loral area dull blue. The abdomen and under tail coverts are much darker and buffier than those of an immature male specimen of *L. v. angelica* (from Texas) at hand.

Ara militaris. Military Macaw.—Recorded three times: three flying together six miles south of Autlán, June 26; a single bird, July 5; and a flock of 12 flying over the tropical deciduous forest, July 8.

Aratinga canicularis. Orange-fronted Parakeet.—Abundant in the tropical deciduous forest south of Autlán. Individuals, pairs, and flocks of up to 80 were seen repeatedly. They were noisy, particularly at dawn when they came in large numbers to the fig trees near camp. Our two specimens, both much worn (male, wing, 132, tail, 94 mm.; female, wing, 133.5, tail, 97), resemble the race *clarae* in that "the greenish blue of the crown continues anteriorly around the bare space in front of the eye. . ." (Moore, 1937. *Proc. Biol. Soc. Washington,* 50: 101); but their measurements, admittedly not satisfactory because of wear, seem to be closer to those of *eburnirostrum* (*ibid.,* p. 102).

Forpus cyanopygius. Mexican Parrotlet.—We saw flocks of 10 to 20 of these wary tiny parrots in and along the edges of the forest 20 to 22 miles south of Autlán in late June and early July. We usually saw them in the early morning with the flocks of Orange-fronted Parakeets.

Piaya cayana mexicana. Squirrel Cuckoo.—Noted occasionally in the forest 20 miles south of Autlán, July 2 to 8. Seen and heard infrequently in the arid scrub near town where a male was taken June 25. The irides of this bird were bright cherry red. A large grasshopper was in its stomach. The call of this species was a loud, measured *chuck . . . chuck . . . chuck . .* , as many as 40 or 50 notes repeated in slow succession.

Geococcyx velox melanchima. Lesser Road-runner.—Observed occasionally in the scrubland and along the roads at from 3000 to 4000 feet. A male taken by Zimmerman on June 28 had been feeding on large red ants. The irides of this bird were brown with a dark buff ring around the pupil; the bare skin around the eye was bright blue except for a small area of blood red posteriorly; the bill was gray above, pale blue-green below, the legs greenish in front, blue behind. Several times we saw Lesser Road-runners pursue and capture small lizards.

Crotophaga sulcirostris. Groove-billed Ani.—One of the most common birds of the farmlands, associating with Red-eyed Cowbirds (*Tangavius aeneus*) among cattle in the fields, sometimes perching and feeding on the animals themselves. Two nests, found in low acacias along the road June 28 and July 12, appeared to be built entirely of sticks. The usual call note was a burro-like *chaw-eek* or *cha-eek-eek*, the last one or two syllables higher than the first. An adult male (testes unenlarged) was taken near Autlán on June 27. A nearly flightless young bird captured July 23 was infested with larvae similar to those discussed under *Megarynchus pitangua*.

Glaucidium minutissimum. Pygmy Owl.—Infrequently recorded in and along the edges of the tropical deciduous forest south of Autlán. Ordinarily we found three or four birds together in the lower branches of the larger trees. Two were seen in a mimosa thicket a mile north of

Pygmy Owl (*Glaucidium minutissimum*). Photographed 19 miles south of Autlán, Jalisco, México, June 30, 1949, by Dale A. Zimmerman.

Autlán (3000 feet), June 25. Our single specimen (male, possibly immature, taken June 30 at 1500 feet) appears to be identical with a Guerrero specimen of *G. m. griscomi* in the Museum of Comparative Zoology except that it is smaller (wing, 82; tail, 51 mm.) and its pileum is unspotted. Both of these variations may be due to immaturity, or it is possible that our specimen represents the race *palmarum*.

Nyctidromus albicollis. Pauraque.—Identified only in forest clearings 20 to 23 miles south of Autlán. The behavior of an adult bird flushed by Zimmerman was interesting: after alighting it raised itself on its legs and bobbed its head up and down several times. When approached closely it flew some 50 feet, flopped to the ground, quickly turned and bobbed its head once or twice, then flew back and landed almost at the observer's feet. Here it continued its head-bowing for nearly a minute, whereafter it flew out of sight. Perhaps it was trying to divert attention from its young. Thirty minutes earlier Zimmerman had accidentally killed the only two young known to be in the vicinity when he had shot the adult male that apparently was brooding them.

Phaethornis superciliosus. Long-tailed Hermit.—Twice during the morning of June 30 Zimmerman clearly saw a bird of this species at very close range plucking insects from a spider's web above a small forest stream. Friedmann, Griscom and Moore (*op. cit.*, p. 161) do not list this species from Jalisco.

Amazilia beryllina viola. Berylline Hummingbird.—Zimmerman shot a male in oak forest (4000 feet) south of Autlán July 16. Others were seen there several times during July.

Amazilia rutila. Cinnamomeous Hummingbird.—Common at the forest edge 21 miles south of Autlán, being seen there daily.

Cynanthus latirostris. Broad-billed Hummingbird.—Several seen and a male (wing, 49.5; tail, 31.5; culmen, 20 mm.) taken northeast of Autlán, June 25. This bird has the measurements and white under tail coverts of *magicus*, but the merging of the blue of the throat with the green of the belly is even more pronounced than in a topotype (at hand) of *propinquus*.

Heliomaster constanti. Plain-capped Star-throat.—Several seen feeding with the commoner Broad-bills among giant cactus flowers, June 25. Immature male taken that day.

Trogon mexicanus. Mexican Trogon.—Noted by Harry on July 23, 26, and 29 in pine-oak forest between 7500 and 9000 feet on the Sierra de Autlán.

Trogon elegans ambiguus. Coppery-tailed Trogon.—One to six seen daily in the tropical deciduous forest south of Autlán. Breeding female and male taken June 30 and July 5 respectively. Young bird seen July 9.

Trogon citreolus. Citreoline Trogon.—Recorded only on July 6 when Zimmerman collected a singing male (enlarged testes) in the forest 21 miles south of Autlán. The plumage of this specimen is nearly identical with that of an adult female. The head, back, and tail are plain slate gray without a single iridescent feather. The mottled brown alula of the right wing and the plumulaceous character of some of the under tail coverts suggest immaturity. The song of this individual was a low, soft *hoo-koo, hoo-koo, hoo-koo*. The brilliant lemon yellow iris showed clearly in the field.

Momotus m. mexicanus. Russet-crowned Motmot.—Single birds seen infrequently near streams in the forest 15 to 21 miles south of Autlán. Adult female taken July 6 (Zimmerman).

Colaptes cafer. Red-shafted Flicker.—Noted occasionally in pine forests (7500–8000 feet) on the Sierra de Autlán in late July (Harry).

Centurus chrysogenys flavinuchus. Golden-cheeked Woodpecker.—Abundant in the scrubland among giant cacti; less numerous at the edge of the tropical deciduous forest. On June 25 Zimmerman observed what he believed to be a courtship display: a male, perched on a large cactus fruit, bowed elaborately, swaying and spreading his wings, sometimes hanging upside down, before a female. These actions were accompanied by a flicker-like *chicker-chicker-chicker*, etc. The performance lasted about three minutes. Adult (female in coloration) with well-defined brood-patch taken June 24.

Balanosphyra f. formicivora. Acorn Woodpecker.—Seen occasionally in oak and pine forests at about 8000 feet. Harry collected a female, July 25.

Piculus auricularis. Gray-crowned Woodpecker.—Zimmerman collected an adult female in scrub oak forest (4500 feet), July 29.

Dendrocopos scalaris centrophilus. Ladder-backed Woodpecker.—One or two pairs seen daily in the scrubland. A male taken July 27 (wing, 101; tail, 56; culmen, 22.5 mm.) and a female taken July 25 (wing, 94, culmen, 18.5 mm.) have the dark under parts and broad black dorsal bars of *centrophilus*.

Dendrocopos arizonae fraterculus. Arizona Woodpecker.—Harry took a female in mixed pine-oak forest (8000 feet), July 23. The wing (100 mm.) of this bird is shorter than that of the shortest-winged female *D. a. fraterculus* measured by Ridgway (1914. *U. S. Natl. Mus. Bull.* 50, pt. 6, p. 263).

Xiphorhynchus flavigaster. Ivory-billed Woodcreeper.—Seen sparingly in the tropical deciduous forest during July and early August. Two immature males taken (July 9; August 5). In neither of these is the bill or tail full grown. The August specimen (bill, 24 mm.) appears to be the older. In both specimens the throat feathers are buff, tipped with dusky, and the breast markings are distinct, the buff striping being more sharply defined than that of adults. The plumage has a rich yellowish cast throughout, probably a concomitant of immaturity.

Platypsaris aglaiae albiventris. Rose-throated Becard.—Recorded three times. By following a food-carrying female Zimmerman found a nest in a large, isolated fig tree in a plowed field near Autlán on July 26. The tree held also an occupied nest each of the Vermilion Flycatcher (*Pyrocephalus rubinus*) and Mexican Cacique (*Cassiculus melanicterus*). The ragged, bulky becard nest was about ten inches long and eight inches wide, and was attached to the tip of a long branch 30 feet above the ground. Both adults made regular trips to the nest but only the female was seen with food in her bill. Three days later there was no sign of the becards at or near the nest. Zimmerman took a breeding male near Autlán on July 23.

Tityra semifasciata. Masked Tityra.—Rather common in forest south of Autlán. Conspicuous because of its coloration, loud calls and fearlessness. Usually seen in groups of four or five. Small fruits seemed to be its principal food though the stomach of one specimen contained a few insects. Our two specimens (males, June 30, July 21) are slightly darker, especially above, than male specimens of *personata* at hand, and the black of the outer webs of the lateral rectrices is extensive (wing, 133.5, 130 mm.; tail, 81, 76.5; culmen, 26, 26.5; tarsus, 27, 28); probably they represent the race *griseiceps.*

Pyrocephalus rubinus mexicanus. Vermilion Flycatcher.—The most abundant flycatcher and one of the commonest birds of the arid scrub. Nests with young found June 30 and July 26 were about 20 feet above ground in large trees. That found July 26 was in a fig tree which also held active nests of *Cassiculus melanicterus* and *Platypsaris aglaiae* (see above). Two males and four females taken June 29 to August 2.

Tyrannus melancholicus occidentalis. Olive-backed Kingbird.—Seen regularly in the farming areas and scrubland near Autlán, but not common. Specimens taken: adult male, June 29; two young males, August 5.

Tyrannus crassirostris. Thick-billed Kingbird.—A noisy, conspicuous species recorded six times, June 29–August 4, in the scrubland. It probably bred there for Zimmerman found three young accompanied by adults on July 26. Some of the notes of this bird are similar to those of a Vermilion Flycatcher but louder and longer: *brrr-zee* or *purr-eet,* the last syllable slurring upward. A longer call, a loud, raucous, throaty *cheek, cheek, cheek, purreek,* was also heard. Our two specimens (males, June 29, July 22) appear to be larger, darker-crowned, and paler below than specimens from Nayarit and Sinaloa.

Myiodynastes luteiventris. Sulphur-bellied Flycatcher.—Encountered wherever we went below 4000 feet but more numerous in the heavy woodlands than in the drier scrub. Usually the most conspicuous bird in the forest, its sneeze-like calls being heard throughout the day. Specimens: male, June 27; female, June 30.

Megarynchus pitangua. Boat-billed Flycatcher.—Seen only in the tropical deciduous forest and rare there. One pair, feeding recently fledged young, seen July 8. The female (collected) was infested with seven white larvae from 1.5 to 2 cm. in length. After the bird died, six larvae emerged, two through the skin of the throat, two from each wing at the wrist. Another was found in the throat during the skinning process. The flycatcher was taken within 60 miles of the type locality of *caniceps,* yet its measurements are closer to those of *tardiusculus* (exposed culmen, 31.5; width of culmen, 14.5 mm.).

Pitangus sulphuratus. Derby Flycatcher.—Noted occasionally near the forest edge about 20 miles south of Autlán and, especially in late July, in the scrubland up to 3000 feet. Our single specimen (male, July 21) is in juvenal plumage. Its crown is wholly dark except for one yellow feather.

Myiarchus cinerascens inquietus. Ash-throated Flycatcher.—Single individuals recorded July 4 and 13 in the scrubland. Male (wing, 86; tail, 81.5; culmen, 14 mm.) taken on the former date.

Myiarchus tyrannulus magister. Arizona Crested Flycatcher.—Two males in juvenal plumage taken by Zimmerman near Autlán, July 25.

Myiarchus tuberculifer querulus. Dusky-capped Flycatcher.—Bird in juvenal plumage (wing, 75; tail, 77; culmen, 14.8 mm.) collected along the forest edge 22 miles south of Autlán, July 21.

Contopus p. pertinax. Greater Pewee.—Observed July 16 (adult feeding a young bird) and July 29 in oak forest at 4500 feet. Female (wing, 99; tail, 79; culmen, 15.5 mm.) taken on latter date.

Empidonax difficilis. Western Flycatcher.—Several seen and a male in juvenal plumage taken in pine forest on the Sierra de Autlán at 8100 feet, July 23 (Harry).

Mitrephanes phaeocercus. Tufted Flycatcher.—Seen daily July 25–31 in pine and oak forest on the Sierra de Autlán (Harry). The upper parts of a female taken July 25 at 8000 feet are too dark and the bill is too large for *tenuirostris.*

Stelgidopteryx ruficollis. Rough-winged Swallow.—Single birds seen in Autlán, July 1 and 24. Several flocks (10 to 30 birds) seen feeding over farmland north of town, August 4.

Hirundo rustica. Barn Swallow.—Common in Autlán and around dwellings south of the city. Adults seen feeding young, July 16.

Corvus corax. Raven.—From one to 15 seen daily. Noticeable as they fed in plowed fields at any hour between daybreak and late afternoon. Small groups often observed flying eastward at dusk.

Calocitta formosa colliei. Magpie-Jay.—Seen occasionally in rocky arroyos and scrubland. Harry found a short-tailed young bird, evidently just out of the nest, July 12. On July 20, at the same locality, he saw three young all capable of strong flight, but still accompanied by their parents. Adult male (with black crest, auriculars and throat) taken June 24.

Xanthoura yncas speciosa. Green Jay.—Noted along a stream in the oak forest on the Sierra de Autlán, July 28 and 30. A male (wing, 131; tail, 157 mm.) collected by Harry on July 30 has the yellowish-white eyelid feathers (some tipped with blue), yellow forehead, and yellowish bases of the blue hindneck feathers characteristic of this race.

Cissilopha san-blasiana nelsoni. San-Blas Jay.—Common in dense forest south of Autlán (about 1500 feet). Seen in pairs and groups of four or five. Rare in scrub areas at 3000 feet. Birds seen carrying sticks, possibly for nest construction, July 7. The stomach of a female taken June 26 contained insects and a small snail.

Cyanocitta stelleri. Steller's Jay.—Seen daily, July 22–31, in pine forest on the Sierra de Autlán. Female taken July 22 (Harry).

Sitta carolinensis. White-breasted Nuthatch.—Seen frequently in pine-oak forest on the Sierra de Autlán (about 7500 feet), July 23–31. Young male taken July 25 (Harry).

Certhia familiaris jaliscensis. Brown Creeper.—Noted frequently in pine-oak forests on the Sierra de Autlán (7500–8000 feet). Male taken July 27 (Harry).

Campylorhynchus gularis. Spotted Wren.—Found only in clearings and in vegetation beneath scrubby oaks at 4000 feet nine miles south of Autlán. On July 29, on one hillside, Zimmerman encountered six adults and eight long-tailed young birds actively foraging low in the thicket. He collected from a family group the adults and one of three young. The color-pattern of the young bird was quite unlike that of either adult: its underparts were unspotted and its pileum was *black* (brown in adults). It had a black postocular streak and the superciliary line was wider than in the adults. The irides were gray, those of the adults bright rusty orange. This species and *C. jocosus* have been regarded as conspecific by some taxonomists, but the fact that the juvenal plumage of the one differs strikingly from that of the other does not seem to support such a concept (*cf.* van Rossem, A. J., 1938. *Bull. Brit. Ornith. Club,* 59: 11).

Thryothorus sinaloa. Sinaloa Wren.—Noted daily in the scrubland and along the forest edge (1500 to 4000 feet). Its song was a loud *pee, twa, weet-weet, woit-woit-woit-woit,* often ending with a higher pitched *wit!* Two males taken July 9 and 13 are darker and less rufous than six *T. s. sinaloa* specimens at hand (though the brightness of some of these may be due to "foxing"). The dorsal coloration of our birds is closer to that of the geographically-far-removed *cinereus*, while the heavy spotting on the lower belly and abdomen is different from that of any other specimens at hand.

Thryomanes bewicki. Bewick's Wren.—Noted only on July 10 when Zimmerman collected near Aultán one of three young being fed by an adult.

Troglodytes brunneicollis. Brown-throated Wren.—Seen daily July 22–31, in oak, pine, and bunch grass habitats on the Sierra de Autlán (Harry). A young female taken July 27 (8300 feet) is slightly paler below than a female in stub-tailed juvenal plumage from the Mt. Tancítaro district of Michoacán (UMMZ 115,792).

Catherpes m. mexicanus. Canyon Wren.—A few seen or heard daily in Autlán and in nearby arroyos. Adult male (June 29) and young female (August 6) taken.

Toxostoma curvirostre. Curve-billed Thrasher.—Seen occasionally in scrubland in late July. Young birds taken July 22 and 25; adult female (wing, 106; tail, 102.5; culmen, 27.5 mm.) taken July 29. On the basis of measurements the adult seems closer to the nominate race than to *occidentale*.

Mimus polyglottos. Mockingbird.—Seen occasionally in roadside thickets between Autlán and Guadalajara.

Turdus migratorius. Robin.—Adults and young seen July 25–27 in pine and oak forests on the Sierra de Autlán (Harry).

Turdus r. rufo-palliatus. Rufous-backed Robin.—Seen only in the tropical deciduous forest south of Autlán. Its alarm note, a low *chuck*, reminded us of *T. migratorius*. Adults were seen carrying food, July 21. The irides of a freshly killed male (July 21) were rusty brown, the eyelids and bill ochre-orange.

Turdus assimilis renominatus. White-throated Robin.—Found in the same habitat as the above but twice as numerous and usually stayed high in the trees, seldom near the ground. Song, call notes, and behavior very similar to those of *T. migratorius*. A male taken June 30 is more tan and less olive-gray below, and appreciably duller, paler, and less olive above than examples of the nominate race. It is even somewhat duller than specimens of *renominatus* at hand. Female taken July 9. Irides of both sexes were dark rusty, the eyelids lemon yellow, and the bill brownish-black above, yellow-brown below.

Catharus occidentalis fulvescens. Russet Nightingale-Thrush.—Heard at dawn and dusk daily, July 21 to 31, near mountain streams in oak forest on the Sierra de Autlán (Harry). Adults and young taken July 28 and 29. The adults differ puzzlingly *inter se*, the female being brighter than the male throughout the upper parts.

Sialia sialis. Bluebird.—Seen infrequently in scrubland and oak forest (3000 to 4000 feet). Two males (adult and young) taken August 4.

Polioptila plumbea bairdi. Black-capped Gnatcatcher.—Seen occasionally in the scrubland. Our female (July 4) agrees with specimens of *P. plumbea bairdi* at hand, though the tail (50.5 mm.) is longer than Ridgway's average (43.5) for females of that form. A male (July 23) is also close to *bairdi* but the white in the second rectrix is more restricted than in most specimens of that race at hand.

Ptilogonys cinereus. Gray Silky-Flycatcher.—Female (plumage badly worn) taken on the Sierra de Autlán, August 1 (Harry).

Lanius ludovicianus. Loggerhead Shrike.—Fairly common in the scrubland. On July 27 three young birds, capable of feeding themselves, were seen begging from an indifferent adult.

Vireolanius melitophrys goldmani. Chestnut-sided Shrike-Vireo.—The chest-band of a male taken by Harry in pine forest on the Sierra de Autlán (9000 feet) July 25, is rufous, not deep chestnut (as in the nominate race); contrary to Nelson's original description of the type of *goldmani* (1903. *Proc. Biol. Soc. Washington*, 16: 155), however, the gray of the pileum meets abruptly the green of the back. The type of *goldmani* is, of course, a female.

Vireo huttoni mexicanus. Hutton's Vireo.—Females taken July 27 and 31 in pine-oak forest on the Sierra de Autlán (Harry).

Vireo h. hypochryseus. Golden Vireo.—Singing male taken July 5 along the forest edge 21 miles south of Autlán (Zimmerman). The irides of this bird were bright rusty-brown, the bill bluish, tinged with pink below, and the legs gray-blue. Two small yellow birds seen along a stream 19 miles south of Autlán, June 30, were probably of this species.

Vireo olivaceus hypoleucus. Red-eyed Vireo.—Present in the scrub forest near Autlán, but more abundant near edge of tropical deciduous forest farther south. Adult female taken June 24. A nest found July 6 was in a sapling, on a dead branch eight feet above a dry stream bed. An adult was on the nest. Another adult, which had been singing nearby, promptly attacked and pursued a cacique that alighted in a tree some 20 feet from the nest.

Nest and egg of Rufous-capped Warbler (*Basileuterus rufifrons*). Two other eggs were in the grass close by. Photographed 20 miles south of Autlán, Jalisco, México, July 21, 1949, by Dale A. Zimmerman.

Parula pitiayumi pulchra. Pitiayumi Warbler.—Male and female taken nine miles south of Autlán July 15 and 16.

Myioborus m. miniatus. Bright-bellied Redstart.—Several seen and a female in juvenal plumage taken on the Sierra de Perote (5000 feet), July 2 (Harry).

Euthlypis l. lachrymosa. Fan-tailed Warbler.—Male taken July 19 in a forested ravine nine miles south of Autlán (Zimmerman). This bird seems to represent the nominate race, though its wing-length (70.5 mm.) is less than that of four Tamaulipas males (73–75, average, 74) in the Sutton collection.

Ergaticus ruber. Red Warbler.—Seen daily, July 23–29, in oak and pine-oak forests (8000 feet) on the Sierra de Autlán. Male taken July 23 (Harry).

Basileuterus belli bateli. Bell's Warbler.—Seen daily in oak and pine-oak forest, Sierra de Autlán, July 22–31. Specimens taken: female (wing, 62, tail, 60 mm.), July 22; female (?) (wing 62.5, tail 59 mm.), July 30; juvenile (sex?), July 22.

Basileuterus rufifrons dugesi. Rufous-capped Warbler.—Seen frequently on brushy, grass-covered hillsides south of Autlán (4000 feet). Less common along the forest edge at about 1500 feet. A nest containing four well developed young, found in the latter area July 8, was on the bank of a roadside drainage ditch. It was well concealed by long, overhanging grasses and constructed of the same material, being lined with finer grasses and rootlets. Both adults were feeding the young. On July 21, our next visit, this nest contained one *egg* and two others were in the grass a foot or so away, but we did not see the warblers themselves. The song of this species resembles that of a Chipping Sparrow (*Spizella passerina*), and was recorded by us as *ti-ti-ti-ti-ti-ti* and *che-che-che-che-che.* Adults at the nest uttered a soft *tip.*

Passer domesticus. House Sparrow.—Not common at Autlán. An occupied nest found there June 24.

Cassiculus melanicterus. Mexican Cacique.—A conspicuous bird of the tropical deciduous forest. Mornings and evenings we heard its notes there—an odd *ker-yack*, *ker-yack*, *ker-yack*, and a somewhat *Agelaius*-like *cheedle-quaaaaa.* Two males taken (July 20; July 26). Its long pendulous nests were on the lower branches of tall, isolated trees along the forest edge. We saw no evidence of colonial nesting. An active nest found July 26 was in a fig tree: in the same tree were two other active nests—one of the Vermilion Flycatcher and one of the Rose-throated Becard. A cacique nest found July 7 probably held eggs, for we saw the adults change places several times that day. Nesting caciques ordinarily were tolerant of other birds, but we saw one male chasing a Golden-cheeked Woodpecker that had alighted in the cacique's nest-tree.

Tangavius a. aeneus. Red-eyed Cowbird.—Small flocks seen in farming areas and scrubland throughout our stay. Specimens taken June 26, July 26, and August 4. Our single adult male measures: wing 114.9, tail 78.5 mm.

Molothrus ater obscurus. Brown-headed Cowbird.—A bird in juvenal plumage collected in the scrubland August 4 was the only Brown-headed Cowbird we encountered. In this specimen the outer rectrices are marked with buffy white in such a way as to give the tail a pattern much like that of a Chestnut-collared Longspur (*Calcarius ornatus*).

Cassidix m. mexicanus. Great-tailed Grackle.—Small numbers seen near Autlán throughout our stay. Immature male taken August 5.

Icterus w. wagleri. Wagler's Oriole.—Pairs seen July 14 and August 2 near water holes in the scrubland. A male taken July 14 approaches *castaneopectus* in size (wing, 112; tail, 115; culmen, 23 mm.).

Icterus pustulatus. Scarlet-headed Oriole.—Common in the scrubland. Seen occasionally along the forest edge at 1500 feet. Adults seen feeding a recently fledged bird, July 7. Three specimens taken from a flock of eight immatures, August 3. Our adult males (June 26, July 10) possess the small lanceolate dorsal markings of *microstictus*, though the size of these markings differs greatly in the two specimens.

Sturnella magna. Meadowlark.—Seen and heard June 23 and August 7 in fields 20 miles northeast of Autlán.

Piranga flava. Hepatic Tanager.—Seen in oak forest (4000 feet) and among pines (8000 feet) in the mountains near Autlán. Adult and sub-adult males taken July 19 and 25; female taken July 19.

Piranga erythrocephala. Red-headed Tanager.—Male taken from a group of four immatures on July 19 (Zimmerman).

Habia rubica rosea. Red Ant-Tanager.—Zimmerman collected the male of a pair found along a stream in a wooded arroyo 19 miles south of Autlán, July 2.

Guiraca caerulea. Blue Grosbeak.—Pairs recorded at Autlán, July 13 and 21.

Passerina versicolor. Varied Bunting.—Singing male (testes enlarged) taken six miles northeast of Autlán, June 25. On the basis of measurements this bird seems closest to *dickeyae* (wing, 66; tail, 51.5 mm.).

Passerina l. leclancheri. Leclancher's Bunting.—Seen occasionally on brushy hillsides northeast of Autlán. Its song, which was much like that of the Indigo Bunting (*Passerina cyanea*), was often heard during the warmest hours of the day when most species were silent. Males (wing. 66, 66.5 mm.) taken June 24 and August 4. Female (wing, 60 mm.) taken July 10.

Carpodacus mexicanus. House Finch.—Seen daily in Autlán, though not common there. Adults seen feeding young July 12 to 23.

Sporophila t. torqueola. Seedeater.—Immature male (wing 54.5, tail 45.5 mm.) taken two miles south of Autlán, July 26.

Volatinia jacarina. Blue-black Grassquit.—Common in the scrubland. Its song, a thin, buzzy *wee see chew* (last syllable dropping) or *wee see sit* (last syllable rising), was usually given from the top of a low bush or fence wire. Males (testes enlarged) taken July 4 and 23. One of these has black under wing coverts, while the coverts and bases of the remiges of the other bird are largely white. These birds were taken in an area included in the range of *V. j. diluta* by van Rossem (1938. *Bull. Brit. Ornith. Club*, 58: 131).

Spinus p. psaltria. Dark-backed Goldfinch.—Seen frequently among oaks at about 4000 feet. Male taken July 16.

Atlapetes torquatus virenticeps. Green-striped Atlapetes.—Common in oak forests on the Sierra de Autlán (6500–8500 feet). Male taken July 22.

Pipilo ocai. Collared Towhee.—Seen frequently in oak forest on the Sierra de Autlán July 23–29. Less common in pine forest and bunch grass meadows. Female taken July 23 (Harry).

Pipilo fuscus. Brown Towhee.—Seen occasionally in scrubland and oak forest up to 5000 feet. A male (wing, 92.5; tail, 90.5; culmen, 14 mm.) taken August 4 is paler below than specimens of *P. f. fuscus* examined.

Melozone k. kieneri. Rusty-crowned Ground Sparrow.—Noted infrequently in heavily forested arroyos at 2000 feet, scrub forest (3000 feet), and oak forest (5000 feet), but most common in dense undergrowth in arroyos from 3000 to 4000 feet. Harry found a nest containing three pale bluish-white eggs, July 12. It was built of grasses and placed three feet from the ground in a shrubby vine. Male (July 2) and female (July 11) taken.

Aimophila h. humeralis. Black-chested Sparrow.—Locally common in the scrubland, being found in small loose colonies, often in association with the following species. Its song was a rapidly executed, run-together *che-ti-ti che-ti-ti chi-chiti chititi*, etc. The songs of this species and *A. ruficauda* were quite similar: both species gave duet performances. The alarm note of the present species was a metallic, junco-like *pit.* Four adults taken, July 4–August 4.

Aimophila ruficauda acuminata. Russet-tailed Sparrow.—The most noticeable species in the scrubland, inhabiting fence rows and acacia thickets. What we presumed to be mated pairs often sang in duet. When performing one bird would fly into a low bush, chatter a bit, and then, after a short buzzy flight low over the ground, join another bird. Soon both birds would perch side by side, or one just above the other, and begin singing together a rapid, vigorous *see-chee-see-seeche, see-chee-see-seeche,* over and over. This would continue for half a minute to two minutes before the birds would fly off into the brush. Zimmerman found two nests, each with three white eggs, July 20 and 27. About five feet above ground in low acacias, they were loosely built of thin twigs and grasses, lined with horse hair. Four adults taken June 24–August 5.

Aimophila ruficeps. Rufous-crowned Sparrow.—Male taken July 16 nine miles south of Autlán. This specimen bears little resemblance to some examples of *fusca* at hand, being more striped and not so reddish above. A topotype of this race (U. S. Natl. Mus. 135910) is redder in general tone above than the Autlán bird, though it is not very different in any other respect. The auriculars of the topotype are buffy; those of our specimen are gray.

Junco phaeonotus. Red-backed Junco.—Seen daily July 23–31 in bunch grass meadows

(8000–9000 feet) on the Sierra de Autlán. A female taken July 23 seems closest to *australis* on the basis of bill measurements. The outer tail feathers, however, have much more white than examples of that race at hand. In this respect the specimen is similar to *J. p. palliatus.*

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NEW LIFE MEMBER

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NOTES ON THE ORNITHOLOGY OF SOUTHEASTERN SAN LUIS POTOSI

BY GEORGE H. LOWERY, JR., AND ROBERT J. NEWMAN

On the basis of current estimates, about one-half of the species comprising the avifauna of México occur also in the state of San Luis Potosí, in the east-central part of the republic. As recently as 12 years ago, however, it would have been difficult to find definite published evidence for the presence there of even 200 kinds of birds. Several factors contributed to this circumstance.

In the earlier days of Mexican ornithology, the middle latitudes of the country were less accessible to visiting naturalists than the northern and southern parts and offered less promise. The few ornithologists who did reach San Luis Potosí were collectors primarily interested in acquiring the novel and the exotic. They must have met with, but passed by, scores of common species obtainable with less effort in the United States. In general, these men left no record of their achievements other than the data on their specimens, and this information has but gradually filtered into the literature through taxonomic reviews and works of a broad distributional nature. Furthermore, the celebrated team of E. W. Nelson and E. A. Goldman were the only early collectors to push down over the rough mule trails into the southeastern corner of the state, where the Sierra Madre Oriental rises abruptly to an altitude of 9000 feet, where the rain forest of San Luis Potosí attains its highest development, and where, in consequence of these combined influences, the most colorful and most varied elements of the birdlife are concentrated. Their brief stay at Xilitla, rendered rather unfruitful by difficulties of terrain and by bad weather, failed to disclose the real potentialities of the surrounding area.

With the official completion of the Pan-American Highway through southeastern San Luis Potosí in 1936, that corner of the state was rapidly to prove itself the richest source of new distributional data in all east-central México. It early attracted the attention of L. Irby Davis, who used it as an area for studies in the field identification of tropical birds. His work was all of an observational nature and has remained for the most part unpublished, so that the full extent of his numerous early accomplishments cannot be gauged. The excellent report on the birds of Tamazunchale and its environs by Sutton and Burleigh (1940b) was the first published locality list from the region. Fifty-nine of the 141 species included had never before been reported from the state, and the proportion would have been larger, had not a slightly earlier publication by the same authors (1940a), on the birds of Valles, listed for the first time species also seen at Tamazunchale. Our own activities in San Luis Potosí began in 1941. They initiated a decade of study which during its latter half has been devoted to a systematic survey of the vertebrate fauna of the state sponsored by the Louisiana State University Museum of Zoology. Our work in the southeastern corner of the state alone has revealed the presence of well over 80 additional species of birds for which at the time there were no San Luis Potosí records in the literature. State records for many of these birds have subsequently appeared in a breeding bird census (Davis and Johnston, 1947), in Audubon Bird Counts (Newman and party, 1947; Davis and party, 1951), in the first part of the "Distributional Check-List of the Birds of México" (Friedmann, *et al.*, 1950), and in short papers of a taxonomic or distributional character (Lowery and Newman, 1949; Sutton, *et al.*, 1950; Pitelka, 1951).

Meanwhile the list for the whole state, as represented in our files, has climbed to a total of no less than 490 species. A book-length report would be required to set down all that is known, but yet unpublished, about the distribution of these birds on a statewide basis. Pending the preparation of such a report it is possible, however, to compress a relatively large amount of information into a small compass by confining attention to the extreme southeastern portion of the state, arbitrarily defined for this purpose as the area lying south of latitude 21° 28′.

Among the references cited, two relate directly and exclusively to the area herein defined (Sutton and Burleigh, 1940; Davis and party, 1951). Sixty-one of the birds in the Sutton and Burleigh paper and, of course, all of the records in the 1951 Christmas bird count, were included on the basis of sight identifications. Our collection contains corroboration of the state occurrence of all but three of these species. The exceptions are the Mississippi Kite, in the Tamazunchale report, and the Tennessee Warbler and Grace's Warbler, in the bird count. The latter was made on December 28, 1950, by Davis and 19 collaborators within a circle 15 miles in diameter, centered one mile north of Xilitla. Their spectacular list of 230 species far exceeds the results for any previous effort of this sort and shows that the Xilitla area encompasses a variety of birdlife unsurpassed by any known district of its size on the North American continent. While it is true that 40 of the birds included have never been noted by us in the same locality in winter, this result may be attributed in large measure to a "norther" of unprecedented severity that shifted many birds of western range transiently to the east. Most of the 31 species formally attributed to San Luis Potosí for the first time in the Xilitla bird count have an unchallengeable right, as indicated above, to a place on the state list, at least on the basis of occurrence in other localities or at other seasons.

There remain another 32 species that are found in southeastern San Luis Potosí but whose presence in the state is still generally unknown. The majority of these birds were recorded not far from Xilitla, within the boundaries of the bird count territory defined by Davis—an area of such tremendous interest that we and our associates have devoted 1650 party hours to its exploration. These birds are listed in the account that follows, together with an indication of their status in southeastern San Luis Potosí, their observed altitudinal range, the essential details concerning the first record and first specimen from the area, and brief taxonomic comments where pertinent. All sight identifications and specimens cited in detail but not otherwise credited represent the work of Newman.

Cairina moschata. Muscovy Duck.

The wild ancestor of our domestic duck of the same name, apparently resident in small numbers on the Río Huichihuayán, at an elevation of 400 feet or less. It was first observed at the dugout crossing near the village of Huichihuayán, on June 20, 1942, when a pair was noted. A female was later shot by Charles Shaw 1 mile west of the village, on August 29, 1947.

Micrastur ruficollis. Small Forest Hawk.

Our three records of this trim little hawk of the dense rain forest are all of birds collected in the vicinity of Xilitla, at elevations of from 600 to 4000 feet. An immature male was taken by Shaw on September 9, 1946, in a ravine about 2.5 miles by road from the Pan-American Highway, along the road to Xilitla; an adult male and an adult female were taken subsequently. Since each specimen is in a different plumage, it is not possible to evaluate fully the color-characters of this extreme northern population of the species. The wing and tail measurements of each, however, fall within the limits of variation for the Mexican race, *M. r. guerilla*, as given by Friedmann (1950: 575).

Falco albigularis. White-throated Falcon.

A small tropical falcon, noted several times in the area, within an altitudinal range of 400 to 2800 feet. Our initial observation of this species in San Luis Potosí was that of two individuals seen in the vicinity of the Río Huichihuayán on December 20, 1946. A female shot 2 miles northwest of Xilitla on January 29, 1947, is definitely assignable to *F. a. albigularis*, though several San Luis Potosí specimens, like material from farther north, show some of the paleness characteristic of the western race, *F. a. petrophilus*—a resemblance we believe to be of independent origin.

Dendrortyx barbatus. Bearded Wood-Partridge.

Though unreported anywhere in the present century, the Bearded Wood-Partridge is a not uncommon resident of the mountain forests back of Xilitla, from 4000 feet to probably 7000 feet. Its presence there was not definitely established until June 12, 1947, when a female and three downy young were captured in the cloud forest on Cerro San Antonio. Adults are so difficult to secure that our present series of nine of these partridges, comprising every major developmental stage, includes only one fully mature bird. While we are not, therefore, yet certain that recognizable geographic variation occurs in this species, the possibility of such variation is rather definitely indicated.

Heliornis fulica. Sun-Grebe.

The Finfoot or Sun-Grebe, otherwise unknown north of Boca del Río near the city of Veracruz (*cf.* Warner and Mengel, p. 290 of this issue) was found only on the Río Huichihuayán between the village of Huichihuayán and the ferry crossing on the road to Xilitla, a stretch of river where on occasion several have been seen in a day. It was first recorded on December 14, 1941, and first collected (by David Cutler) on August 29, 1946.

Oreopeleia albifacies. White-faced Quail-Dove.

This heavy-bodied, slate-headed dove occurs, and probably is resident, in cloud forest above Xilitla, at elevations of 4000 to 5000 feet. It was discovered by Shaw on the mountain adjoining the village of Ahuacatlán on September 7, 1946, when he shot one of two birds seen.

damaging it so badly it could not be preserved. Our subsequent series of three specimens, all from Cerro San Antonio, differs in numerous details of coloration from examples of *O. a. albifacies* from central Veracruz, the northernmost district from which the species was previously known. Since, however, only one of our birds is fully adult, we feel that we do not yet have sufficient material to consider naming a new race.

Otus guatemalae. Middle American Screech Owl.

Owls of this species were presumably heard several times at elevations of 5200 to 6800 feet in the mountains of the Cerro Conejo group, but were seen only twice. The first of our two specimens was shot in broad daylight in the forest bordering the Llano de la Cruz on May 9, 1947. The somewhat greater grayness of our material compared with topotypes of *O. g. cassini* from central Veracruz may be simply a matter of individual variation, since too few specimens are available to demonstrate the full probable range of grayness among topotypical birds.

Ciccaba nigrolineata. Black and White Owl.

Although this extremely rare owl was taken on three occasions, in three widely separated months, all three specimens came from a single vine-covered tree in a ravine along the road to Xilitla, the same ravine that also produced the cited example of *Micrastur ruficollis*. This remarkable sequence of records began on September 9, 1946, when Shaw shot a female. According to Friedmann, *et al*. (*op. cit*., p. 147), the species has hitherto been known in México from only eleven specimens, from Veracruz, Oaxaca, and Chiapas.

Xiphocolaptes promeropirhynchus. Giant Woodhewer.

A flicker-sized woodhewer, which is fairly common in the high forests of Cerro Conejo and the associated peaks, above 6200 feet. It was not certainly identified until May 14, 1947, when a pair was obtained at 7300 feet near Cerro La Luz. Our six specimens, three of which were taken in 1947 and three in 1951, demonstrate the tremendous amount of "foxing," or brightening of the browns, that can occur in the short span of four years. Our early material from San Luis Potosí was impressively darker and duller than the much older skins available from the range of the geographically nearest race, *X. p. sclateri*, in Veracruz and Oaxaca; but it is rapidly becoming indistinguishable from examples of that race.

Xiphorhynchus triangularis. Spotted Woodhewer.

An inconspicuous inhabitant of wooded slopes from 4200 to 6800 feet encountered only in the Xilitla area. A female was shot near the Llano de Garzas on May 24, 1947, and but two other specimens were taken thereafter. All Mexican examples of this species are currently assigned to *X. t. erythropygius*. Our birds differ from the bulk of the material currently representing *erythropygius* in museums; but the differences, being of much the same order as those discernible in the preceding species, are probably the result of postmortem change.

Automolus rubiginosus. Ruddy Automolus.

Our one record for this rare furnariid is that of a male collected at 4000 feet among the tree-ferns on Cerro San Antonio, on June 7, 1948. This specimen cannot be exactly matched among available examples of *A. r. rubiginosus*, which has heretofore been believed to be confined to the neighboring state of Veracruz. Its darker coloration may, however, be explainable on the same basis as that of the woodhewers, while the greater thickness of its bill may not be significant in view of the considerable variation in this character already demonstrable in the nominate race.

Erator inquisitor. Black-capped Tityra.

An uncommon species of the lower tropics, not recorded above 400 feet and most frequently observed in the low country east of the Pan-American Highway. An immature male (Texas A. and M. College Collection) was taken at the village of Axtla on June 26, 1942, by C. W. Reid and we have encountered the species on five occasions since. Like all Mexican examples of the species, San Luis Potosí birds are assignable to the race *E. i. fraseri*.

Myiarchus crinitus. Crested Flycatcher.

This well-known bird of the eastern United States is doubtless commoner in migration than the three state records indicate, since the presence of five species of *Myiarchus* in San Luis Potosí tends to discourage sight identification. The single specimen from the southeastern corner of the state, a supposed female from El Sol, dated August 22, 1946, has the small bill that is the chief distinguishing feature of *M. c. boreus*.

Empidonax flaviventris. Yellow-bellied Flycatcher.

A common spring and fall migrant and winter resident, found from 400 to 4300 feet. The extreme dates for the state are August 23 (a female taken in 1946 at El Sol) to May 22.

Empidonax hammondi. Hammond's Flycatcher.

One of the commonest winter Empidonaces in the Xilitla area, from 2200 to at least 4500 feet. Dates on specimens extend from January 18 (1947 at the village of Xilitla) to March 10.

Empidonax albigularis. White-throated Flycatcher.

A not uncommon inhabitant of weedy fields around the 4000-foot level immediately above Xilitla, where it presumably breeds. Seasonal limits are uncertain. It was unrecorded until June 17, 1947, when a female was obtained at Rancho Miramar Chico. We have identified our series as *E. a. axillaris*, a race that occurs also in the state of Veracruz.

Pipromorpha oleaginea. Ochre-bellied Flycatcher.

The nine state records of this little flycatcher are all from the humid tropics within six miles of Xilitla, between 600 and 2900 feet. They extend from September 9, 1946, when Shaw secured an immature male in a wooded ravine along the road to Xilitla, 2.5 speedometer miles from the Pan-American Highway, to April 30 (1947). Our two adult males are shorter-winged (63.6, 65.2 mm.) than any of the other 12 males from México and Guatemala that we have examined (65.5–72.9 mm.). The birds from the Tuxtla Mountains of Veracruz in that series are, however, larger than other Mexican material to about the same degree that San Luis Potosí birds are smaller. Nomenclatural recognition of the interesting size trends indicated would therefore require describing not just one but two additional races. Even if more adequate material should bear out these minor trends, we would recommend that all Mexican *Pipromorpha* continue to be called *P. o. assimilis* as at present.

Iridoprocne albilinea. Mangrove Swallow.

A predominantly coastal swallow that ranges inland along the larger rivers, reaching Tamazunchale in small numbers. Although we observed and collected the species farther north in the state much earlier, it escaped our detection within the area of this report until May 17, 1948, when a single bird was seen flying over the Río Amajaqui near its junction with the Río Moctezuma. All Mexican and Central American populations of this species belong to one subspecies, *I. a. albilinea*.

Cyanocitta stelleri. Steller's Jay

A common resident of the higher mountain forests of the Cerro Conejo district, recorded from 6000 to 7200 feet. A female taken on February 25, 1947, near the Llano de la Cruz was the first of our present series of 14 specimens from the area. With the exception of one apparently mutant individual, these are all typical blue-crested *C. s. coronata*, exhibiting no constant differences, either in size or coloration, even from examples of the species from Guerrero.

Henicorhina leucophrys. Gray-breasted Wood Wren.

This tiny but brilliant vocalist is an abundant resident of the upper wooded slopes above Xilitla (recorded altitudinal range: 2000 to 7000 feet). Seemingly it replaces *H. leucosticta* at about the level of the village, where Cutler took a female on September 2, 1946. We have referred our series of 22 specimens to *H. leucophrys mexicana*, though they are somewhat darker in over-all coloration than older material from the range of that race.

Hylocichla mustelina. Wood Thrush.

A rare winter resident and migrant. Our only record for the area is that of a single male secured on December 22, 1946, 6 miles by speedometer east of Xilitla on the Xilitla Road.

Catharus occidentalis. Russet Nightingale-Thrush.

This Veery-like thrush of the deep forest shade is common the year around at elevations above 5000 feet. It was added to the known avifauna of the state on February 25, 1947, when a male was taken near the Llano de la Cruz, at 5800 feet. Two types, distinguished by subtle, but numerous, correlated characters, occur and may represent age classes. These introduce such complications that the whole problem of geographic variation in the species should be reinvestigated on a broad basis. Pending such a reappraisal, we tentatively have placed our Conejo series with *C. o. occidentalis*.

Vireolanius melitophrys. Honey-browed or Chestnut-sided Shrike-Vireo.

An uncommon inhabitant of the wooded mountain district back of Xilitla. Our four records range from 4000 to 6700 feet. One was seen on December 21, 1946, on Cerro San Antonio, but none was collected until May 8, 1947, when a female was taken at 5800 feet, near Puerto del Oso. Pending further study of specimens from Guerrero, all the Mexican material from north of Chiapas may be treated under one name, *V. m. melitophrys*, since the type of *V. m. goldmani* proves to be nothing but an immature example of the nominate race.

Hylophilus decurtatus. Gray-headed Hylophilus.

This rare little vireo, which superficially resembles the Tennessee Warbler (*Vermivora peregrina*), is known in San Luis Potosí only from a mountain along the Pan-American Highway 3.6 speedometer miles south of Tamazunchale, where a pair were taken by Newman and Leonardo Guerrero on May 22, 1948. These specimens have never been actually compared with a representative series of *H. d. decurtatus* from elsewhere in México; but, since the species ranges from Veracruz to Panamá in a more or less continuous habitat without any named geographic variation, it would be surprising if they did not closely agree with that form.

Vermivora chrysoptera. Golden-winged Warbler.

A rare transient in México. The one record for San Luis Potosí is that of a male taken by Shaw on April 19, 1947, one mile south of Xilitla.

Vermivora pinus. Blue-winged Warbler.

Similar in status to the preceding species. There is a single state record, that of a male shot by Lowery on April 3, 1950, 7 miles east of Tamazunchale.

Dendroica fusca. Blackburnian Warbler.

A rather uncommon spring transient, unrecorded in fall. A male was secured one mile west by north of Xilitla at 2400 feet on April 19, 1947, and there is one subsequent record for the same general locality.

Wilsonia canadensis. Canada Warbler.

A spring and fall migrant, more frequently observed than any of the preceding warblers.

It was first noted on September 3, 1946, when a female was collected 1.5 miles north-northwest of Xilitla by Shaw, and three other individuals were observed by the field party.

Myioborus miniatus. Slate-backed or Bright-bellied Redstart.

A fairly common resident of the high elevations back of Xilitla; altitudinal limits, 5800 to 7200 feet. The discovery of the species in eastern San Luis Potosí on May 13, 1947, when a female was obtained at Puerto del Oso, was long preceded by the unpublished records of W. W. Brown at Alvarez in the western part of the state (specimens in American Museum of Natural History). Our small series from eastern and from western San Luis Potosí definitely differ from each other in the coloration of the under parts. It is difficult, however, to imagine a pattern of true geographic variation that would account for this situation, since populations from central Veracruz to faraway Sonora are currently regarded as one subspecies, *M. m. miniatus.*

Icterus wagleri. Wagler's Oriole.

An oriole of the arid plateau, probably merely a stray on the eastern side of the Sierra Madre Oriental. Our one record from eastern San Luis Potosí is that of a male taken on April 19, 1947, at Xilitla. This specimen conforms fairly well with samples of *I. w. wagleri*, but the material from the state as a whole does not. The matter requires further study on a broad geographical basis.

Thraupis episcopus. Blue-gray Tanager.

Not uncommon at low humid elevations throughout the area, from 400 to 2200 feet. It was first seen on June 21, 1942, in a tree-dotted pasture on the outskirts of Tamazunchale and was first taken on September 14, 1946, along the Río Axtla, three kilometers west of the village of Axtla by W. W. Dalquest (skeletal specimen of a female in the collection of the University of Kansas Museum of Natural History). This species extends all the way from San Luis Potosí to Panamá without significant variation, under the name *T. e. diaconus.*

Spizella breweri. Brewer's Sparrow.

Recorded but once in southeastern San Luis Potosí—on April 17, 1948, when a female was secured on the Llano de Conejo, at 7000 feet. It has been referred to *S. b. breweri.*

Place names mentioned in this paper may be identified as follows: **Ahuacatlán,** village south and west of Xilitla, at latitude 21° 19′ N., longitude 99° 03′ W.; **Alvarez,** abandoned rail point in western San Luis Potosí, at 22° 02′, 100° 37′; **Axtla,** village just east of the Pan-American Highway, at 21° 27′, 98° 52′; **Cerro Conejo,** 9000-foot mountain northwest by west of Xilitla, with summit at 21° 27′, 99° 06′; **Cerro La Luz,** unmapped peak about 4 miles from Cerro Conejo, along the crestline of the same mountain mass; **Cerro San Antonio,** unmapped mountain 5000 feet high just west and southwest of Xilitla; **El Sol,** locality on the Pan-American Highway, 1 mile north of Tamazunchale; **Huichihuayán,** village on Pan-American Highway, 25 miles by road north of Tamazunchale, at 21° 28′, 98° 57′; **Llano de Conejo,** unmapped meadow on shoulder of Cerro Conejo at an approximate elevation of 7000 feet; **Llano de la Cruz,** unmapped meadow on shoulder of Cerro Conejo at an approximate elevation of 6000 feet; **Llano de Garzas,** another unmapped mountain meadow in the Cerro Conejo group; **Puerto del Oso,** unmapped pass on the trail between Xilitla and Cerro Conejo, at about 6000 feet; **Rancho Miramar Chico,** unmapped rancho on trail from Xilitla to Cerro Conejo, at elevation of 4000 to 4500 feet; **Río Amajaqui,** an affluent of the Moctezuma River, joining it at Tamazunchale; **Río Huichihuayán,** a branch of the Axtla River, flowing in a course roughly parallel to the Pan-American Highway, south of the village of Huichihuayán; **Tamazunchale,** town on Pan-American Highway in extreme southeastern San Luis Potosí, 21° 16′, 98° 48′; **Valles**, town on Pan-American Highway, at 21° 58′, 99° 02′; **Xilitla**, village at 21° 23′, 99° 01′ in mountains west of the Pan-American Highway, connected with that highway by an all-weather dirt road.

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THE MOLTS OF THE RUFOUS-WINGED SPARROW

BY ALLAN R. PHILLIPS

THE Rufous-winged Sparrow (*Aimophila carpalis*) is known only to a fortunate few. Its range is limited to a strip of country south from Pinal County, southern Arizona, to northern Sinaloa, México. In our country, the land-speculator, the military, and especially the stockman wage unending warfare on the few places where it still survives. Given a patch of grass and thorn-bushes, it can take good care of itself; but against short-sighted human greed and bulldozers it has no defense. One of the last species of United States birds to be discovered thus bids fair to be one of the first exterminated.

To the casual observer, the loss might seem of no consequence. Modest and retiring, the bird is no popular favorite. Its song is a plain, metallic trill. Other birds build more striking nests and have more engaging habits. Trim, slender and appealing perhaps, but by no means brightly colored: only a press agent could call it beautiful.

Why then, you ask, the "fortunate few?" Because our little subject is unique in some ways. The various other obscure sparrows of the Southwest nest in the spring, and in August and September have the usual complete postnuptial molt. Most of them have also, in March and early April, a partial prenuptial molt, this often being restricted to the chin or to the head and neck. But *Aimophila carpalis* does not nest in the spring. Though sexually active in spring and early summer, it delays its actual nesting until the summer rains. While waiting for these rains it has an almost complete prenuptial molt.

The molts of the Rufous-winged Sparrow have been known for some years; but little has been written about them, and even that little is not altogether correct. Van Rossem (1945: 275) mentioned casually that birds taken "in southern Sonora between May 6 and June 22, 1937 . . . all were in various stages of the complete prenuptial body and tail moult." Moore (1946: 118) discussed the molt at somewhat greater length. Referring presumably to birds taken in the Tropical Zone of México, he stated that "some individuals of *Aimophila carpalis* present feathers in process of molt in every month of the year . . . ." Periods specifically mentioned included January, late February, July, August, late September, and October. A male with a new secondary in one wing on September 18 had fully developed testes. Moore stated that "new secondaries almost invariably develop before the new primaries" (p. 122).

The Rufous-winged Sparrow becomes badly worn on the exposed parts of its feathers, as is usual among grass- and cactus-haunting birds. In the closed wing, the tertials cover and protect the secondaries, while most of the primaries project at their tips. By July and August the primaries in the closed wing look frayed and faded, while the secondaries usually are still in good condition. This, plus the replacement of feathers accidentally lost, may lead the student to believe that a bird is molting when actually no molt is under way.

My studies have extended intermittently over 11 years. They have been greatly aided by the cooperation and suggestions of Lyndon L. Hargrave, Joe T. Marshall, Jr., Gale Monson, Milton B. Trautman, the late Charles T. Vorhies, and the authorities of the American Museum of Natural History, Cornell University, the Fish and Wildlife Service, the United States National Museum, and the University of Arizona. My findings agree in the main with van

Rossem's; they agree with Moore's in revealing that molt and sexual activity are not mutually exclusive, but disagree—in so far as Arizona and northern Sonora birds are concerned—in certain particulars.

Postnuptial Molt

The postnuptial molt of the Rufous-winged Sparrow occurs rather late in the fall. An equally late molt occurs in such related forms as the Blue Grosbeak (*Guiraca caerulea*), Brown Towhee (*Pipilo fuscus*), Rufous-crowned Sparrow (*Aimophila ruficeps*), Cassin's Sparrow (*A. cassini*), and Black-throated Sparrow (*Amphispiza bilineata*), however; so *carpalis* is not unique in this regard. It is the tail molt that is odd, departing as it does from the orthodox pattern.

The postnuptial molt begins with the tertials, tail, coverts (both upper and under) of wing and tail, and in some cases the inner primaries. Soon it spreads to the head and sometimes the back. Of two adults taken in Arizona, September 11, the female shows no regular molt as yet, while the male has begun the molt of wing coverts, upper tail coverts, tertials, and inner primaries. On the other hand, three adults taken there as late as October 9 are not very far along in the molt. One, a female in the American Museum of Natural History, retains the longer wing and tail feathers of the old nuptial plumage, except for the tertials. The other pair (especially the male), though only *beginning* to renew the tertials, have new inner primaries that are already well grown. Molt, then, seems to begin in early or mid-September in males and perhaps two or three weeks later in females. None of the few specimens showing the tail in molt reveals any regular order of molting the feathers. In central Sonora and south, the molt may be even later, at least in some years (Pitelka, 1951).

An adult male, taken in Arizona on September 30 and examined in the flesh, had the tertials and inner five primaries nearly or quite full-grown. The outermost secondary also seemed full-grown, but the next was in a still unbroken sheath. Primary 7 was likewise in an unbroken sheath; 6 was about half grown; and old 8 and 9 had yet to be shed. Molt had begun in the inner secondaries, the innermost being nearly full-grown, but the rest were old feathers. Clearly, this male retained the old secondaries, as a group, and the outermost primaries the longest; and this appears to be the normal pattern. Other old feathers retained were the alula, two outer primary coverts, and the longer *under* primary coverts. The rest of the wing coverts had been renewed. The body was still in heavy molt, advanced especially on the tail, longer tail coverts, head and throat. The shortest obvious tail-feather was the outermost on the right side, but the adjacent two were full-grown, the succeeding one nearly full-grown, and the central four subequal, falling (in the closed tail) 25 to 29 millimeters short of the longest feather (third from right), which already showed a trace of wear. The fourth rectrix from the left was so short as to be barely out of its sheath; only by parting the feathers could it be found. The outer three feathers on the left formed a gently graded series falling 20, 26, and 31 millimeters, respectively, short of the longest rectrix. The shortest (outermost) of the three was almost as short as the right outermost.

The postjuvenal molt resembles the postnuptial, but is incomplete. Of the major flight-feathers, only the tertials are ordinarily molted; but in one Arizona female (U. S. National Museum 79616, September 11, 1874) the inner primaries and two outer pairs of rectrices are in molt. At this season, some birds have nearly finished the postjuvenal molt, while others are not yet full-grown. Most young October specimens from Arizona have some juvenal tail coverts (and often neck, flank, belly, and scapular feathers). Of two November birds, one (Granados, Sonora, November 12) still has a few juvenal upper tail coverts, while the other (Arizona, November 29) has apparently finished the postjuvenal molt.

Prenuptial Molt

I can detect no evidence of molt in series from Arizona and northern Sonora taken from December through April, nor in December and January birds from Álamos, Sonora, nor in a March male from Sinaloa. Some late April birds look suspiciously unworn, as if recently molted, on the lower back and rump; but this I attribute to the protection afforded these feathers by the overlying wings. An adult male from near Estero de Tasiota, northwest of Guaymas, Sonora, May 3, and a female from nearby Ortiz, May 12, still have not begun the prenuptial molt, but it is evident in a male (probably young) from east of Ures, Sonora, May 5. In this bird the sides of the crown, the postocular portion of the pale superciliary stripe, and the outer tertials are in molt.

Van Rossem, as quoted above, recorded molt in southern Sonora birds from May 6 to June 22. An Arizona specimen taken May 7 is starting the molt of the outer tertials. A female from near Tucson, May 19, is molting over at least the dorsal surface, and has several subequal new rectrices as if it had lost the central part of its tail accidentally. Except in the tail, the molt is farther advanced in two males taken at the same time and place; each has the central pair of rectrices 21.5 millimeters long, while the outer five pairs are old; among the remiges, only the tertials are in molt. Such new feathers as I have seen seem to indicate that, in the spring molt, the tertials are the only remiges regularly replaced. Other fresh feathers at this season may be replacements for accidental losses.

All Arizona specimens taken from May 19 to June 10 are in heavy molt. Of two males taken June 1, one has the entire tail old; the other has the outer four pairs old, the central pair missing or shot out, and the next pair coming in very unevenly (one about two thirds grown, the other just emerging from its sheath). The latter male is well along in its body molt and is molting its tertials and their coverts, greater secondary coverts, and feathers along the radius and tibia.

The general sequence of the spring molt seems to be the same as that of the fall, but it involves the wings and tail less. The old secondaries, primaries, and primary coverts are retained; the other wing coverts seem to be molted rather irregularly, most but not all evidently being renewed. In some young birds, apparently, the alula feathers molt. The tail is partly retained, only the central pair (and occasionally one or two adjacent rectrices) being shed.

One of three specimens taken near Tucson on June 30 still has a central tail-feather only about three-quarters grown. This date marks about the end of the prenuptial molt. No molt was evident on the other two birds except that the female lost one pinfeather from the downy area near the flanks in skinning. About three ova were greatly enlarged (at least one was in the oviduct), and a nest which I found nearby held one egg. July and August specimens examined, few in number, show no regular molt. This is the nesting season in Arizona, the time of summer rains.

In a general way, then, the Rufous-winged Sparrow undergoes a regular sequence of alternate molting and nesting, or both, from early May continuously until November. Molting and sexual activity can and do overlap. During May and June the males sing freely and, in all probability, are mated and defending territory. These points need detailed study; but there is no doubt about the swollen testes, which measure from 4 by $3\frac{1}{2}$ up to 6 by 4 millimeters during the spring molt. This is about maximum size for birds weighing 14.4 to 17.3 grams.

In the well-watered localities that once existed around Tucson, nesting probably began in late May. Stephens (Brewster, 1882: 196) found a nest and three eggs on May 25, 1881. Bendire (1882) found eggs about June 14, 1872, and believed the birds had commenced to breed "about a month earlier." Birds, grass, and water are nearly all gone from these stream-bottoms today; but it seems unlikely that there can have been much difference in the season of molt among different populations within the Tucson valley. Thus, laying and even incubation apparently occurred during molt.

Summary

The Rufous-winged Sparrow has a late postnuptial molt differing from that of most birds in lacking a regular sequence of molting the tail-feathers. Again in May and June it undergoes

a nearly complete prenuptial molt. Parts of the wing and tail are not involved in this molt; in the tail it is limited usually to the middle pair of rectrices. It is later than the spring molts of other fringillids, and overlaps periods of sexual activity.

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Museum of Northern Arizona, Flagstaff

PHOTOGRAPHIC RECORDS OF CAPTURED BIRDS

BY B. M. SHAUB[1]

DETAILED photographs of living birds held captive at banding stations have appeared from time to time especially in ornithological journals published abroad. Photographs of this sort should, it seems to me, be preserved for record far more often than they are. Killing a bird and preserving its skin or skeleton is one way of establishing a record, of course; but if the banded bird can be studied, weighed, photographed, released, recaptured, photographed again, etc., the possibilities are well nigh limitless. All sorts of plumage and growth studies might be carried on—or at least aided and abetted—in this way, not to mention the distributional data which might in time accumulate as it became apparent that certain subspecies and intermediates were identifiable, *as such*, from photographs.

The idea of photographing captured birds came to us in the spring of 1949, when several redpolls continued to visit our feeding station at Northampton, Massachusetts. Most of the birds were Greater Redpolls (*Acanthis flammea rostrata*), but a few were Common Redpolls (*A. f. flammea*). Each bird was weighed when banded and whenever recaptured, and the recorded weights showed the bigger looking birds to be, with few exceptions, the heavier. The 32 Greater Redpolls weighed (in grams) from 13.8 to 22.8 (average: 17.8), the five Common Redpolls from 11.4 to 13.8 (average: 12.9). The Greater Redpolls were definitely the longer-winged and longer-billed; indeed, we found no "birds which had measurable characters of intermediate proportions" (see Shaub, B. M., 1950. *Bird-Banding*, 21: 105–111). Interested in keeping a visual record of some of these differences without collecting, we decided to try photographing the birds, close-up, side by side, in such a way as to obtain strictly comparable pictures.

A major problem was that of holding the birds quiet in one position at exactly the same distance from the lens without in any way injuring them. We soon decided that transparent containers were what we needed. With these no tying down of the wings was necessary, the birds could be placed in any desired position, and shadows and reflections could be kept to a minimum by adjusting the source of light.

Using cellophane of .008 in. thickness, we made cylinders just large enough for each bird, tacking the material in place with transparent cellulose tape. A glass-sided container large enough for two cylinders we made by sawing kerfs in a piece of wood and trimming pieces of glass to fit (see Fig. 1B). The spaces at the ends of the cellophane tubes were not sealed shut, so the birds had plenty

[1] Contribution No. 11 from the Shaub Ornithological Research Station.

of air. In tubes the birds settled down quite satisfactorily. Unable to lift their wings at all, they did no fluttering and almost no kicking or scratching.

Because the birds' head-movements were frequent and unpredictable we used a synchronized flash when making exposures. The camera, on a tripod, was set in a vertical position. The 'tubed' birds, in their container, were placed on a platform and illuminated with the usual tungsten bulbs. The exact position of the container was marked by guides or stops, so as to facilitate replacing it with precision. Frequent removal and replacement was necessary for the position of the birds had to be adjusted. In the container shown in Fig. 1B the end-piece, c, was of glass. Had this been of some dark material, wood perhaps, the birds might not have tried so hard to crawl forward.

When the birds were in exactly the position desired, we pushed the button controlling the flash apparatus. We found it best to hold the reflector in the hand so as to be able to shift the direction of the illumination quickly in making additional exposures.

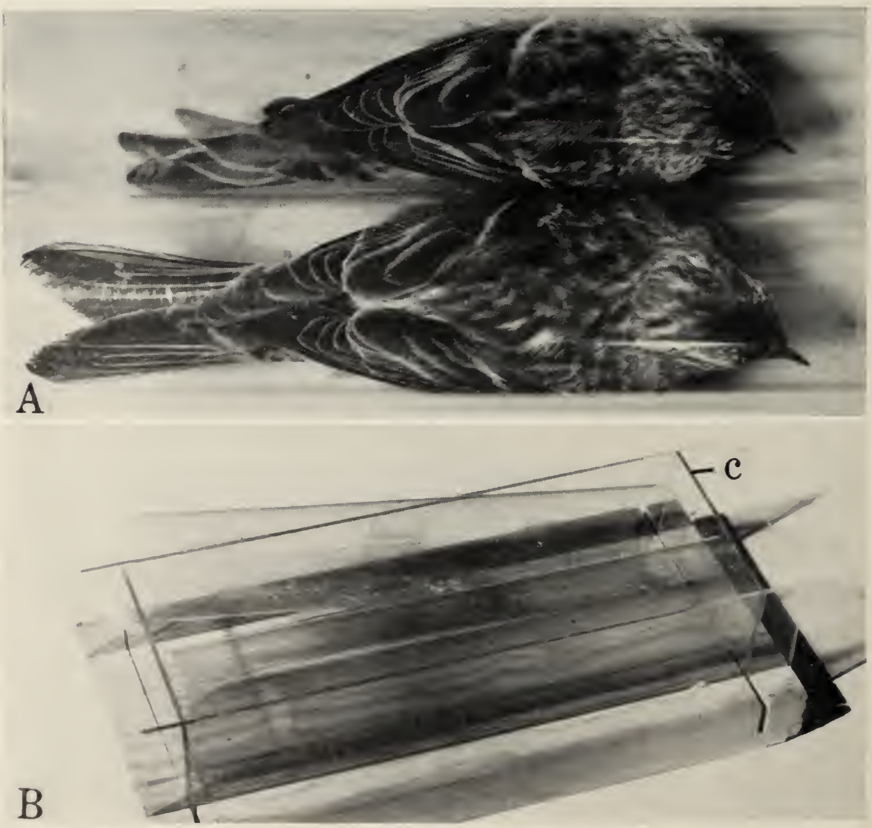

Fig. 1. A. Living redpolls in cellophane cylinders. Above is a Common Redpoll (*Acanthis f. flammea*), below a Greater Redpoll (*A. f. rostrata*). B. Cellophane cylinders and glassed-in container. Photographed March 25, 1949, by B. M. Shaub.

In photographing captured birds in this way the greatest depth of field and sharpness of detail are obtainable through closing the diaphragm opening well down and using a fast shutter speed synchronized to catch the very peak of illumination. Unless this is done the rapid movements of the birds result in blurred negatives.

The cellophane cylinder and cylinder-container described above may not be the best apparatus devisable for this work. Other methods should be tried. Photographs like those made at the Fair Isle Bird Observatory, showing heads, feet, or spread wings of living birds should be taken (see *Wilson Bulletin*, 62: 141–143). If a series of photographs, showing increase in bill-size over a period of years, is to be taken, the method should be worked out with great care so as to make certain in advance that the photographs will be *directly measurable* and strictly comparable. For this sort of record far more than mere sharpness of detail will be necessary: the bill must be strictly in profile, so as to preclude the possibility of any distortion. The bills themselves should be measured too, of course, and the records kept with the photographs.

For records of color-differences, color transparencies should be made. These should be preserved with great care so as to prevent fading.

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AMENDMENT TO THE CONSTITUTION OF THE WILSON ORNITHOLOGICAL CLUB

An amendment to the Constitution of The Wilson Ornithological Club was proposed by the Executive Council and placed before the membership at the annual meeting on April 27, 1951, at Davenport, Iowa. The proposal was published in the June, 1951, issue of *The Wilson Bulletin*. In accordance with the provisions of the By-laws, the members were asked to vote on this amendment by mail before September 1.

As a result of this ballot, the amendment was adopted, effective October 1, 1951. The amendment eliminates the associate membership class and raises the subscription price of *The Wilson Bulletin* to $3. With this change, the minimum cost of membership becomes $3. Hence, Sections 1 and 3 of Article II of the Constitution now read as follows:

Article II

Membership

Section 1. The membership of this club shall consist of five classes: Active Members, Sustaining Members, Life Members, Patrons, and Honorary Members.

Section 3. The annual dues of Active Members shall be three dollars ($3.00); and of Sustaining Members, five dollars ($5.00). Any member may become a Life Member, exempt from further dues, by making a payment into the endowment fund of the Club of one hundred dollars ($100.00). Any member may become a Patron, exempt from further dues, by making a payment into the endowment fund of the Club of five hundred dollars ($500.00) or more. Upon the unanimous recommendation of the Executive Council, honorary membership may be conferred by the Club by a three-fourths vote at any annual meeting.

TERRITORIAL SONGS OF THE WHITE-WINGED DOVE

BY DOROTHY CHAPMAN SAUNDERS

THE author spent five months in the winter and spring of 1948–49 and five months in the winter and spring of 1949–50 travelling by jeep in México. In connection with other biological work, she made a study of the territorial songs of several male White-winged Doves (*Zenaida asiatica*). She studied these songs principally at four localities—two in eastern México, two in western (see below).

Thirteen songs were formally transcribed—seven songs of the western race, *Z. a. mearnsi*, and six songs of the eastern race, *Z. a. asiatica*. Necessary for the work of transcription was a musical instrument (of known key) which could be carried about easily. The author found an alto recorder (vertical flute) satisfactory. Each song was quickly figured and fingered out, note by note, as the melody was repeated by the bird.

The intervals between certain notes in songs of the White-winged Dove are shorter than the shortest interval commonly used in our musical scale—i.e., that between a note and its sharp or flat. The diagrams presented in Figure 1 give, therefore, only the approximate position on the piano keyboard of the actual sounds. With each diagram are, however, the fingerings used on the alto recorder in determining the true bird sounds, and by repeating these *on the recorder* anyone may ascertain the exact notes. In all diagrams the key of C is used for the piano keyboard transcriptions. The alto recorder is always tuned to the key of F. Customary notations are used for the recorder fingerings. The following data pertain to the songs diagrammed in Figure 1.

A. *Z. a. mearnsi* No. 1. January 5, 1949. Wild bird at Playa de Coyuca, near Acapulco, Guerrero.

B. *Z. a. asiatica* No. 1. December 11, 1949. In cage at Hotel Balneario del Río Pánuco, Tampico, Tamaulipas.

C. *Z. a. asiatica* No. 1. Same date and place as above. This is the common 'short' song, generally phrased as "Who cooks for you?", or "*Que triste estoy*" ("How sad I am"), which all white-wings sing.

D. *Z. a. asiatica* No. 1. December 13, 1949. Same place as B.

E. *Z. a. asiatica* No. 2. Same date and place as B.

F. *Z. a. asiatica* No. 2. December 16, 1949. Same place as B. This song was given at 11 p.m., the lights near the bird cages in the hotel being on at that hour.

G. *Z. a. mearnsi* No. 2. February 12, 1950. Ten miles south of Tepic, Nayarit, at 3200 feet elevation.

H. *Z. a. mearnsi* No. 3. Same date and place as G.

I. *Z. a. mearnsi* No. 4. Same date and place as G.

J. *Z. a. mearnsi* No. 5. Same date and place as G.

FIG. 1. Transcriptions of songs of the White-winged Dove. For an explanation see page 330.

K. *Z. a. mearnsi* No. 6. Same date and place as G.
L. *Z. a. mearnsi* No. 7. Same date and place as G.
M. *Z. a. asiatica* No. 3. March 26, 1950. Near Valles, San Luis Potosí.

A given song is usually repeated from two to ten times; then, after an interval which varies greatly, the same song, or a variation of it, is repeated two to ten times, etc.

Besides the well known "Who cooks for you?" 'short' song, each male sings long songs which seem to be composed of 'short' songs with individual variations. This is clearly shown in the transcriptions B, C, D, E, and F of songs sung by caged birds at Tampico. Eastern white-wing No. 1 had the 'short' song (C) and three long songs, each being a series of variations of the same general theme. Eastern white-wing No. 2 had a 'short' song identical with that of eastern bird No. 1 and also two long songs, these differing *inter se* and also from the three long songs of eastern bird No. 1. All the songs were, however, obviously related: they seemed to be variations of exactly the same theme.

All the long songs recorded near Tepic, Nayarit, and at the Playa de Coyuca, Guerrero, were, save one, slight variations of the very same theme sung in eastern localities. The exception was a performance transcribed at Tepic: it was identical with one of the long songs sung by an eastern white-wing at Tampico. Each other long song studied was in some slight way different from every other one.

White-winged Dove songs usually have a range of about two full tones. Variations commonly consist in (1) different groupings of the notes; (2) different arrangements of these groups; and (3) different tempos (there may be a very considerable difference in the duration of an individual note). During any one singing (see paragraph immediately following explanation of the diagrams) a variation is repeated over and over without change.

Patuxent Research Refuge, Laurel, Maryland

GENERAL NOTES

Birds new for the Río Grande delta area.—A bird picked up dead near the jetty on Brazos Island by Terry Gill, and brought by him to Harlingen, Texas, on January 28, 1947, I identified as an Audubon's Shearwater (*Puffinus lherminieri*).

A census team composed of William S. Jennings and Luther Goldman, while working on the Harlingen Christmas Bird Census on December 23, 1950, listed "a strange dove of reddish-brown color." The next day Jennings and I went back to the same area and found the bird—quite obviously a Ruddy Ground Dove (*Columbigallina talpacoti*)—with a flock of Inca Doves (*Scardafella inca*). A few days later I accompanied Goldman and Jennings to the Axtla River, in eastern San Luis Potosí, México, where we saw a number of Ruddy Ground Doves. Both men readily agreed that the bird they had seen near Harlingen was in every way identical with those they were seeing in the tropics.

Maurine and Terry Gill showed me a drawing and careful description of a flycatcher which they had observed for some time in a prairie area east of Río Hondo on November 19, 1946. Since it was with a flock of Scissor-tailed Flycatchers (*Muscivora forficata*), and since there were also Mockingbirds (*Mimus polyglottos*) nearby, the Gills were able to make an appraisal of the bird's exact size. From the data supplied me I readily identified it as a Fork-tailed Flycatcher (*Muscivora tyrannus*). This possibility had not occurred to the Gills because the bird had lost so much of its tail that when it flew only one (or what appeared to be one) long streamer trailed out behind. I recall that the first Fork-tailed Flycatcher I ever saw (on the coastal prairie in central Veracruz) had had a similar mishap.

A visitor from New York, Arthur Aranoff, reported a Black Phoebe (*Sayornis nigricans*) on the Resaca del Rancho Viejo near the village of Olmito, Cameron County, Texas, in December, 1947. Later I found the bird and kept watch over it for several months. It disappeared in the spring of 1948 and, so far as I have been able to determine, it has not returned since.—L. Irby Davis, *Box 988, Harlingen, Texas.*

Mexican Cormorant in Oklahoma.—Visitors to Lake Texoma (on the Oklahoma-Texas border, south of Marshall, Love and Bryan Counties, Oklahoma) have, since its impoundment in 1945, occasionally seen cormorants there, most of them Double-crested Cormorants (*Phalacrocorax auritus*) presumably, that being the only species listed by Nice (1931. "The Birds of Oklahoma," Revised Edition. *Publ. Univ. Oklahoma Biol. Surv.*, Vol. 3, No. 1, p. 54) for the state.

In the summer of 1950, I saw cormorants almost daily near the University of Oklahoma Biological Station, some 14 miles south of Madill, Marshall County. Actually, there may have been very few birds, but they flew past so often, or spent so much of their time resting on stubs within plain view, that they seemed to be common. On August 18, I noted groups of four or five repeatedly, and wondered if they might be gathering for migration. The strong south wind made the water rough. The temperature (estimated) at about noon was 90°F.

That day Barbara Wells and I went by motorboat to islands some miles from the Station. Soon after leaving the Station we saw five cormorants perched together on floating logs. About two and one-half miles southeast of the Station, we came upon two more perched on a stub about a hundred yards out from shore. They resembled each other in size. One of them I managed to collect.

The specimen proved to be an extremely fat adult female (ovary distinct, but the ova small). A band of white bordered the gular pouch and there was a sprinkling of fine white feathers on the head and neck. The eyes were green. The skin I placed in the Station's collection.

George M. Sutton, who was on the Station staff in the summer of 1951, called our attention to the bird's smallness and expressed his belief that it was a Mexican Cormorant (*P. olivaceus*). After comparing it recently with several female *auritus* and *olivaceus* he has identified it as the latter. Its bill measures only 45 mm. (base of culmen across to tip); its tail, 161. Only seven of its rectrices are of full length, but otherwise it seems to be in full breeding plumage. Since the bird I saw with this female appeared to be of about the same size, I think it must have been a Mexican Cormorant too. The species has not heretofore been reported from Oklahoma.—KENNETH J. STARKS, *Department of Zoological Science, University of Oklahoma, Norman.*

Great Blue Heron killed by Bobcat.—While ascending the Colorado River in an outboard motor boat, at Devil's Elbow in Havasu Lake National Wildlife Refuge on January 8, 1951, Leo K. Couch and I saw a Bobcat (*Lynx rufus*) catch a Great Blue Heron (*Ardea herodias*). At about five o'clock in the afternoon, when the canyon was already in shadow, the heron flushed from the Arizona side and flew across to the California side. It began struggling as it alighted on the rocky bank, as if its foot had been caught in a trap. At this juncture, the motor ran out of fuel and the boat stopped, so we looked at the bird with our binoculars. To our surprise, we saw that a large Bobcat had grasped it by its under side at the lower end of the neck. The cat turned its head to regard us for a few seconds, then began dragging its prey up the bank. It had some difficulty in doing this, as it stepped on the outstretched wings. In less than a minute it reached the top of the bank and disappeared behind a ledge. We deduced that it had been in a small cavelike hideout along the bank and that it had sprung as the heron, wholly unaware of its presence, had attempted to alight. As far as I know, the capture of the Great Blue Heron by the Bobcat has not hitherto been reported.—GALE MONSON, *Fish and Wildlife Service, P.O. Box 1717, Parker, Arizona.*

Feeding behavior of young American Bitterns.—In the spring of 1950 not far from Ann Arbor, Washtenaw County, Michigan, I found the nest of an American Bittern (*Botaurus lentiginosus*) in a small marsh. There were four eggs. The bird at the nest, presumably the female, refused to leave, so I caught and banded her (Biological Survey No. 35541942). Then I set up a blind seven inches from the nest. During the period of my observations from this blind (June 10 to 25 inclusive) the banded bittern was the only adult to appear at the nest. She swelled out her feathers and growled like a broody hen when I approached or left the blind, and pecked with such speed and finesse that she brought the blood repeatedly while I was counting the eggs under her. As long as I stayed in the blind, however, she paid little attention to me.

The first chick hatched shortly before 6:30 a.m. on June 11. The second had hatched by 2:50 p.m. that same day. The third hatched on June 13. One egg did not hatch. The feeding behavior differed in some respects from that reported by Gabrielson (1914. *Wilson Bulletin*, 26: 64), who described the feeding of several-day-old bitterns large enough to swallow fish, frogs, mice, etc., as they were regurgitated whole by the parent.

When twenty-four hours to eight days old, the chicks I observed jumped at the parent's bill and attempted to seize it in the manner described by Mr. Gabrielson; but they could seldom cope with the large chunks of food which fell into their bills, so this food often dropped to the nest. After the parent had regurgitated her store of food animals, she re-swallowed those which the young would not manage to get down, and presented this food later when partial digestion had made it more acceptable. The period of waiting varied from twelve to forty-five minutes—depending on the eagerness of the chicks as well as on the size of the food items. On two occasions the hungry chicks squeaked and jumped at the parent's bill so persistently that she regurgitated food before it was 'done' and she had to swallow it again.

Table 1 lists all of the food I saw the parent bittern bring to the young during their first seven days. I could not spend much time in the blind, so what I saw the parent bring was

TABLE 1

Feeding Behavior of Three Young American Bitterns

Date	Observation Period	Activities at Nest	Success of Feeding
June 11	6:30–8:45 a.m.	Parent brooded chick	No food offered
	2:50–3:45 p.m.	At 2:55 parent arrived; chicks became restless and squeaked	No food offered
June 12	4:45–7:00 a.m.	Parent on nest; chicks quiet	No food offered
	3:13–4:30 p.m.	Chicks restless under parent until, at 3:44, she regurgitated 4-inch fish	Fish too large for chicks, so parent re-swallowed it
June 13	4:00–5:10 p.m.	Parent brooded chicks; chicks squeaked softly from time to time	Continuous rain probably led parent to continue brooding
June 14	10:50 a.m. to 12:32 p.m.	At 11:26 parent arrived and settled on restless chicks	No food offered
		At 12:10 parent regurgitated 7-inch salamander and 3-inch fish	Chicks could not swallow either salamander or fish so parent re-swallowed them
		At 12:22 parent regurgitated above-named items again	Chicks got them down
	3:45–5:10 p.m.	Chicks slept until parent returned at 4:40. At 4:48 she regurgitated 4-inch fish	Fish too large for chicks so parent re-swallowed it
		At 4:48, parent regurgitated two partly digested frogs	Two chicks each promptly swallowed a frog
		At 5:10, parent regurgitated 4-inch fish again	Fish still too large, so parent re-swallowed it
June 16	2:45–3:50 p.m.	At 2:45 parent regurgitated two frogs—one partly digested, the other entire	Partly digested frog stuck in chick's throat; whole frog also too large
		At 2:46, parent regurgitated shapeless gob, probably a much-digested frog	Chick swallowed gob; parent re-swallowed two frogs, taking one from chick with some difficulty
		At 3:29, parent regurgitated two frogs again	Chick promptly swallowed one frog; another chick failed to swallow second frog; parent swallowed this frog again
June 17	7:30–8:40 a.m.	Parent brooded restless chicks until 7:55, when she regurgitated a 4-inch fish and a jumping mouse	Fish too large for chick, but mouse promptly swallowed. Parent re-swallowed fish
		At 8:40, parent regurgitated 4-inch fish again	Fish promptly swallowed by chick
	8:10–9:10 p.m.	Parent brooding; chicks quiet	

presumably only a small part of the total brought.—ESTHER (MRS. GEORGE) BYERS, *University of Michigan Museum of Zoology, Ann Arbor.*

Frigate-bird, Oystercatcher, Upland Plover, and various terns on the coast of Tamaulipas, México.—While studying and collecting vertebrates in the State of Tamaulipas, México from February 15 to June 15, 1949, we made three brief trips to the coast. From April 27 to 29 we visited the Barra Trinidad region, 8 miles north of the village of Morón. We could not stay longer because of lack of fresh water there. On April 25 and May 2 we visited the beach at Miramar, near Tampico. On May 9, Robins and Heed visited the village of Tepehuaje, some 20 miles south of Pesca and 80 miles north of Tampico (see World Aeronautical Chart No. 589, Tamiahua Lagoon Sheet, village of Tepehuaje de Arriba). Our base-camp at that time was 10 miles northeast of Zamorina, and the trip to the coast meant a 25-mile jeep ride over oil-prospecting trails.

Some of the birds we encountered on the coast are of special interest either because they have never actually been reported from Tamaulipas or because no one has found them breeding there. One of the latter category, the Willet (*Catoptrophorus semipalmatus*), George M. Sutton has already discussed (1950. *Condor*, 52: 135–136). The following also merit comment:

Frigate-bird, *Fregata magnificens*. Present in large numbers in the Barra Trinidad region. Most evident in the morning and in the evening dusk, when they did considerable soaring. During the afternoon they remained on the brush- and tree-covered shore of a large bar. They may have been nesting there, but we were unable to cross the lagoon to investigate. An immature male specimen taken at Tampico on April 23, 1923 (University of Michigan Museum of Zoology, No. 58976), has been identified by Pierce Brodkorb as *F. m. rothschildi*. Friedmann, Griscom and Moore (1950. "Distributional Check-List of the Birds of México," *Pacific Coast Avif.* 29) do not list Tamaulipas among the states from which this species has been recorded.

Oystercatcher, *Haematopus ostralegus*. Robins and Heed saw three Oystercatchers on the beach near Tepehuaje in company with Wilson's Plovers (*Charadrius wilsonia*), Black-bellied Plovers (*S. squatarola*), Willets, Turnstones (*Arenaria interpres*), and Sanderlings (*Crocethia alba*). Friedmann, Griscom and Moore (*op. cit.*, p. 89) state that this species is "to be sought in the lagoons of northeastern Tamaulipas."

Upland Plover, *Bartramia longicauda*. One was frightened by the approaching jeep from a grassy woodland road near a small village between our Zamorina camp and the coast, May 10.

Sandwich Tern, *Thalasseus sandvicensis*. Robins and Heed clearly saw two of these terns on the beach near Tepehuaje in company with one Royal Tern (*T. maximus*), several Black Terns (*Chlidonias niger*), and some Least Terns (*Sterna albifrons*). Near Barra Trinidad we saw ten Royal Terns on the beach and many more flying about the lagoon.

We wish to point out that, during the dry season at least, the coast from Pesca to Tampico is more easily accessible than is generally believed. At least one fishing company runs trucks regularly from Pesca to Tampico along a coastal route which we saw and used at Tepehuaje and, farther south, from El Sabino to Aldama.—C. RICHARD ROBINS, *Department of Conservation, Cornell University, Ithaca, New York;* PAUL S. MARTIN, *University of Michigan Museum of Zoology, Ann Arbor;* and WILLIAM B. HEED, *University of Texas Department of Zoology, Austin.*

Unusual water birds in Rockbridge County, Virginia.—In three previous papers in *The Wilson Bulletin* (1935, 47: 59–67; 1937, 49: 48–49; 1940, 52: 280–281) I listed 61 forms of water birds recorded in this Virginia mountain county. Two of these were supposed races of the Black Duck, but since 'Red-legged Black Ducks' are now believed to be merely highly colored individuals, only *Anas rubripes* should be listed. This brings the list to 60 forms, as of December, 1940.

Recently I published notes on four additional birds: the Lesser Snow Goose, *Chen h. hyperborea* (1950. *Auk*, 67: 233–234), Blue Goose, *Chen caerulescens* (*ibid.*), Stilt Sandpiper, *Micropalama himantopus* (1948. *Auk*, 65: 607), and Caspian Tern, *Hydroprogne caspia* (*ibid.*). The following six species (five of which are new for Rockbridge County) I wish to record here. The total list of water birds for the county now numbers 69 forms.

Yellow-crowned Night Heron (*Nyctanassa violacea*). Colonel and Mrs. Gordon Heiner saw an adult at a small stream in their yard on the edge of Lexington, July 26, 1950. They gave me an accurate description and an easily recognizable drawing of the bird.

Least Bittern (*Ixobrychus exilis*). On September 4, 1948, I observed a bright yellowish brown female at close range at Cameron's Pond, one mile from Lexington. The bird remained there for three days.

Turnstone (*Arenaria interpres*). Robert Paxton saw one in bright summer plumage at the Womeldorf fish pond, August 28, 1949.

Red-backed Sandpiper (*Erolia alpina*). I saw one in bright breeding plumage at Cameron's Pond on May 29, 1950.

Stilt Sandpiper (*Micropalama himantopus*). One which I saw at Cameron's Pond on October 13, 1947, I have already reported (1948. *Auk*, 65: 607). I saw a Stilt Sandpiper at the same place September 22 to 30, 1948.

Sanderling (*Crocethia alba*). One appeared at the Womeldorf fish pond on August 20, 1950, at a time when a hurricane was moving up the Atlantic coast. I collected it August 21. It was a male in first winter plumage. Apparently this is the first inland record for the Atlantic States between Washington, D. C., and Aiken, South Carolina.—J. J. Murray, *6 White Street, Lexington, Virginia.*

Bicolored Hawk in Tamaulipas, México.—An exceptionally beautiful adult female Bicolored Hawk (*Accipiter bicolor*) was shot by a Mexican hunter on August 16, 1950, in heavy forest along the foot of the Sierra Madre Oriental near the Río Sabinas about five miles north of the town of Gómez Farías, southwestern Tamaulipas, México. Circumstances of the capture are interesting. Shortly before August 16, a pair of jaguars (*Felis onca*) with two half-grown cubs had been seen in the forest just upslope from the Sabinas sugar cane fields, and the female shot. When, on the 16th, a party returned to collect the skull of the jaguar and search for the male and cubs, they chanced to see this hawk perched quietly in the dark woods. Vegetation in this area resembles that of the tropical evergreen forest of Leopold (1950. *Ecology*, 31: 507–518), here found as a narrow belt along the base of the Sierra Madre. This habitat apparently marks the northern distributional limit of many distinctly neotropical plants and animals, including *Accipiter bicolor.*

My friend William B. Heed, now a graduate student at the University of Texas, prepared the specimen with great care, making important label comments. The ovary was paired, the whole mass measuring about 12 x 4 mm., the largest ovum being about 1 mm. in diameter. The legs, feet and eyelids were yellow, the eye bright red, the cere dark. The outermost primary was very short (about 65 mm.), the basal half still being sheathed.

The specimen is, apparently, the first for Tamaulipas. It represents the race *fidens*, described from the State of Veracruz. The upper parts are blackish slate, darkest on the top of the head and tail. The under parts, except for the white crissum and rufous flags, are slate gray, each feather having a fine grayish black shaft-line. Some of the median plumage, especially of the throat and lower belly, is light gray basally. The wing measures 254 mm. (primaries pressed flat), the tail 208, the tarsus 72, the culmen (from cere) 19.5. The specimen is No. 11068 in the Sutton collection.—Paul S. Martin, *University of Michigan Museum of Zoology, Ann Arbor.*

A nest of the Rufous-breasted Spinetail in México.—The Rufous-breasted Spinetail (*Synallaxis erythrothorax*) is a not very noticeable furnariid found from Veracruz, Yucatán, and Chiapas southward to northwestern Honduras and El Salvador. It is a thicket bird about six inches long, with a quiet, four-noted call.

While collecting birds along the Río Atoyac at Ojochico, a few miles east of Córdoba, Veracruz, in mid-April, 1947, we found a nest of this spinetail about four feet above the ground in a thicket at the base of a hill just west of the cane plantations of the Potrero sugar mill. Externally the nest was composed entirely of rather long, slender twigs, sturdily inter-

Nest of Rufous-breasted Spinetail (*Synallaxis erythrothorax*). Photographed in mid-April, 1947, near Córdoba, Veracruz, by Robert B. Lea.

locked. It was, as can be seen in the accompanying photograph, completely domed over. It was about eighteen inches long and ten inches in diameter at the large end. The entrance was at the small end, and the bird passed through a narrow tunnel in reaching the nest chamber at the large end.

We frequently heard and saw an adult spinetail near this nest. Occasionally we saw a bird (sex ?) going in, but so far as we could tell neither incubating of eggs nor brooding of young was going on there. An adult male which we collected about fifty feet from the nest on April 19 had enlarged testes (each about 6 x 5 mm.).—Robert B. Lea, *Charity Hospital, New Orleans, Louisiana,* and Ernest P. Edwards, *Third Chemical Mortar Bn., Ft. Bragg, North Carolina.*

An egg of the Umbrella Bird.—The eggs of many species of the family Cotingidae have never been described. The eggs are rare in collections and identification of some specimens is open to question. Virtually nothing is known about the nidification of the famous Umbrella Bird (*Cephalopterus ornatus*). E. Pöppig's statement (1831. Pugillus descriptionum ad Zoologiam Americae australis spectantium. Supplement to *Frorieps Notizen aus dem Gebiete der Natur und Heilkunde*, Number 681, Vol. 31) that the clutch consisted of two eggs was based on local hearsay and was not accompanied by a description. Pöppig's account was repeated by Burmeister (1856. "Systematische Übersicht der Tiere Brasiliens," Vol. 2, Aves).

I secured a clutch of *C. o. ornatus* on July 25, 1949, in Matto Grosso, Brazil, on the Upper Río Xingú, in the region explored by the Fundação Brasil Central. The nest contained only one egg—the normal set according to the testimony of the Juruna Indians. The egg is oblong and rather pointed at one end. It measures 56.0 x 35.8 mm. The empty shell weighs 2.1 grams. The shell is khaki-colored, spotted with light chocolate and purplish brown and lightly stippled with dark brown. The shell has little gloss.

Further details concerning the biology of the Umbrella Bird I plan to communicate later.—HELMUT SICK, *Fundação Brasil Central, Avenida Nilo Peçanha 23, Rio de Janeiro, Brazil.*

Empidonax albigularis in southwestern Tamaulipas.—One of the most interesting specimens in the bird collection obtained for me by E. K. Miller and J. H. Poppy in the Gómez Farías region of southwestern Tamaulipas in the summer of 1948 is a male White-throated Flycatcher, *Empidonax albigularis*, collected July 21 on the foothill above the Río Sabinas, at an elevation of about 3500 feet, half a mile south of the Rancho del Cielo. To the best of my knowledge, *E. albigularis* has not been taken in Tamaulipas before.

The specimen is similar to four *albigularis* from Michoacán in my collection, but less brown in tone throughout. The sides of the head, the chest and flanks, and especially the wing-bars, remiges edgings, and under tail coverts are almost without brown or buff. The crown, hind neck and back, too, are largely devoid of brown, though a slight staining of the back plumage makes color comparisons involving this region difficult. A notable feature is the darkness of the middle and greater wing coverts. The tips of these feathers are grayish white, in rather sharp contrast to the blackish brown basal part.

This Tamaulipas bird is so different from any of the ten *albigularis* (four from Chiapas, four from Michoacán, one from Costa Rica, one from Durango) before me that I suspect it belongs to an undescribed race. It is closest, apparently, to the Durango bird, a male taken by Paul S. Martin near the village of San Luis, at an elevation of about 8500 feet, 16 miles west of the Laguna del Progreso, on July 8, 1950. This Durango specimen (wing, 63 mm., tail, 54) I have identified as *E. a. timidus*. According to label-comment it was "singing in willows along a stream in open meadows." This habitat, as well as the general appearance of the specimen, suggest close affinity to *E. traillii*.

The Tamaulipas specimen of *albigularis* weighed 11 grams. According to label comment its eyes were dark brown, its mouth yellow, its lower mandible "pale yellow," and its feet black. The wing measures 64 mm., the tail 56. It is much less frayed and faded than the Durango specimen, whose wing-bars have almost disappeared through wear.—GEORGE MIKSCH SUTTON, *University of Michigan Museum of Zoology, Ann Arbor.*

September nesting of the Barn Swallow in Arizona.—O. S. Pettingill, Jr. (1946. *Wilson Bulletin*, 58: 53) has reported young Barn Swallows (*Hirundo rustica erythrogaster*) still in the nest as late as September 24, 1945, at Regina, Saskatchewan (about 50° 30′ N. Lat.). The record calls to mind a late nesting I observed at Springerville, Apache County, Arizona, in September, 1934. Springerville is at the northeastern base of the White Mountains, in central-eastern Arizona, at an elevation of 6,965 feet. On September 16 of that year, in a barn in town, Randolph Jenks and I found a Barn Swallow's nest containing three young birds and an addled egg. The young were at least two weeks old. Two of the young, on being frightened from the nest, flew distances of 20 and 50 yards, respectively, from the barn. This was their first flight. We returned the two birds to their nest. On September 21, we saw the adult swallows feeding a young one perched on a rafter in the barn. On September 27, we saw two adult swallows flying inside the barn, but we failed to find any of the young.

Flocks of from 20 to 40 Barn Swallows were noted almost daily in and near Springerville throughout September—as late, in fact, as October 2. So far as I know, none was observed between that date and October 23, when I left the region. Whether the young birds mentioned above started the southward migration with their parents is, of course, problematical.—J. O. Stevenson, *U. S. Fish and Wildlife Service, Washington, D. C.*

Black Robin in Tamaulipas, México.—The late winter of 1951 was marked by the severest freeze in the memory of most residents of northeastern México. Heavy frosts in early February killed or damaged tropical vegetation on the Atlantic slope at least as far south as Jacala, Hidalgo. My friend Frank Harrison, of the Rancho del Cielo, five miles northwest of Gómez Farías, Tamaulipas, generously supplies the following data on minimum temperatures recorded by him during this period: February 1, $-6°C.$; February 2, $-4°$; February 3, $-2°$, with snow in the morning. During the extremely dry weather following the freeze, Mr. Harrison attracted many birds, including flocks of twenty to thirty Blue-hooded Euphonias (*Tanagra elegantissima*), to pans of water. In late February he collected an unfamiliar dark bird which he saw feeding on mulberries in his clearing. The specimen proves to be a subadult male Black Robin (*Turdus infuscatus*). Its measurements are: wing, 129 mm.; tail, 98; culmen, 20.5; tarsus, 26. The bill and feet must have been bright yellow in life for even in the dried specimen (now in the Sutton collection) they are pale yellowish brown.

Dominant trees in the Rancho del Cielo cloud forest (elevation 1200 meters) are the sweet gum (*Liquidambar styraciflua*), oaks (*Quercus* spp.), *Magnolia schiedeana*, and *Podocarpus Reichei*.[1] Among the more common breeding birds are the Singing Quail (*Dactylortyx thoracicus*), Mexican Trogon (*Trogon mexicanus*), Green Jay (*Xanthoura yncas*), and Black-headed Nightingale-Thrush (*Catharus mexicanus*).

During parts of April, May and June of 1948 I spent five weeks collecting birds in this region, but only once, in late April, did I see what appeared to be a Black Robin. On that occasion a dark, robin-size bird went skulking through the heavy forest about a mile from Mr. Harrison's clearing. Since then several observers, especially Byron Harrell of the University of Minnesota, have devoted many weeks to study of cloud forest birds thereabouts without encountering *Turdus infuscatus*. The species apparently has not heretofore been reported from Tamaulipas. The extreme cold spell and equally severe drought may have been responsible for the species' appearance.—Paul S. Martin, *University of Michigan Museum of Zoology, Ann Arbor.*

[1] For a brief account of the vegetation in this unique Tamaulipas habitat, see Sharp, *et al.*, 1950, *Soc. Botánica de México Bull. No.* 11, p. 1–4.

EDITORIAL

Every purposeful ornithologist has filing problems. Letters, scribbled notes, newspaper clippings, work sheets recording measurements and color comparisons, excerpts from notebooks—all these must be kept in order if they are to be useful.

Some folders in an 'active file' are not, admittedly, opened from the year's beginning to its end. This is not surprising in view of the fact that Black Rails keep themselves hidden most of the time and some correspondents do not correspond. Other folders, however, are consulted almost every day. Among the most remarkable of this category in our file are four which have been put away from time to time but refuse to become inactive. In one of these are explicit directions for loading shells, reaming out auxiliary barrels, repairing shotgun stocks, cutting wads, and knocking out old primers. That folder bears the name Semple, John B. In another is a sheaf of yellow sheets with scribblings concerning the subspecific identification of Mexican birds—references to type specimens examined in European museums, to personal observations in El Salvador, Sonora, and a hundred other places, to correspondence with Stresemann, Hellmayr and Berlioz. That folder bears the name van Rossem, A. J. A third holds letters both typewritten and long-hand outlining enough ornithological projects to keep a man busy for a lifetime, and with these effervescent suggestions amusing discussions of persons in the public eye, reminiscences brimming with good humor, and references to happy hunting grounds full of marshes. This one bears the name Peet, Max Minor.

The fourth does not hold much. But the letters there, all long-hand, are so full of vigor, good spirit and encouragement that reading them is a tonic. The folder bears the name Nunnemacher, Gertrude A.

This issue of *The Wilson Bulletin* is a memorial to Gertrude Nunnemacher. Those who made possible the memorial were her husband, Henry J. Nunnemacher, and the following members of the Bird Group of the Milwaukee City Club: Myrtle Baer, Mr. and Mrs. A. P. Balsom, Mrs. A. C. Bromm, Mrs. F. Bunkfeldt, Mrs. H. K. Coen, Mrs. M. Cutler, Mrs. C. R. Decker, Jr., Mary Donald, Susan Drake, Mrs. J. Freede, Mrs. L. B. Goodrich, Mrs. M. D. Hartley, Dr. Anna Hehn, Mrs. Blanch Hibbert, Mrs. W. F. Jackson, Mrs. T. L. Kelley, Mrs. Bruno Kroetz, Mrs. Hugo Kroetz, Mrs. C. A. Lind, Mrs. Lillian Logemann, Isabel Miller, Mr. and Mrs. Martin Paulsen, Mrs. Gustave Reuss and daughter, Mrs. Carl Schwendener, Mrs. Amelia Simmons, Mrs. L. C. P. Smith, Helene Stoll, Leo Tiefenthaler, Dr. Pearl Thompson and Mrs. E. R. Weber.

The Bird Group of the Milwaukee City Club had its beginnings in late April, 1926. An informal body at first, it sponsored several spring and summer field trips and some discussion meetings. In November, 1926, it was formally organized and membership was thrown open to both members and non-members of the City Club. Mrs. Nunnemacher was elected the first Secretary. On May 27, 1927, the first 'May Day Census' was taken, a total of 85 bird species being seen by those participating. This census was to become an annual event. On Mrs. Nunnemacher's return from Europe in 1930 she was elected Vice-Chairman, an office she held until 1941, when she became Chairman. The Group celebrated its twenty-fifth anniversary on November 18, 1951. There are now 25 members, seven of whom were active members in 1926.

John G. Williams, of the Coryndon Museum, Nairobi, Kenya Colony, East Africa, has very generously offered his assistance to any member of the The Wilson Ornithological Club fortunate enough to visit Africa. Because of Mr. Williams' extensive field experience in East Africa, he can give excellent advice on safari itineraries, localities where special birds may be seen or collected, and similar matters.

Mr. Williams has almost completed a monograph on "The Sunbirds of Kenya Colony." This work contains an illustrated key to the genera of sunbirds recorded from Kenya Colony, and discusses the distribution, field characters, and habits of all species and subspecies found there. It will be illustrated by ten color-plates; by many photographs of sunbirds and their nests and eggs; and by distribution maps. The publishers, Longmans, Green & Co., Ltd., of Nairobi, are much interested in finding out how large a sale may be expected in America. Persons desiring more information about the book should write Dr. Berger or Mr. Williams.

The many friends of Helmuth O. Wagner, a member of our Club since 1945, will be glad to know that his interest in Mexican birds continues. A little over a year ago he moved from Mexico City to Bremen, Germany, there to become the Director of the Museum für Natur-, Völker- und Handelskunde; but he has recently finished a life history of the White-eared Hummingbird, a species he saw much of in México, and a paper on the Cracidae of Chiapas. Dr. Wagner is sorely missed on this side of the Atlantic. While residing in México he often helped friends from the United States in finding their way about; joined them in their field work; or visited remote areas in order to obtain specimens needed by them. His knowledge of field techniques, his ability as a linguist, and above all his abounding energy and good spirit made him an invaluable ally, no matter what the problem or occasion.

A book, to be compiled from the many writings of Althea R. Sherman, for much of her life a devoted member of our Club, will contain certain articles which first appeared in *The Wilson Bulletin*. The book, to be titled "Birds of an Iowa Dooryard," will be compiled by Fred J. Pierce, the editor and publisher of *Iowa Bird Life*.

The Hamilton Nature Club, of Hamilton, Ontario, has been granted permission to reprint in their journal, *Wood Duck*, "The Persecution of Predaceous Birds," by William H. Elder and Charles M. Kirkpatrick, an article which appeared in a recent issue of *The Wilson Bulletin*. The Club, whose president is Robert O. Elstone, is to be commended for this lively interest in protection of the birds of prey.

Bruce Campbell, Secretary of the British Trust for Ornithology, informs us that the address and registered office of the Trust is now 2 King Edward Street, Oxford, England. Certain publications of the Trust have recently been reviewed in our *Bulletin*.

A law now in force in Connecticut forbids the killing of any hawk or owl except when it is caught in the act of molesting poultry. This is a marked improvement over the old, weak law that left most birds of prey unprotected. Since so few can tell one hawk from another, the law seems better than one which designates certain species as harmful and therefore unprotected. The dangers of omitting protection for certain species of predators, or of trying to reduce their numbers, are well illustrated by the results of the Pennsylvania bounty on the Goshawk some years ago, when a high proportion of the birds presented for bounty payment were not Goshawks—or even accipiters.

The passage of this law should prove encouraging to conservationists in other states, not only the six which have no protective laws whatever for birds of prey, but also the many which provide incomplete legal protection. Connecticut is not a state where in the past all local groups interested in conservation in general and birds in particular have been closely organized for common action. After *Audubon Magazine* mentioned the scant protection afforded birds of prey in Connecticut, the Westport Audubon Society, under the enthusiastic leadership of Mrs. Harry Long, introduced a bill and notified conservation groups all over the state of the need for support. The combination of a sound measure and this enthusiasm proved effective.

The new law does not of itself guarantee protection for birds of prey in Connecticut. There were no points in the state, apparently, at which concentrations of migrating hawks furnished regular targets for gunners—as they once did at Hawk Mountain in Pennsylvania. The birds have been killed all over the state, in small numbers on any one day, making enforcement of the new law more difficult than it would be at hawk concentration points. From now on, however, fewer owls will be killed merely because their calls keep someone awake, and taxidermists should no longer handle dozens of trophies for the mantelpiece. However, the type of hunter who, out of ignorance or boredom, shoots cormorants from a duck blind, is still a menace to all birds of prey. As discussed in the June issue of *The Wilson Bulletin* (pp. 138–140), protective statutes mean little unless the general public is sympathetic, and the larger part of our task in Connecticut remains to be done.—E. Alexander Bergstrom.

The organization of a group to promote zoölogical studies in the New World tropics is well under way at Ann Arbor, Michigan. To be known as "The Foundation for Neotropical Research," this organization hopes soon to begin limited subsidization of both technical and semi-popular projects, not necessarily limited to birds, in the American tropics. Funds toward this objective are already accumulating through the advance sale of a limited edition of paintings of Mexican birds soon to be published. More detailed information from the new Foundation, whose present headquarters are the University of Michigan Museum of Zoology, may be expected in the near future.

The Wilson Bulletin color plate fund has continued to grow in recent months in a gratifying manner. The most important augmentation was brought about by the auction of original bird drawings and paintings held at the Davenport, Iowa, meeting, at which exactly four hundred dollars came into the fund. The Club is deeply grateful to the bird artists who generously contributed their work: W. J. Breckenridge, R. P. Grossenheider, F. L. Jaques, O. J. Murie, R. T. Peterson, and G. M. Sutton; to Robert M. Mengel, Chairman of our Illustrations Committee, who managed the affair so well; to Dwain Warner and others who proved themselves so able as auctioneers; and to Jane Mengel and Jean Tordoff, who displayed the pictures so decoratively. A matter of regret is that several pictures sent on by T. M. Shortt, to whom we extend our thanks, did not arrive in time. Worthy of special mention also is Hazel Bradley, of Jackson, Michigan, who contributed substantially to the fund after failing to obtain a single picture in the vigorous bidding. We hope that such auctions will continue to be a feature of our meetings; besides helping with the color plates, they enable all members to obtain attractive originals for their own permanent enjoyment.

In June, 1951, the first five Frank M. Chapman Memorial Fellowships were awarded by the American Museum of Natural History. The amount distributed was $1950, and the recipients and their projects were: 1. Richard B. Fischer, Cornell University. A study, based upon banded birds, of the reproductive behavior of the Chimney Swift in central New York State. 2. Byron F. Harrell, University of Minnesota. Faunal and ecological investigations of birdlife in southern Tamaulipas, México. 3. Owen A. Knorr, Colorado College. Life history studies of the Northern Black Swift in the Rocky Mountains. 4. Mrs. Robert Schultz, University of Washington. Continuation of a study of the life history of the Glaucous-winged Gull. 5. David K. Wetherbee, Clark University. The pterylosis of North American birds.

Additional fellowships may be awarded in the spring of 1952. In general, student investigators will be given preference over candidates already possessing wide prestige. Applicants should clearly state their problems and their qualifications and be sponsored by one or more of their professors. Applications should be addressed to the Frank M. Chapman Memorial Committee, American Museum of Natural History, Central Park West at 79th Street, New York 24, New York. Applications should be received not later than January 31, 1952, in order that decisions may be made well in advance of the summer vacation period.

The Michigan Audubon Society has blazed an important trail. Realizing that nature counsellors in summer camps often need to know more about nature than they do, the Society instituted, this past summer, a Nature Counsellors' camp. The week of June 17 to 22 (just before the opening of most summer camps) and Camp Mahn-Go-Tah-See, near Hale, Michigan, were selected as the time and place. Four members of the Society, all teachers, made up the staff. One of the four, Homer D. Roberts, the Society's President, acted as Director. The others were Almeda Boulton and Wilson Club Life Members Hazel Bradley and H. Lewis Batts.

Enrollment came about through contact with Y.M.C.A. camp directors and the Michigan Campers' Association. Nineteen camps sent representatives, paying their expenses. Other persons attended, paying their own way. The counsellors, divided into groups, attended half-day outdoor sessions, studying birds, insects, minerals, weather, plants, and water-life. Evening sessions were devoted to stars, conservation laws, and nature games. There were three early morning bird-walks.

Plans for another such camp in June, 1952, are already under way. The Society is to be congratulated upon seeing so clearly how this great work may be a means of spreading nature education, and therefore of sound conservation concepts, to countless young people in Michigan.

In the death, on June 1, 1951, of Southgate Yeaton Hoyt the cause of ornithological education lost a devoted ally and our Club an unusual member. Born January 13, 1913, in Baltimore, 'South' was interested all his life in the imparting of biological knowledge. As an undergraduate at Washington and Lee; as an assistant to William Beebe in Bermuda in 1935; as a visitor to Europe in 1938 (he attended the International Ornithological Congress at Rouen, France, that year); as director of nature study at the Cold Spring Harbor Biological Laboratory in the summers of 1941, 1947, 1948, and 1950; and as a member of the Cornell University and Sampson College faculties, he was interested primarily in teaching. In the spring of 1942 he married Sally Foresman. That year he began 42 months of service with the Army Medical Corps. In 1945 he returned to Cornell. On completing a study of the Pileated Woodpecker in 1948 he was awarded the Ph.D. degree. In 1949 and 1950 he was especially active in teaching youngsters about birds. Many local schools listened regularly to his radio programs. His refusal to complain, despite his painful illness, was a marvel to all who knew him.

The Club's Research Committee has voted to award the Edward L. Chalif Grant for Bird-Work in México to Byron E. Harrell, who is studying the ecology of the Rancho del Cielo forestlands in southwestern Tamaulipas. Mr. Harrell and Dwain W. Warner, Curator of Birds at the Minnesota Museum of Natural History, left for Mexico in November.

The Local Committee for the thirty-third Annual Meeting of our Club at Gatlinburg, Tennessee is composed of Arthur L. Stupka, Chairman, Albert F. Ganier, Joseph C. Howell and James T. Tanner.

The editors are grateful to the following for assistance in preparing for publication the material presented in this issue: William H. Allen, Burton L. Baker, William L. Brudon, Esther Byers, Theodore H. Hubbell, William A. Lunk, Rogers McVaugh, James L. Peters, Haven H. Spencer, Kenneth J. Starks, Charles F. Walker and Albert Wolfson. Realizing that this issue of the *Bulletin* is their last, they take this opportunity to thank especially Elsa Hertz, who has, during their tenure as editors, re-typed literally hundreds of pages of manuscript so as to give them clean copy; William Lunk, who has given edited manuscripts a final going-over just before their being sent to the printer; J. Van Tyne, who has furnished lists of additions to the Club Library; William Brudon, who has 'sharpened up' diagrams with his expert brush; and Betty and Powell Cottrille, who have given financial aid from time to time.

LETTER TO THE EDITOR

This is a reply to those who have taken issue with ideas expressed in my paper, "Convergence in American Orioles." The criticisms of my arrangement and the counter proposals by G. G. Williams (*Wilson Bulletin*, 63: 52–54) are based on the importance he assigns to the plumage of female and young birds. He claims it is "axiomatic" that this be taken prominently into consideration in making any phylogenetic arrangement.

The facts do not appear to support Williams' assumption that this plumage represents the true genetic picture of the species. Sex-inversion experiments involving gonadectomy or hormone injections show that in some groups of birds sexual dimorphism may be genetic while in others it is the resultant of pituitary gonadotropins or gonadal hormones or a complex interaction between them (see Danforth in "Sex and Internal Secretions," E. Allen, editor). In orioles the year-round male plumage and total absence of a female plumage in most species suggests that the former is genetic and the latter under hormonal control. While the female plumage could be an expression of gene physiology, the increasing incidence of sexual dimorphism northward in México in races of *Icterus pustulatus* (van Rossem, 1938. *Bull. Brit. Ornith. Club*, 58: 138) strongly suggests environmental control via the pituitary. Moreover, where plumage dimorphism is lacking, females have the plumage of males, not the reverse.

Actually, ornithologists are cautious in using female and juvenal plumage to imply relationship because it is too often absent to serve as a reliable index—and this is especially true in the orioles. I do think the female plumage (plain olive or streaked) in dimorphic species tends to be a throw-back to types, possible primitive, which are still common among Old World insect-eaters. But this conspires to bring out, in bright-hued species of finches, warblers, tanagers, weaver-birds or even starlings (*Aplonis*, *Cinnyricinclus*), female plumages that are similar to those in female orioles or blackbirds (*Agelaius*). And this reversion to a common, inconspicuous type can hardly be considered an index of close relationship comparable with the distinctive plumage patterns of males. Moreover, in oriole species in which both adults have male plumage the juvenals often are protectively colored and it seems logical that the latter may need this protection even when the more experienced female does not. In fact protection appears to be the reason for plumage dimorphism and female plumage is very plastic, changing markedly within the populations of a single species, as van Rossem pointed out. Williams' conclusion that this "female" plumage indicates a yellow ancestry for all orioles is not "inescapable." It is escapable.

Incidentally, Williams also mis-states my case. I do not say that *all* orioles come from a black ancestor. I distinctly say that in my opinion *Icterus* arises from a yellow ancestor (*Xanthopsar*), and I draw a picture of it (Fig. 6).

If Williams' initial assumption concerning the phylogenetic importance of female and juvenal plumage is false, his counterproposals for an arrangement of orioles based on it are likewise false. I am hardly justified in taking space to refute them point by point, since any reader of my paper will know my answers in most cases. Taking his main thesis, we might ask where in Central America is the yellow blackbird from which to derive yellow orioles? Or, if that seems unfair—what is the genetic mechanism by which *Icterus gularis*, *I. pustulatus*, and *I. pectoralis* combine their segregated bill and palate characters in a single, variable descendent species, *I. nigrogularis*, in northern South America? In my paper I contend that these three arise from *nigrogularis*, segregating its variations. It does not work backwards. I am unable to believe in a Central American origin of orioles which then spread into South America. When we try to derive species from species, range by range, the Williams hypothesis breaks down repeatedly. Any ornithologist studying a group will make a number of such schemes for testing, but an hypothesis has no reality—does not exist outside the mind—until it accounts for all of the facts.

I find Williams' proposal somewhat frightening. Space did not permit me to go more deeply into taxonomy and my desire to explore an interesting biological phenomenon (the convergence) tempted conjecture, but I hope my paper will not be regarded by younger ornithologists as a signal for unsupported hypotheses. I consider mine rather well supported.

The complete ignoring, in Williams' superficial hypothesis, of the ecological picture is inexcusable since this picture is known (and given in my paper). In view of the demonstrated plasticity of female plumage I see no justification for putting Cayenne Orioles of dark forest thickets in a different phyletic group from, say, Hooded Orioles of the desert simply because the former lack plumage dimorphism. This is too obviously an environmental effect: one might as well attempt to separate *Agelaius humeralis* of Cuba from all mainland *Agelaius* (from which it is derived) for the same reason. Williams' static morphological arrangement is that of a taxonomist of 100 years ago. It reflects no knowledge of behavior, ecology or geology. Based entirely on color resemblance, it takes no account of evolution under environmental pressures. That type of ornithology is still the best we can do for some parts of the world, but is hardly permissible for the American orioles in the 1950's.

Fr. Haverschmidt's note on *I. nigrogularis* (*Wilson Bulletin*, 63: 45) shows ecological tolerance for the species not previously reported. He finds it confined to swampy areas in Surinam while Todd and Carriker (1922. "The Birds of the Santa Marta Region of Colombia," p. 472) say it is "abundant in the semi-arid coast belt" and quote Simons to the effect that it prefers the cacti and acacias of the hot valleys to the cool forests.

For Bond's opinions (*Wilson Bulletin*, 62: 216) regarding the distribution of West Indian birds I have the greatest respect, but I am unable to see how the absence of *Agelaius* and *Bananivorus* from Jamaica is accounted for by the presence of *Nesopsar nigerrimus* and *Icterus leucopteryx*, even if extinction of the one is implied from the presence of the other. Direct evolution on Jamaica of one oriole from the other is 'out' because they belong to distinct phyletic lines, and this is also true for the blackbirds. That arboreal *Agelaius humeralis* was forced from the Cuban marshes by *A. phoeniceus assimilis* is also incredible because the latter is a very slightly modified recent arrival from the mainland and *A. humeralis* must have required a very long time to achieve its arboreal adaptations.

Since Williams' and Bond's objections both arise partly out of an unwillingness to recognize an additional oriole genus I feel obliged to re-affirm my belief in one. Due to the convergence, my diagnosis must be unconventional—based as it is on the fact that, wherever the two genera are found together, *anywhere in their ranges*, *Bananivorus* is decidedly smaller. But it is also true that the chestnut found in the plumage of the Cayenne Oriole persists in some small degree in all other species of *Bananivorus* except *cucullatus*, *auricapillus* and *parisorum*, the forms most convergent with forms of *Icterus*. But these three make unmistakable, compact *Bananivorus* nests, sewing *through* the leaf. Moreover, the very fact that the orioles of these two genera have distinctly different distributions on the islands of the Caribbean, suggests that they were distributed at different times.

Ornithologists who know its evils have every right to fear the splitting of genera. My own tendency is in the opposite direction but the orioles are numerous in species and the splitting is in the best interest of a classification expressive of phylogeny. A classification that cannot recognize cases of convergence fails to express evolution and is, therefore, one of convenience only. We might as well classify all yellow birds, or all red birds, together. That, too, would be classification of convenience—but it would not be phylogeny.

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ORNITHOLOGICAL LITERATURE

Distribution and Origin of the Birds of Mexico. By Ludlow Griscom. Bulletin of the Museum of Comparative Zoology, Cambridge, Mass., Vol. 103, No. 7, June, 1950: 339–382.

This study by one of the co-authors of "Distributional Check-List of the Birds of México" classifies virtually the whole vast Mexican avifauna, species by species, into seven major groups and 15 sub-groups, each representing a different distributional pattern. Since present-day ranges furnish the chief clues to the area of origin of a given bird, each of these categories further reflects something of the possible recent evolutionary history of the species and genera comprising it. Listed in the order of their importance with the number of species pertaining to each, the seven main groups, corresponding to the seven basic elements in the Mexican avifauna, are: Old North American—432; widely ranging (origins various)—155; South American —147; circumpolar—108; preglacial relict—68; pelagic (origins unknown)—37; West Indian —12. With the further inclusion of stragglers, the estimated grand total reaches about 2200 recognized forms and about 1000 full species, 733 of the latter being resident. These are the first figures of the kind for México to have the backing of a special study, and they probably forecast the approximate number of entries to be included in the completed Check-List. No fewer than 292 species and 69 genera are deemed to be endemic to the Mexican fauna, that is, to political México plus adjoining parts of Central America and of the southwestern United States. But, since the Ruby-throated Hummingbird is included in this category, with full cognizance of the fact that it breeds nowhere in the area outlined, it is apparent that the interpretation of endemism employed is an unusually broad one.

As might be anticipated in an undertaking of this immense scope, dealing with a region that is the scene of much continuing field work, not all of the individual species listings reflect the known facts of distribution with literal accuracy. Particularly evident in this regard are a number of species implied to be absolutely dependent on humid rain forest, though actually they range far beyond that habitat and some of them—as, indeed, has been stated in the Mexican Check-List itself—have developed races that are restricted to arid districts. While such instances are individually misleading, it is unlikely that they have any serious effect on the general conclusions.

The 15 lists, together with the accompanying tables of summary, make up about one-half of the paper. They alternate with passages of commentary designed to explain the evolutionary significance of the various distributional patterns and to stress other pertinent points. The primary emphasis is upon the *loci* of origin of Mexican genera and species. A minimum of direct comparison is afforded, therefore, with Mayr's "History of the North American Bird Fauna" (1946. *Wilson Bulletin*, 58: 3–41), which dealt chiefly with families. Griscom expresses a large measure of agreement with Mayr, though he prefers not to go quite so far in his generalizations. He is tempered in his speculations and wary of the difficulties imposed upon the student of avian origins by the inadequate fossil record, by the extreme mobility of birds, by their adaptability, and by their varying rates of evolution. Because of this and because he has previously expressed his viewpoint in regard to the development of the Central American avifauna, his broader conclusions, though too numerous to summarize here in more than a general way, are, for the most part, lacking in pronounced novelty.

México is pictured as a geologically ancient land, long possessed of a high, mountainous terrain suited to the development of new forms and well supplied off both coasts with islands attractive to sea birds. Always a southern extension of the North American continent, it was never in direct contact with the West Indies, which were to contribute but little to its avifauna. Its first land birds came from the north, and many of them passed on to South America, there to undergo tremendous further evolution into new species, genera, and even families. Later, some of the more aggressive of these newly-developed South American birds spread back into the Mexican tropics, and the process of interchange was not completely halted even by the various water gaps that separated the two continents during part of the Tertiary. The refrigeration of climate that began in late Pliocene time drove group after group of Old Northern species southward to tropical America. The original South American element in México was almost wholly destroyed, but here and there an occasional species has survived as part of the present list of preglacial relicts. Mountain-dwelling species of the subtropical zone, once isolated by the discontinuity of the higher elevations, descended to the now cool continuity of the lowlands. With the restoration of warm conditions after the Ice Age, these birds reascended into the mountains over a wide range, thus accounting for their present interrupted distribution. On the eastern side of the continent there developed a solid belt of rain forest, extending from central México to South America and providing a highway along which the South American element of Griscom's summary now pushed its way northward. Because of the continuity of this habitat, these birds have developed no new species in México. In the arid Pacific lowlands, on the other hand, rain shadows have produced a sharply contrasting alternation of scrub forest and gallery forest. The resulting ecological islands are so inaccessible to colonization that only one species, a parakeet, has succeeded in establishing a continuous range up the Pacific Coast from Amazonia to Chiapas. But the same factors have worked toward the development of distinctive species of limited range, so that the Pacific lowlands have contributed no fewer than 19 endemics to the great avifauna that makes México such a fascinating field of study for the ornithologist of today.—Robert J. Newman.

Biological Investigations in Mexico. By Edward Alphonso Goldman. Smithsonian Miscellaneous Collections, Volume 115, July 13, 1951: xiii + 476 pp., 71 plates, and inserted map. $4.50.

Every person in any way concerned with Mexican ornithology will welcome this work because of its descriptions and photographs of places if for no other reason. The descriptions are arranged alphabetically for each state, and the states, too, are in alphabetical order. The descriptions are, one must remember, of places as they were, not necessarily as they are. The geographical facts about Las Vigas, Veracruz, for example, are certainly correct, though one would never gather from what is said that the slopes about the town, for miles around, are now devoid of trees. The description of Victoria, Tamaulipas, does not even hint at the sisal industry which has so extensively cleared away the thickets, and one would never gather from the comments about Matamoros, Tamaulipas, that tomato fields have so widely replaced the chaparral there. The marshes about Lerma, in the state of México, must have been wonderful in November, 1892, and early July, 1904, when Goldman visited them, but when I first saw them in April, 1939, they were so cluttered up with boats, and what appeared to be dredging machinery that they were a sorry disappointment indeed. The description of the Volcán de Popocatepetl seems to fit today's conditions as well as yesterday's. The visitor to that wonderful mountain is sure to be impressed with the fact that the trees just below the *sacatón* grass area, which extends between snow-line and tree-line, are pines, not firs.

The team of E. W. Nelson and E. A. Goldman worked hard in México. The red lines on the map showing their journeyings from January 25, 1892, to February 20, 1906, appear at first glance to be the political boundaries of the states. They show up more plainly than the dotted black lines (the actual boundaries) and they cover the republic like a net designed to let no part escape. The highly interesting Del Carmen mountain area of northern Coahuila the team did not visit. They did very little work in Sonora. But compare their itinerary with that of many of us who have been working there recently! Most of us are stay-at-homes.

So valuable are the descriptions of places (even though allowance must be made for changes) that one wishes the whole work had been kept more purely historical than it is. The ranges given for the birds listed for the several zones and subzones are not by any means in agreement with present knowledge, though the names have been brought up to date. Note, for example, that the northern limit for *Ictinia plumbea* and *Spizaëtus ornatus* (p. 322) is given as southern Veracruz. Ornithologists have known, for years now, that these two species breed northward to southern Tamaulipas. *Falco albigularis* (p. 322), stated to range northward to southern Tamaulipas and Nayarit, breeds northward at least to Victoria, Tamaulipas; Linares, Nuevo León; and Guirocoba, Sonora. I have seen *Herpetotheres cachinnans* myself in San Luis Potosí and southern Tamaulipas, and van Rossem has listed it as a breeding bird of Sonora, yet in this work (p. 322) southern Veracruz is given as its northern limit. Most of the range-summaries are at least largely correct, but cursory inspection indicates that about half of them are not by any means up to date. Had these summaries been corrected along with the birds' names this work would be indispensable to present day workers. As it stands it is likely to be badly misleading because it is neither patently historical nor actually definitive. This adverse criticism must not be construed as a belittling of the work of Nelson and Goldman. Their work was nothing short of splendid. But where money is poured into publishing a great work of this sort and an attempt is made to bring the whole opus up to date *in some ways*, enough time and money should be put into it to make it a dependable reference work.

As for the several lists of birds believed to be representative of certain zones and subzones, opinion will differ according to the reader's own field experience. *Momotus momota coeruliceps*, listed on p. 115 as a bird of the Humid Upper Tropical Subzone, is stated to be also a bird of the Arid Upper Tropical Subzone. Why not also of the Humid Lower Tropical Subzone? It breeds, and commonly, in southern Tamaulipas in areas inhabited by *Cairina moschata*, *Cochlearius cochlearius*, *Ictinia plumbea*, and many other species listed as birds of this very subzone. This criticism, which might be levelled against the inclusion of many species in certain of the lists, must not be taken as haggling. What I am saying is that, the lists being what they are—namely, a summary of the knowledge of some years ago—they must not be regarded as authoritative for the present.

Proof reading, unfortunately, was careless, and this fault is the more deplorable because a work of this sort is certain to be regarded as authoritative. The name of the Mexican Crow is *Corvus imparatus*, not *imperatus*. The name of the beautiful mountain is Ixtacihuatl or Ixtaccihuatl. Pronounced as (incorrectly) spelled in the legends for Plates 68 and 69, it would be strange and unmelodious.—George Miksch Sutton.

Species Formation in the Red-eyed Towhees of Mexico. By Charles G. Sibley. University of California Publications in Zoology, Vol. 50, University of California Press, Berkeley and Los Angeles, 1950: $6\frac{3}{4} \times 10\frac{1}{4}$ in., pp. 109–194, plates 11–16, 18 figs. in text. $1.50.

This study of geographic variation in Mexican towhees adds another to the rapidly mounting list of thorough investigations of species formation. Sibley has seen that the problems arising in such studies cannot be adequately investigated in the museum alone, and he has integrated field observation very nicely with his statistical analysis of variation in color and mensural characters of skins. He has also recognized the fact that the characters of the present populations have resulted from the interaction of earlier genotypes with the changing environments.

Presentation of data follows a set pattern for each of the fifteen forms (two species, the first with ten subspecies, the second with five subspecies) considered and for the most part this pattern is a usable one. Mean measurements with their standard errors, standard deviations, and coefficients of variation are given for all but one of the races treated. It does seem unfortunate that the column set aside for the tabulation of "coefficient of variation," which is not used in the critical discussion, could not have been used to show the limits of the mean plus or minus one standard deviation. The necessity of continued turning of pages back and forth while mentally adding and subtracting is a common failing of practically all papers of this type. The reader desiring the information about variability is provided with the data, in the form of the means and their standard deviations, whereby this statistic can easily be calculated. It would have been helpful if the author had presented more information on statistical methods of analysis utilized. Some of the samples were very small (3–6) and perhaps worthy of special treatment. The terms *significant* and *significantly* are loosely used in a number of places. Thus, on p. 135, in discussing the Mount Orizaba Red-eyed Towhee population, Sibley says: ". . . although in some measurements . . . and in color tones they are significantly different from topotypical *P. e. maculatus*," he does not, so far as this reviewer can determine, present data showing that the color differences referred to *are* significant. Again, on p. 173, we encounter twice the phrase "significant barrier" without being told what a significant barrier is. Loose use of important words of this sort may leave a reader in doubt and confusion.

It would be helpful to know what criterion of separability was utilized in arriving at opinions regarding the validity of the subspecies recognized. Much has been written in recent times regarding this question and it is unfortunate that the author has not given direct information concerning the degree of separability which obtains amongst the various races considered.

For the reader not thoroughly familiar with place names and localities the Hubbs-Perlmutter diagrams are difficult to use. The author apparently feels that all of the subspecies recognized are identifiable on the basis of color, and utilizes these charts of mensural characters simply to show trends and interactions among the populations treated. It would be of interest to know the number of specimens involved in the preparation of these data.

The defects pointed out are all minor ones and do not at all detract from the soundness of analysis. Sibley's comments on the interspecific contacts between *P. ocai brunnescens* and *P. erythrophthalmus oaxacae* and the resultant hybridization and intergradation are especially interesting. It is particularly pleasurable to note his recommendation that *Pipilo maculatus* and *P. macronyx* be considered conspecific with *P. erythrophthalmus*. This action has long been indicated.

The plates showing typical habitats are of interest to readers familiar with *P. erythrophthalmus* in the eastern United States. With the exception of altitude, the subspecies found in eastern Canada and the eastern United States apparently show much the same habitat preferences as do the Mexican races.

This publication should be of great value to all serious students of zoogeography.—J. C. Dickinson, Jr.

Grønlands Fugle. The Birds of Greenland. Part 2. By Finn Salomonsen. Ejnar Munksgaard, Copenhagen, 1951: 9 × 13 in., pp. 159–348, 19 color-plates and numerous decorative sketches by Gitz-Johansen. Paper. Appearing in three parts, each at $9.00, but parts cannot be supplied separately.

For at least three reasons is this sumptuous work also great. First, it focuses sharply on Greenland, yet the reader is never permitted to forget that that island is only a part of the vast arctic whole. Second, it has balance: the taxonomic discussions are cogent and informative, but not over-long; the parts dealing with life history are readable without being discursive; the distributional material, though detailed, does not dominate. Third, and best of all, the work keeps beautifully in key: color-plates, black and white sketches, native names of birds, place-names, even the idiom—all reflect and call to mind Greenland. Part 2, like Part 1, is full of data based on recovery of ringed birds (the Danish government has sponsored this work for a long time); on specimens, most of them now in Copenhagen, collected on numerous expeditions; and on long hours of personal observation and work in the field.

Part 2 deals with the Rock Ptarmigan (*Lagopus mutus*) and with six charadriids, nine scolopacids, two phalaropes, three skuas, nine gulls, and one tern. Six of these 31 forms are only briefly discussed. Among the 25 fully written up are three not known to breed in Greenland—the European Golden Plover (*Pluvialis apricaria*), American Golden Plover (*P. dominica*), and Whimbrel (*Numenius phaeopus*). There are many records for all three of these species and the author's explanation of their occurrence is well presented. Some readers will be surprised to note that the well known Semipalmated Sandpiper (*Ereunetes pusillus*) and Least Sandpiper (*Erolia minutilla*) are nowhere mentioned. Another species 'conspicuous by its absence' is the Great Skua (*Catharacta skua*), a bird of very limited breeding distribution in the north.

Part 2 makes at least two contributions to popular knowledge. One of these has to do with the world's northernmost bird. Pleske, in his "Birds of the Eurasian Tundra," stated (p. 346) that 85° 5′ north latitude, at which degree the *Fram* had encountered the Fulmar (*Fulmarus glacialis*), was the "most northerly point attained by any bird." Alexander, in his "Birds of the Ocean," called the Ivory Gull (*Pagophila eburnea*) "the most northerly of all birds" (p. 136). Salomonsen, in "The Birds of Greenland," says of the Ivory Gull: "It lives nearest to the Pole of all birds and has been observed northwards almost to 85° n. lat." (p. 286). The Rock Ptarmigan collected by Feilden in 1876 in Grant Land was, Salomonsen assures us, the northernmost ptarmigan ever collected by man, but the northernmost *bird* ever collected was a Turnstone (*Arenaria interpres*). The latter specimen, now in Copenhagen, was taken at Low Point, on the north coast of Peary Land, at 83° 7′ n. lat. (p. 205).

Another matter of general interest is the crossing of the notorious ice-cap by birds. Salomonsen states (p. 284) that the Long-tailed Skua (*Stercorarius longicaudus*) is "the only bird which makes long excursions over the ice-cap, covering hundreds of km and sometimes approaching the center of Greenland." By the sheerest of coincidence, I recently received from William H. Allen, a friend since the days when we were army officers together, a photograph of this

A Long-tailed Skua or Jaeger (*Stercorarius longicaudus*) about one hundred miles in from the edge of the Greenland ice-cap. Note the vague barring on the under wing coverts—evidence of immaturity. The picture was sent to the editor by his friend William H. Allen, of the staff of Air University Library, Maxwell Air Force Base, Alabama.

beautiful species taken about a hundred miles in from the edge of the ice-cap. The exact spot at which the bird was encountered cannot, for reasons of security, be stated, but the picture is intensely interesting none the less, especially in the light of Salomonsen's statement.

Certain of Salomonsen's distributional data are thought-provoking to say the least. There are puzzling gaps in the breeding range of the Arctic Tern (*Sterna paradisaea*). The American Golden Plover (31 records, all based on skins) has been reported only from the west coast, principally in the Disko Bay area. The Long-tailed Skua, which breeds commonly in the north, is "very rarely observed in southern Greenland," for its migrations are largely pelagic (p. 283). The Iceland Gull (*Larus glaucoides*) is, aside from the Kittiwake (*Rissa tridactyla*), the commonest gull of West Greenland, but in its breeding "it is restricted to the fjord-country in the interior" (p. 313). These are but samples. Data presented clearly show that amelioration of climate has led to remarkable range-change; that competition for food and nest-sites has brought about otherwise inexplicable situations; that some arch-competitors, notably the Great Blackback (*Larus marinus*) and Glaucous Gull (*L. hyperboreus*), manage to 'stand each other' remarkably well where their ranges overlap.

The color-plates, despite their shocking crudity, are strikingly *in character*. As reproductions of brisk water-colors they are fairly breath-taking. Speaking as a fellow bird artist, however, I wish that Gitz-Johansen would refrain from outlining a white breast in black. I wish he would study more closely (not, I hasten to make clear, draw in greater detail, but *study*) the perspective of spread wings. I wish he would never forget what happens to a flying bird when its wings fail to keep it in one place (as when hovering) or to hold it up and push it forward (as in ordinary flight). One of the most beautiful spots in the book is the back of the Iceland Gull (plate 32). Here the effect of softness and cleanness is incredibly authentic and beautiful.—George Miksch Sutton.

THE BIRDS OF NEWFOUNDLAND. By Harold S. Peters and Thomas D. Burleigh. Department of Natural Resources, Province of Newfoundland, St. John's, 1951: $6\frac{1}{2} \times 9$ in., xix + 431 pp., 32 color-plates, 40 text figures and pictorial map end-papers by Roger Tory Peterson. $6.00.

Rugged Newfoundland has long been one of the most backward political entities on this continent in wildlife conservation matters. Not until 1949 when it became Canada's newest province did it become a party to the International Migratory Bird Treaty of 1916. As Britain's oldest colony it maintained its aloof individuality and made its own game laws, lax compared to those of its neighbors. Its fisherman population has always utilized its once abundant bird-life as a source of food, a welcome change from an otherwise monotonous diet of "fish and brewis." There loons, alcids, and gulls are hunted and eaten as avidly as geese and ptarmigans; egging the sea-bird colonies has always been established practice. Enforcement of the mildest game laws is difficult, and not pressed actively by the politically wise.

It is praiseworthy indeed, and a great step forward for the Newfoundland government to sponsor and finance a book "to aid the people of Newfoundland in identifying the birds of that Island and to provide information concerning these birds," as the authors say in their preface. With this in mind Messrs. Peters and Burleigh have provided a fairly adequate volume for the needs of the people of the area. Their brief descriptions and field marks, when used in combination with the 32 competent colored plates by Roger Tory Peterson, are sufficient to enable any reader to identify the local birds. Short accounts of voice, nest and eggs, range, and habits, largely abridged from standard reference works, supply the essential information available for each form recognized.

Between 1937 and 1947 the authors covered their territory thoroughly, spending a total of 304 days in field work which should have made them more familiar with the flavor and color of this distinctive island than is apparent from their text. They have reviewed the literature and examined much of the specimen material available in North American museums. It is also gratifying to note their extensive use of banding data, a source of information still too little used. They have followed the as yet unpublished dictates of the AOU committee for their scientific and accepted English names, a preview which reveals many of the latter to be rather unwieldy mouthfuls for lay use.

The analysis of data on occurrence is becoming a difficult and delicate matter in this day of increasing use of sight records. The serious student may question the authors' evaluation of their evidence of the local status of each species and subspecies. More than 25% of the forms recognized are considered "casual" or "accidental" which, though the categories are not defined, seems abnormally high for an area so little worked ornithologically. They seem to have been neither sufficiently critical of their material nor consistent in their treatment of it. Why, for instance, do they accept, apparently on the basis of sight records alone, the Ruby-throated Hummingbird and Nighthawk which are at best rare, irregular visitants of uncertain status, and reject for lack of specimen evidence Barrow's Golden-eye which is certainly of regular occurrence, and for which they present equally valid sight records? They wisely relegate to the hypothetical list 55 other species for which no specimen evidence exists, but accept such rarities as the Yellow-nosed Albatross and Sandhill Crane, among others, on the basis of old mounted specimens formerly in the St. John's Museum, since destroyed by fire, which were completely without data, and which may well have arrived there as curios brought home by Newfoundland's far-travelling seafarers.

The volume is handsomely produced and well printed. Peterson's 40 black and white text figures and his picto-map end-papers are very fine. It is a pity the manuscript was not competently edited to correct grammatical errors and awkward use of English because it is the only work available on the birds of this unique island and will doubtless have a wide distribution both at home and abroad. It is to be hoped it will stimulate and encourage the Newfoundlanders to appreciate and conserve their avifauna, and perhaps to study it and give a more accurate and comprehensive knowledge of it to the world.—O. L. Austin, Jr.

The Hawaiian Honeycreepers (Aves, Drepaniidae). By Dean Amadon. Bulletin of the American Museum of Natural History, Volume 95, article 4, December 11, 1950: pp. 151–262, figs. 1–23, pls. 9–15, tables 1–15. $1.75.

Perhaps nowhere else in the world was there such remarkable opportunity for a thorough comparative study of the mechanisms of adaptive radiation as that offered by the Hawaiian honeycreepers. On these volcanic islands all conditions were ideal: varying degrees of isolation, diversity of available niches, repeated cataclysmic changes, relative freedom from natural enemies, and plastic immigrant stock upon which evolution could work. The divergence of the drepaniids has been correspondingly extreme. The great pity is that the broader concepts of biological thinking had not developed to the point where such a study could have been undertaken fifty or seventy-five years ago. Like the author, I spent a considerable part of my army service in Hawaii; I was able to get a very little field experience with the Drepaniidae, or with the pitiful remnants thereof. I know their unique fascination. But I also can appreciate firsthand the near-hopelessness of trying to reconstruct conditions in the primeval forests, which were already on the wane in the days of Perkins and Henshaw (around the turn of the century); or of making comparative studies when a large percentage of the forms are extinct, or so nearly so that work on them is impracticable, and existing material is grossly inadequate.

We are not told precisely what material was used in all parts of the study, or how many specimens were handled in all. But it is clear that much time was spent in the Bishop Museum in Honolulu, and that the large series in the American Museum of Natural History (especially in the Rothschild collection), formed the "principal basis." Apparently far more specimens were examined, particularly of *Vestiaria*, in the study of plumages than in other connections.

In the systematic list, which includes diagnoses and distributions, the 22 species and total of 39 forms are grouped into two subfamilies and only nine genera: a far less cumbersome arrangement than those heretofore employed (e.g., in Munro's "Birds of Hawaii." 1944. pp. 89 ff., where 17 genera are used, following Perkins). No particular evidence is presented as a basis for the consolidation; but it seems justified in view of the "great morphological diversity existing among closely related species in this family," and certainly makes for easier understanding of the groups.

The analysis of measurements is given considerable space, although many conclusions here are either very general or negative. There is interesting discussion of racial and specific variations, limiting of variability by small population-size (not demonstrated), possible effects of allometric growth in some forms, and probable adaptive significance of characters. The ratio diagrams (based on a method of Simpson's and explained in an appendix) show quite strikingly the changes in body proportions; I wish it had been possible to extend their use to include both higher and lower categories in more detail.

The anatomical section, while very instructive, nevertheless suffers most of all from the woeful lack of comparative material. Repeatedly we are led into some new aspect or other, only to find that data are insufficient or conflicting, and that we can after all conclude little or nothing. The emphasis here is upon probable relationships of the family, and scarcely at all (as the author points out) upon patterns of radiation within it. While Amadon favors an origin from some generalized coerebid, he does not close the door to other possibilities. We are left with the idea that the nine-primaried passerines are such a close-knit group that, since the ancestral drepaniid was an insect- or nectar-feeding member of this basic stock, it makes little difference just what we call it. While we evidently postulate a monophyletic origin for the family, I find no definite evidence brought to bear upon this point. However, the data in the various sections of the study are made to support very strongly a divergence into the two subfamilial lines—evolution in the one case largely through extreme modification in bill, and in the other through less marked structural change coupled with change in coloration.

There are many pages of general discussion, dealing with various aspects of speciation phenomena, with examples drawn both from the Drepaniidae and from other groups. The endemicity of the Drepaniidae and of other Hawaiian birds is summarized in tables and maps. Stress is given the importance of isolation, secondary overlap, and competition between adaptive types in radiation of species and of higher categories. Several instances are pointed out and explained. This discussion, in addition to being informative, is keenly thought-provoking. It is fascinating to consider, for example, *why* the two species still most abundant are not only among the most widespread (one breaking up into subspecies and the other not), but also allegedly the most primitive of their respective subfamilies. And why should the Drepaniinae, in which all the genera but one are monotypic, and of which the two most primitive members are such frequent inter-island stragglers as to inhibit even subspeciation, yet have evolved more genera than the Psittirostrinae, with three of its four genera rather highly polytypic.

There is an occasional apparent contradiction in the text; the present status of *Drepanis* (while given elsewhere) is omitted from the species-by-species summary of this information; I noted three minor typographical errors; one might wonder why the tree *Metrosideros* has one specific name in the text and another under the figure.

The paper and print are good, and the seven plates of remarkably sharp and clear photographs of skins serve well as illustrations. The conclusions are for the most part conservative, and the data well presented. Viewed in the light of present-day conditions, the paper appears splendidly worked out; it gathers available data from many sources, and presents us with as clear a picture of the structure, plumage, habits, general ecology, and relationships of this family as is now available. Most criticisms that might be made are more a reflection of the difficulties involved than a discredit to Amadon's capable work.—William A. Lunk.

A GUIDE TO BIRD FINDING EAST OF THE MISSISSIPPI. By Olin Sewall Pettingill, Jr. Oxford University Press, New York, 1951: $4\frac{1}{2} \times 7\frac{3}{8}$ in., xxi + 659 pp., 72 pen-and-ink sketches by George Miksch Sutton. $5.

Now for the first time we have a Baedeker for bird watchers.

Anyone who has travelled into unfamiliar territory with limited time hoping to see the distinctive birds of the area—and who hasn't?—will appreciate the usefulness of such a book. In fact, out of just such experiences of his own, usually disappointing, came Pettingill's inspiration for this guide.

The amount of information contained here is astonishing. There are descriptions of more than 500 places of ornithological interest, with detailed suggestions for reaching them, for finding lodgings, for securing permission to enter, and for solving other problems confronting the visitor. Most of these are places for seeing birds in the wild—in nesting season, during migration, or on the wintering grounds. But there are notations also on zoos, museums, libraries, research stations, bird clubs and other institutions of ornithological importance. A chapter is devoted to each of the 26 eastern states with two exceptions (two states combined), and the points of interest appear alphabetically according to the name of the nearest town shown on road maps.

A feature of special merit is the ecological description of the state at the beginning of each chapter. This feature will command the attention not only of ornithologists but also of naturalists generally. Although most of the book is intended for reference rather than for consecutive reading, many people will find themselves skipping through the chapters, reading the state descriptions with interest. There are few people indeed who will not be surprised to learn what a diversity of habitat occurs in every state, even a prairie state like Illinois.

No one person alone could have written this book, as Pettingill acknowledges. The finished product is a triumph of cooperative effort. Probably there has never before been a book in ornithology that has had so many people participating directly in the preparation (more than 300). Yet Pettingill's terse style marks the whole, including four chapters written by state authorities.

The sketches of birds have the lifelike quality of form and motion we have come to expect from the skilled hand of George Miksch Sutton.

At the end of the state chapters there is a list of books for further reference—guides to field identification and regional publications.

The alphabetical index to places and bird species appears quite complete, but I consider it a little unfortunate that some attractions are not to be found directly under their well-known names. For example, I did not discover immediately that Hawk Mountain was listed under "mountains," nor that Pymatuning was listed under "swamps" and placed in the Pennsylvania chapter. (It is also a lake lying mostly in Ohio.) Still, this is a minor point and it does not detract appreciably, if at all, from the fine work. The searcher for a specific item will applaud the practice of showing place names in capital letters throughout the book so that a familiar name may be found fairly easily by scanning the proper chapter.—Harold Mayfield.

AUDUBON WATER BIRD GUIDE. By Richard H. Pough. Doubleday & Company, Inc., Garden City, New York, 1951: $4\frac{1}{2} \times 7\frac{1}{4}$ in., xxviii + 352 pp., 48 colored plates and 138 black and white drawings. $3.50.

This volume complements Dr. Pough's earlier *Eastern Land Birds* in the Audubon Bird Guide series. Its scope is defined by the sub-title, "Water, game, and large land birds of Eastern and Central North America from Southern Texas to Central Greenland, most of which range to the Pacific Coast." There are 485 illustrations in color on 48 plates by Don Eckelberry, and 138 in black and white by Earl L. Poole.

Those of us who grew up with the handy little Reed "Guides" in our hip pockets will recognize Pough's spiritual inheritance from these useful, but decidedly limited, volumes. Division of species and territory covered by both authors are approximately the same, but Pough's works are enriched by a wealth of material which precludes their fitting into anyone's hip pocket. Modern bird students will, however, gladly sacrifice the convenience of Reed's books for the excellent text and fine illustrations in the present volumes.

The *Audubon Water Bird Guide* treats each species under the sub-heads *identification*, *habits*, *voice*, *nest*, and *range*. Measurements include overall length, length of wing, and, for some species, length of bill. A valuable feature is the average weight given for most species. For ready comparison there are numerous tables showing average length and wingspread of related species, or of birds likely to be observed in the same habitat. Vernacular names follow newer concepts in nomenclature. Where there is disagreement between American names and those recognized by the British Ornithologists' Union, the latter are given in parentheses. Data are given on bird ages where these are known.

As might be expected from Dr. Pough's background and interests, there is much emphasis on sound ecology and militant conservation in the treatment of each species. Birds are related to their habitats through a discussion of food and cover requirements. Attention is called to the fertilizing effect of large bird colonies, and the influence of this factor on fish, shellfish, and other aquatic populations. Possibilities of extending the ranges of species with limited distributions are explored.

From the inclusion of detailed information on ranges, the reader will derive an impression of the holarctic character of our waterfowl and of many of our larger land birds. The front end-piece is a map of the North Atlantic, with named quadrats and information on water temperatures and major flight-routes. Inside the back cover is a map of North America showing major biotic regions. Extralimital species which occur in eastern North America as casuals or strays are rather fully treated.

Eckelberry's colored illustrations are arranged on plates bound in the center of the volume. They show major plumage phases, and are generally excellently drawn and well reproduced. Plate No. 48 includes the pigeons and doves, and encounters the difficulty of reproducing exactly the delicate iridescent shades in the plumages of these birds. Poole's black and white drawings accompany the text.

The author's foreword contains pertinent suggestions for the best use of the volume. A well arranged Table of Contents shows families and genera, and makes reference to text and illustrations easy. Information is concise and well presented. Because of the ecology and conservation which is included, this volume is much more than a "bird guide".—Maurice Brooks.

Ontario Birds. By L. L. Snyder. Clarke, Irwin & Company, Ltd., Toronto, 1951: 6 × 9¼ in., x + 248 pp., with 146 line drawings by T. M. Shortt. $4.50.

We have in this attractive volume a source of general information on the common birds of Ontario, authored by one of Canada's leading ornithologists who, since 1935, has served as Curator of Ornithology at the Royal Ontario Museum of Zoology in Toronto. As stated in the Preface, the book is in no sense a complete reference work nor a guide to field identification; rather is it "intended as a source book for teachers, pupils, amateur naturalists, and all out-of-doors people, for use indoors."

The first four chapters are of an introductory nature, pointing out, respectively, the characteristics of the bird as an animal; certain peculiarities of bird distribution; a few outstanding facts obtained from observations of bird migration; and the accepted method of classifying birds, together with a list of the 351 Ontario species grouped according to orders and families. The fifth and last chapter, entitled "Natural History," comprises the bulk of the book (pp. 33–235) and contains its principal substance. A Spring Calendar giving the first-arrival dates of 50 common migrant birds; an adequate index; and endpaper maps showing all the Ontario places mentioned in the text, complete the volume.

Under "Natural History" the common Ontario bird species are taken up by families in phylogenetic order. There are subheadings for families, but not for species. After each family subheading the text usually consists of, first, a description of the more obvious family characteristics and, second, a discussion of each of the common species with respect to its geographical and seasonal distribution in the province, habitat, song (if any), nesting habits, feeding habits, and general winter range. Aside from the parenthetical use of the scientific names of families and species, and of an occasional term denoting an anatomical feature, all technical terminology is avoided. The information presented is consistently pertinent, clearly demonstrating that the author, with his years of experience in a public institution, understands what people, when inquiring about birds, want to know. The style of writing is simple and direct, without flowery expressions, dramatized anecdotes, whimsical comments, anthropomorphisms, or other devices often considered necessary to satisfying public interest. For a presentation that reads easily and informs well, it is, in the opinion of this reviewer, one of the finest examples extant.

Scattered through the volume are 146 line drawings by T. M. Shortt, Chief of the Division of Art and Exhibits at the Royal Ontario Museum of Zoology. Forty-nine are of the bird skeleton and external structural characters distinguishing bird families; the remainder are of live birds in various attitudes. All are beautifully done and contribute immeasurably to the attractiveness of the work. Some of the drawings of live birds are especially refreshing.

Only one unfavorable criticism of "Ontario Birds" seems justified, namely, its failure to include any reference whatever to other sources of information. Arousing, as it inevitably will, an interest in birds, the book should present somewhere a list of guides to identification, sound recordings, treatises on methods of attracting and studying birds, and some of the more readable works on such important ornithological matters as migration, distribution, and life history. Readers would then be encouraged to widen their interest.—Olin Sewall Pettingill, Jr.

Birds' Nests of the West. A Field Guide. By Richard Headstrom. Ives Washburn, Inc., New York, 1951: $4\frac{1}{2} \times 7\frac{1}{4}$ in., 177 pp., with 29 photographs. $3.00.

Bird-watchers living in the western part of the United States will be pleased to learn of Mr. Headstrom's latest book. This volume contains keys for nest identification of birds breeding in the United States west of the one hundredth meridian. The keys are arranged according to the general habitat and location of the nest-sites. The 29 generally excellent photographs of nests taken by Harry L. and Ruth Crockett add considerably to the value of the book. More thought might have been given to the selection of species to be illustrated, however. For example, 4 of the 29 photographs are devoted to the dove family, while the warblers are not represented at all. The eggs of few species have been illustrated as many times as those of the Killdeer. Their inclusion here was hardly necessary.

In his "Birds' Nests" of the eastern United States (1949: 24), Mr. Headstrom stated: "This guide is an attempt to help those who enjoy nest-hunting to identify nests with some measure of success, especially during the winter months in the North, when many nests are easy to see. And since bird life and plant life are then at their lowest ebb for observation, another objective will add interest to our winter trips." Mr. Headstrom has done an admirable job in fulfilling the purpose for which his two field guides were written. Scout leaders, teachers, and nature counselors should find these guides indispensable in their work with children.

In the introduction (p. 18) of the present volume, Mr. Headstrom says: "It must be admitted that the best way of identifying a nest is when it is still occupied by the maker." The books were not written for, nor will they be of much value to, the professional ornithologist or serious amateur bird student.—Andrew J. Berger.

ADAPTATIONS OF ANIMALS TO CLIMATIC EXTREMES: A REVIEW

BY A. D. MOORE

BODY INSULATION OF SOME ARCTIC AND TROPICAL MAMMALS AND BIRDS. By P. F. Scholander, Vladimir Walters, Raymond Hock, and Laurence Irving. *Biological Bulletin*, Vol. 99, No. 2, pp. 225–236, October, 1950.

HEAT REGULATION IN SOME ARCTIC AND TROPICAL MAMMALS AND BIRDS. By P. F. Scholander, Raymond Hock, Vladimir Walters, Fred Johnson, and Laurence Irving. *Biological Bulletin*, Vol. 99, No. 2, pp. 237–258, October, 1950.

ADAPTATION TO COLD IN ARCTIC AND TROPICAL MAMMALS AND BIRDS IN RELATION TO BODY TEMPERATURE, INSULATION, AND BASAL METABOLIC RATE. By P. F. Scholander, Raymond Hock, Vladimir Walters, and Laurence Irving. *Biological Bulletin*, Vol. 99, No. 2, 259–271, October, 1950.

These three papers are important additions to the literature on body insulation, basal metabolism, heat regulation, and cold adaptation of arctic and tropical mammals and birds.

The biological literature has long been crowded with qualitative discussions of the role of fur, feathers, and fat in heat conservation. However, very few measurements have been made. Here, at last (in the first paper), Scholander, *et al.* report on the thickness of fur and fat on the mammals they studied; they actually made measurements from which the thermal conductivities could be found. The arctic work was done on winter furs of mammals at Point Barrow, Alaska. The studies were rounded out by working with tropical animals in Panamá.

Pieces of fur, taken from more thickly furred areas, were stretched tight against both sides of a round, flat hot-plate and its surrounding guard ring. The plate and ring were kept at 37° C. The fur was roughed up to give maximum insulating effect. The surrounding box, with its still air, was kept at 0°; additionally, for the beaver, polar bear and seal, there was immersion of the hide in ice water. The inner side of the skin was moistened; but as the authors point out, the temperature drop measured through the skin seems high, and is no doubt due to poor contact between skin and hot-plate. This writer would suggest that perfect contact as well as moistening might be attained by coating the skin's inner side with rather viscous Methocel solution. Methocel, a Dow Chemical Company product, is virtually inert; it can be mixed with water to almost any degree of viscosity desired.

When thus measured flatwise, it was found that the quality of the prime arctic furs and the better tropical furs was roughly constant. That is, for parallel heat flow out through a flat-stretched piece of fur, for a given temperature drop through the fur, the rate of heat flow per unit of area was inversely proportional to the fur thickness: double the thickness, and the rate of flow is halved. The charts showing what the authors call "insulation," plotted against fur thickness and against animal weight, give values as measured by the above flat method, for skin plus fur (or blubber plus skin for the seal); and is given in terms of 1/(Cals. m²/24 hrs./1° C.). This will take on meaning if restated: it is the degrees C. drop through the skin and fur, for a rate of heat flow of one kg.-calorie per day, for an area of one square meter.

This matter of "insulation" value and its meaning is of critical importance. Several meanings of "insulation" are possible, if factors are taken only one at a time. To make this clear, consider two animals, precisely similar in every way, having a size ratio (e.g., height ratio) of 1:2. The fur thicknesses are 1:2; the surface areas are 1:4; the fur volumes are 1:8. If clipped and weighed, the two batches of fur would have a weight ratio of 1:8. Thus, if we were in business, selling such insulation, the insulation values would be 1:8; but this is a useless heat conservation criterion for the animals themselves. Starting over again, we note that the surface area ratio is 1:4, and we might conclude that the insulation values are the inverse of this, or 4:1; but again, this factor alone will not tell us about the relative heat losses of the two animals. Trying another factor alone, we point to the fur thickness, and its ratio of 1:2, and might conclude that the larger animal is twice as well insulated as the smaller. This conclusion is also untenable: the factor of fur thickness alone is not sufficient. However, this last seems to be the viewpoint presented and used in the first paper. Such a concept of "insulation" may obscure some important issues. A different analysis will now be given.

Both the area and the fur thickness should be taken into account. For the above similar animals, the fur thicknesses are 1:2, tending to reduce the larger animal's loss; but the surface areas are 1:4, tending still more to increase it. Combining the two factors, we find that for the same temperature drop, the heat loss rates would be 1:2. The larger would dissipate twice as much as the smaller.

But, if the smaller animal is taken to be adequately insulated, the larger would turn out to be over-insulated. Their weight ratio is 1:8. Using the correlation of basal metabolic rate, calories per day versus weight, as adopted by Benedict or as given in the third paper, the larger animal's basal heat production rate is about five times that of the smaller. The heat production ratio is 1:5. Thus, if the larger animal were given twice the smaller one's fur thickness as assumed so far, it could dissipate at only twice the smaller one's rate through the coat, but would have five times as much heat to get rid of. Therefore, it should have considerably *less* than twice as much fur thickness.

In fact, it can be argued that the larger animal's fur thickness should be less than that of the smaller! If we adopt the *same* thickness for both, the larger has five times the heat to lose, but only four times the area to lose it from. Therefore, if the smaller animal is adequately insulated, the fur of the larger is more than adequate at the same thickness. However, the writer can see at least three considerations stepping in to prevent the adoption of less and less fur thickness as size becomes greater and greater.

First, the larger land mammals must survive while abroad or resting, under extreme exposures. The taller they are, the greater are the wind velocities at their body levels. This is a factor of real importance, but the biological literature has neglected it. Standing in the "same" wind, a moose is exposed to much higher velocities than is the marten or weasel.

Second, when an animal is lying down on cold snow—with fur compressed and the insulating value of the fur reduced—the pressure per unit of area on the fur doubles when the size is doubled. The compressing effect for a lemming-size animal is very low indeed; for a caribou it is vastly greater. Highly compressed fur is a poor insulator, due both to its reduced thickness and to its being compacted.

Third, animals are not flat, like signboards, with flat slabs of insulation stretched on them. They are made up of roughly cylindrical parts. Heat flow out through the fur is more or less divergent, or radial, in character. A 10 mm. thickness of fur on a very small animal has far from the same heat-conserving value, per unit of surface area, as the same thickness of fur on a large animal. The fact that the geometry of the case plays a major part in considering small versus large has not been adequately recognized in this kind of literature.

Turning to the animals, compare the lemming and the Eskimo dog, the weight ratio being about 1:1000, the size ratio therefore about 1:10. The lemming fur thickness is about 20 mm. If fur thickness had to obey the law of similarity, the dog would have an unwieldy 200 mm. of fur thickness. Or if we use only the factors of relative heat production and relative area, the dog should have less than 20 mm. But with the three considerations in mind, it is not surprising to find that the dog actually has about 40 mm., or about twice that of the lemming. Moreover, the dog can sleep outdoors through the arctic weather, and the lemming cannot. Also with the foregoing arguments in mind, we are not surprised to learn from the paper that when the size of the fox or dog is reached, increase of size occasions little change in fur thickness.

"From the size of a fox to the size of a moose there is no correlation between insulation and body size, they all have about the same insulation per surface area" is one of the conclusions. This must first be corrected to read, per *unit* of surface area. They then do have "about the same insulation," when measured flatwise as described in the paper. But when the geometry of flow (the radial flow effect) in the fur, as actually worn, is taken into account, the insulating effect for the smaller of these animals is less than it at first seems to be.

The data secured are valuable. Eventually, when geometry of heat flow, habits of the animals in evading or accepting extreme exposure, wind effect related to size, and compression of fur when resting or sleeping—when these various considerations can be evaluated and weighted into the analysis, we may eventually be able to work out a very good correlation of fur-thickness with size.

An attempt was made to secure insulation measurements for snow bunting and ptarmigan skins. "However, these measurements are less satisfactory since it is impossible to produce on the test plate the well-ordered elevation of the feathers which the live bird can achieve to produce maximum insulation." That is, flatwise testing of small skins does not work out well. This points to the need for developing test methods in which skins will have more nearly their natural conformation, by stretching them over cylinders or spheres, or even models of the animals themselves.

The paper has some good discussion of animal heat loss as affected by vasomotor control, and of the way the legs and feet of arctic animals are adapted to tolerate extreme cold exposure and at the same time reduce heat loss, by permitting these members to go to low temperatures.

The second paper gives valuable new data on basal metabolic rates and heat regulation for arctic and tropical mammals and birds. The mammals studied at Point Barrow were the white fox, Eskimo dog, polar bear (cub), ground squirrel, lemming and weasel; the birds, the Glaucous Gull (*Larus hyperboreus*), Canada Jay (*Perisoreus canadensis*) and Snow Bunting (*Plectrophenax nivalis*). The Panamá mammals were the two-toed sloth, night monkey, marmoset, raccoon, coati and jungle rat; the birds, the Yellow-thighed Manakin (*Pipra mentalis*) and Pauraque (*Nyctidromus albicollis*).

Measurements of metabolic rates were made in a controlled-temperature respiration chamber, the heat production being determined by the oxygen consumption or carbon dioxide production. Each animal was started in its thermoneutral zone. Within this zone of lowest metabolic rate (conditions being that the animal is awake, resting, and in the post-absorptive state) lowering the chamber air temperature does not change the rate of heat production or heat loss. Instead, the animal compensates for the increased cold exposure by pilomotor erection of fur or feathers, which increases the insulating value of the coat; by vasomotor control of heat carried by the blood to skin and limbs; by vasomotor control of temperature of these parts; by changes in posture, and so on. At the lower end of the zone the critical temperature is reached. As the chamber temperature is lowered below the critical, step by step, heat loss is more and more increased; and the body maintains its temperature by resort to shivering, so that muscle energy turned into heat causes heat production to keep even with heat loss. This is observed in terms of the rising metabolic rate.

The authors described a conceptual mechanical model, housed in a controlled-temperature chamber, which would have a heat source, thermostatic control, and insulation variable automatically up to a maximum. Up to this limit the model would perform within its thermoneutral zone; heat production and heat loss would be held constant by variation of the insulation. Thereafter, as the test chamber is cooled further, heat loss would rise, and the thermostat would operate to make the heat production rise with the loss. The animals are then interpreted in terms of such a model.

The model would have only simple insulation in the true or technical sense; whereas, for the animals insulation "means the sum total of all factors, such as fur, skin and tissue cool-ing, and posture, that impede the loss of heat from the animal" (p. 249). The reader of this paper may seriously misinterpret its findings unless he carefully takes note of this broadened use of the term *insulation*. Also, it is regrettable that this term, which is needed for what it heretofore has meant, should be so broadly construed. Some other term or phrase, such as *heat conserving ability*, should have been used to denote the over-all effect of the several factors.

The tropical animals display much greater temperature sensitivity than the arctic animals. As the test chamber temperature is progressively lowered, they reach their critical temperatures much sooner, and their metabolic rates thereafter rise much faster than those of the arctic animals. The difference is not accounted for solely by difference in thickness or quality of the fur or feathers. As is brought out, much of the difference in sensitivity comes from differences in adaptive heat regulation factors displayed by the extended parts of the body—the face, limbs and feet. The tropical animal has not had to meet extended cold threats; and when so exposed, the extended parts tend to maintain their temperatures. The arctic animal has had to adapt in order to live through what we tend to consider intense cold exposure; and a major factor of adaptation is its ability to let limbs and feet get along with little heat supplied from the central body mass, accompanied by the fact that normal (and presumably perfectly comfortable) tissue temperatures in the extended parts may be down near 0°. This was demonstrated for the aquatics, and presumably holds for the terrestrials.

Nothing about research is more typical than its tendency to indicate still more research. Plenty of interesting work remains to be done to round out the picture and lend verification. Using thermocouples, the same arctic and tropical species should be studied, to measure skin temperatures and even internal temperatures at various depths, for the extended parts and for the trunk as well. In fact, a little of this work was done at Point Barrow.

It is very interesting to note that Point Barrow failed to furnish weather cold enough to cool the test chamber down to the critical temperature for the foxes and dogs. Two foxes were flown to the Naval Research Laboratory in Washington, D.C., where shivering was induced by −70° chamber temperature.

In discussing the ability of arctic mammals to stand cold extremes, the authors would have done well to mention the fact that the insulating quality of entrapped air materially improves with the low temperatures encountered by these animals. Taking the thermal conductivity of air at 40° as a base, the conductivity at −40° is about 80% as great; and at −70°, about 70%. This must be of real importance in arctic survival.

The third paper opens by contrasting the extremes of the thermal environment of Point Barrow with the relatively constant environment at Barro Colorado. Body temperature and climatic adaptation are then discussed, and it is shown that with few exceptions—all moderate in degree—mammals and birds the world over have body temperatures falling within a narrow temperature band. That is, the homoiothermic animal, broadly speaking, does not adapt to climate by change of body temperature. Insulation and climatic adaptation are taken up next; and here, of course, it is brought out that change in amount of insulation is a major adaptive factor. Also, if we follow the authors when they include, under the term insulation, vasomotor regulation permitting body extremities to drop in temperature, then it can be said that: "The cold legs of arctic aquatic birds and mammals (and probably of the terrestrial forms as well) may be taken as another example of adaptive insulation" (p. 262).

The paper presents new data on basal metabolic rates, showing them in relation to the standard mouse-to-elephant curve of kg.-calories per day plotted against weight. All of the arctic and tropical mammals fall on or close to the curve, except that the weasel is quite high (two or three times the expected value) and the sloths, with their labile temperatures, are low. The authors apparently accept the arctic weasel as an exception and they point, in this connection, to what they believe to be an insulating coat thin enough to go along with the apparently higher basal rate. "Hence we are forced to conclude that our arctic weasels had a greatly increased resting metabolic rate compared with the southern form. This may possibly mean a metabolic adjustment to cold" (p. 265). The exception is so striking—as is the conclusion forced upon us if it is proved—that further research on the northern form surely is in order.

The weasel is an extremely active animal. Benedict was meticulously careful to make sure his animals were in a truly resting state before he accepted a metabolic rate as basal. He also found that unless a wild animal became accustomed to test conditions, rates were high even at rest. The weasel is prone to be defiant and restless. In further tests, steps should be taken to make sure that both criteria are met. It may even be necessary to duplicate, on the weasel, Hoover's work on the rat, by killing the animal, quickly measuring metabolic rates for the several main types of tissue, allowing for heart and respiratory activity, and summing up.

New data on birds are also presented. Much less is known about basal rates for birds than for mammals. However, "Two of our night hawks [Pauraques] are very low, and this is probably due to their faculty for hibernation" (p. 265). The two Glaucous Gulls studied were high. But, as is said: "More material is necessary before we can tell whether the basal metabolism in birds may be adaptive to climate" (*loc. cit.*).

The critical temperature, to repeat, is the lower limit of the thermoneutral zone. The difference between this and the body temperature is called "critical temperature gradient" by the authors. For four arctic and seven tropical species, they give the value as observed; and also, as calculated by use of basal rate, body insulation as measured, and surface area as computed by the Meeh formula. In spite of the over-simplification inherent in the calculating method, the agreement between observed and predicted values is surprisingly good in most cases.

The critical temperature *gradient* just mentioned should have been called the critical temperature *difference*. The general excellence of these three papers may tend to induce some workers to adopt all of their usages. However, very strong objection must be entered against the misuse of the term *gradient* which, throughout the papers, is almost always used when *temperature difference* is what is intended.

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THE EXTERNAL PARASITES OF BIRDS: A REVIEW

BY ELIZABETH M. BOYD

Birds may harbor a great variety and number of ectoparasites. Among the insects are biting lice (Mallophaga), fleas (Siphonaptera), and such Diptera as hippoboscid flies (Hippoboscidae) and the very transitory mosquitoes (Culicidae) and black flies (Simuliidae), which are rarely if every caught on animals since they fly off as soon as they have completed their blood-meal. One may also find, in birds' nests, bugs of the hemipterous family Cimicidae, and parasitic dipterous larvae that attack nestlings. Arachnida infesting birds comprise the hard ticks (Ixodidae), soft ticks (Argasidae), and certain mites.

Most ectoparasites are blood-suckers; only the Ischnocera lice and some species of mites subsist on skin components. The distribution of ectoparasites on the host varies with the parasite concerned. Some show no habitat preference while others tend to confine themselves to, or even are restricted to, definite areas on the body. A list of 198 external parasites for 255 species and/or subspecies of birds east of the Mississippi has been compiled by Peters (1936) from files of the Bureau of Entomology and Plant Quarantine between 1928 and 1935. Fleas and dipterous larvae were omitted from this list. According to Peters, it is possible to collect three species of lice, one or two hippoboscids, and several types of mites on a single bird. He records as many as 15 species of ectoparasites each from the Bob-white (*Colinus virginianus*), Song Sparrow (*Melospiza melodia*), and Robin (*Turdus migratorius*). The lice and plumicolous mites, however, are typically the most abundant forms present on avian hosts. A good introduction to this field of investigation is "Medical Entomology" by Matheson (1950).

When collecting ectoparasites, the sooner the bird is examined the better, for the parasites. in particular the mites, are easier to see while they are still alive. If inconvenient to examine the freshly killed bird, it should be wrapped in cotton, placed in a refrigerator, and examined as soon as possible. By then most of the hematophagous ectoparasites will have left the skin, been entrapped by the cotton, and be readily visible thereon. The non-blood-suckers usually remain attached to the skin and feathers. Examination of the specimen should be conducted near a closed window in a strong light and under a binocular microscope. The feathers should be carefully turned back with forceps for inspection. Hippoboscids tend to fly toward the light and will thus be easily captured. The eyes, ears, head, back, legs, tail and wings (in particular the under surface of the remiges and under wing coverts) should be examined systematically. Special attention should be given the ventral body feathers and skin, especially around the vent. The roof of the mouth should be cut so as to expose the turbinals for possible nasicolous mites. The parasites may be removed with fine forceps (mites, with a fine needle previously dipped in alcohol) and preserved in 70% alcohol. Temporary or semipermanent microscopic preparations may be made in PVA-lactic acid medium (Pratt and Lane, 1949), or, if the ectoparasites are delicate and lightly chitinized, in chloral hydrate gum-arabic medium (Doetschman, 1944). Permanent preparations may be made by subjecting the latter to heat, and by soaking the former in water, then proceeding in the usual manner for mounting arthropods.

The Mallophaga (suborders Amblycera and Ischnocera) are obligatory parasites: their life cycle must be spent entirely on the host. Their metamorphosis is incomplete. The forms which parasitize birds lay their eggs on feathers. The author has observed that the eggs of at least ten species (six genera) are distinctive with respect to size, shape, cap pattern, and position and method of attachment. Females probably remain fertile for life (one female was observed to lay fertile eggs for a period of 30 days after her mate had died). In general, the Amblycera possess squat bodies, are quick runners, are usually found between the skin and the quill, and often have red intestines, indicative that blood makes up part of their diet (Boyd, 1951). The Ischnocera have relatively narrow bodies, their intestines are never red, and they are usually found clinging to their source of food, the feathers themselves. Recent taxonomic studies of lice, particularly those of game birds, have been undertaken by Emerson (1950). The distribution of Mallophaga on the host is often characteristic for each species of louse. Thus on the Common Crow (*Corvus brachyrhynchos*), *Degeeriella rotundata* and *D. secondaria* occur on the flight feathers, while *Myrsidea interrupta* and *Philopterus corvi* are confined to the plumage of the breast (Morgan and Waller, 1941).

The other insects parasitizing birds and also having incomplete metamorphosis are bugs of the order Hemiptera. They resemble their close relative the bedbug in habit, except that they live in birds' nests rather than in human dwellings. Species of bugs have been collected from nests of the Chimney Swift (*Chaetura pelagica*), from nests of certain swallows (Hirundinidae), and from henhouses.

Fleas undergo complete metamorphosis and the larvae are non-parasitic. Since their immature stages are associated also with the homes of the respective hosts, it is not surprising to find fleas in birds' nests. The flea most commonly found thus is *Ceratophyllus gallinae.*

Hippoboscid flies are also obligatory parasites. They die usually within two or three days when removed from the host. Peters lists seven genera parasitizing birds. The three commonest species are *Ornithoica vicina*, *Ornithomyia fringillina* (syn. *O. anchineuria*), and *Lynchia americana*, the first two infesting mainly passerines. *Ornithoica vicina* has been recorded from at least 27 passerines, especially the Song Sparrow, and also from owls, hawks, the Mourning Dove (*Zenaidura macroura*), and Downy Woodpecker (*Dendrocopos pubescens*). Very similar to this species is *O. confluenta* from wading birds. About double the size of *Ornithoica vicina*, and brown to dark green, is *Ornithomyia fringillina*, which has been found on 30 passerines, principally the Cowbird (*Molothrus ater*) and Red-wing (*Agelaius phoeniceus*), and also on the Marsh Hawk (*Circus cyaneus*), Downy Woodpecker, and Bob-white. Herman (1937) states that it is unusual to collect a Cowbird in August that does not harbor at least one *O. fringillina*. Five species of *Lynchia*, all much larger than those of the two previous genera, have been recorded from avian hosts. *L. americana* occurs on eagles, hawks and owls, as well as on the Egret (*Casmerodius albus*) and Ruffed Grouse (*Bonasa umbellus*). Hippoboscids have been collected between April and November, the majority in July and August. They attack more juveniles than adults—89% juveniles and 11% adults in an instance reported by Thompson (1940). The parent fly probably dies after giving birth to its two larvae, which almost immediately pupate. The insects apparently winter-over as puparia in the hosts' nests. (Dr. J. C. Bequaert of Harvard University desires specimens of this family for his collection. The data should include, of course, a careful identification of the host.)

Dipterous larvae that attack nestlings include those of the calliphorid genera *Protocalliphora* and *Apaulina*. The adults are blowflies. They lay their eggs in birds' nests up until the time the nestlings are half grown. Typically, the larvae are nocturnal and feed intermittently, attacking the legs, base of the primary feathers, and rarely the crown or ear cavity. Pletsch (1948) reported that they occur on or in wounds of the body or head and even in the nasal cavity. Species of *Apaulina* have been found on the abdomen and in the ear but also embedded beneath the skin (George and Mitchell, 1948). When ready to pupate they seek a quiet part of the nest or leave it altogether. They probably winter-over as adults.

Ticks (larvae, nymphs and adults) are completely hematophagous and tend to attack the head of the host, especially the eyes. Their egg production is enormous. Most of them are able to winter-over at any stage if unfed; many, such as the fowl tick *Argas persicus*, can survive three to four years without a blood-meal. They may remain on one host or attack two, three, or many hosts throughout their life history. The majority are 'three-host ticks,' e.g., the common rabbit tick, *Haemaphysalis leporis-palustris*. The Argasidae are many-host ticks with bedbug-like habits. A bird may act as host to ticks in larval, nymphal or adult stages. One of the more unusual life cycles is that described by Baerg (1944) for *Ixodes baergi*. This animal lives on nestling Cliff Swallows (*Petrochelidon pyrrhonota*). Since male ticks have been found still attached to engorged females, mating probably occurs after the female has deserted the host and is on her way to the egg-laying site. The larvae are 'on hand' in the nests when the swallows return in April. For identification of ticks, the reader is referred to the monographic series on New World ticks prepared at the Rocky Mountain Laboratory by Cooley and Kohls (1945). In these and other works, the following forms are reported from birds: *Ixodes* (14 species); *Ornithodorus* (4 species); *Amblyomma* and *Haemaphysalis* (3 species each); *Argas* and *Dermacentor* (2 species each). *Ixodes brunneus* is the commonest, having been collected from at least 64 species of birds.

Parasitic mites vary greatly in habits. Avian mites belong to the superfamilies Parasitoidea, Trombidoidea and Sarcoptoidea. Among the Parasitoidea are numerous forms that live on bird as well as mammalian blood (Strandtmann, 1949). The two commonest bird species are the chicken mite, *Dermanyssus gallinae*, and the northern fowl mite, *Liponyssus sylviarum*. Unlike the former, which is similar to the bedbug in habit, *L. sylviarum* remains on its host most of the time and lays its eggs either on or off the host. The larvae do not feed but molt into the nymph within a day; both the nymph and adult depend on blood and survive less than two weeks off the host, but in laboratory dishes live as long as 60 to 80 days at a temperature of 7° C. The hematophagous mites live on the bird's skin, on the wing, or in the vicinity of the vent, where their eggs are often to be found loosely attached to the calami or skin. Among the Parasitoidea are the Rhinonyssidae, which inhabit the nasal cavities of birds (Crossley, 1950; Strandtmann, 1951).

The Trombidoidea attack many parts of their hosts. The chiggers, larvae of the trombiculids, whose adults are free-living, are blood-suckers and attack the legs of birds and mammals (Wharton, 1947). Other forms spend their entire life among the feathers and on, or even in, the hosts' skin, e.g., *Harpyrynchus*, *Cnemidocoptes* and *Cheyletus* (Baker, 1949; Turk, 1950). Still others are resident in the nasal chambers of birds (Boyd, 1951). The Sarcoptoidea include the true plumicolous mites (Analgesidae and related families). These spend their entire lives in intimate association with the feathers, from which they derive their nourishment. Most forms live on the under surface of the remiges and under wing coverts, but in heavy infestations they spread to the general body plumage. Eggs are laid singly in the interbarb area with the long axis of the egg parallel to the barb. No species characters are discernible in the eggs.

The prevalence of parasitism is dependent on numerous factors including the activity of the host and the degree of host specificity exhibited by the parasites concerned. A heavily infested bird is apt to be a center for dissemination of ectoparasites to other animals. Birds may partly control vermin by means of dust and water baths, by preening, and possibly, as suggested by Groskin (1950), by 'anting.' Through observation and experimentation it has become evident that the bird's beak plays an important role in the control of ectoparasites (Boyd, 1951; Kartman, 1950). Fleas and Mallophaga have been found in the stomach contents of birds. A Starling (*Sturnus vulgaris*) with deformed bill and a Junco (*Junco hyemalis*) with the tip of its upper mandible missing were exceptionally heavily infested with lice. When preening is prevented or inhibited through experimental removal of part of the bill, lice increase enormously. Molting influences the abundance of ectoparasites in birds. A decline of vermin observed on Starlings in July and August coincided with their molt. Similarly, in ducks, a before-molt 100% infestation by the feather mite *Freyana anatina* dropped to 52% after the molt; and the mites on each bird dropped from 500–600 to 100 or less (Ginetzinskaya, 1942).

Temperature may be a factor controlling the incidence of ectoparasitism as well as distribution of the parasites on the host. The temperature of birds varies a few degrees during the day and in different parts of the body, but it may remain relatively uniform throughout the year provided the birds are able to control the amount of food intake as is the case for *Passer domesticus* (Seibert, 1949). On this host the monthly infestation of lice is consistent, but for some species of birds lice and plumicolous mites are less numerous in cold weather. Experiments by the author, using isolated feathers, have proved that low temperature reduces the longevity of lice, prolongs the incubation period of their eggs, and reduces their viability; on the other hand, a temperature of 7°C. merely lowers the metabolism of mites; the viability of their eggs remains unimpaired. Depending on the circumstances, therefore, lice and mites may winter-over in the egg stage on the host.

The degree of host specificity is slight for most parasitic bugs, fleas, ticks, and blood-sucking mites; that is, avian forms may frequently attack mammals, and mammalian forms, birds. Consequently the host-list for such parasites is usually large and varied. To cite two examples: the hen flea *Ceratophyllus gallinae* has been recorded for many birds as well as the chipmunk (*Tamias striatus*), while the rabbit tick *Haemaphysalis leporis-palustris* has been reported from 46 species of birds. Other avian ectoparasites infest only birds, and some of them infest only those belonging to the same order or family as that of their principal host. Mallophaga display marked host specificity: although the Cowbird is known to come in contact with some 158 species of birds through its egg-laying habit, the eight species of lice collected from numerous Cowbird skins are all typically parasitic upon the Icteridae (Ewing, 1933). In fact, classifications of birds have been based to some extent on a study of their parasites—in particular the Mallophaga and certain mites (Hopkins, 1942). The mite *Eupterolichus bicaudatus* is found only on the African Ostrich (*Struthio camelus*) and South American Rhea (*Rhea americana*).

Bodily contact is of prime importance in transmission of ectoparasites, especially among those with slight host specificity, and the habits of the bird have a marked bearing upon the matter. Parasitism by the tick *Ixodes brunneus* runs higher in migratory than in nonmigratory birds; and the same holds true for most hippoboscids. Similarly, Geist (1935) found louse infestations high on gregarious birds (61%) as compared with non-gregarious forms (41%)—particularly the large land birds (65.1%) as compared with aquatic Ciconiiformes, Anseriformes, Charadriiformes, and Gruiformes (57.7%) and small cuculiform, piciform and passeriform land birds (40.4%). Among passerines, incidence is heaviest in the gregarious Hirundinidae, Corvidae, Sturnidae, and Icteridae, and in the non-gregarious Laniidae and Vireonidae. The brooding of young and the roosting side by side of adults must certainly aid dissemination of parasites. This accounts for the interchange of parasites between the Starling and certain native American birds: the louse *Degeeriella nebulosa* on *Turdus migratorius*, the mite *Speleognathus sturni* on the Great-tailed Grackle (*Cassidix mexicanus*), and the icterid louse *Degeeriella illustris* on the Starling (Boyd, 1951). Predators and ground-feeding animals help in spreading numerous ticks and other ectoparasites. The Cooper's Hawk (*Accipiter cooperi*), Bob-white and other birds may, along with the horse, dog, cat, fox and many rodents, harbor the flea *Echidnophaga gallinacea*. Similarly may the presence on the Marsh Hawk of *Ornithomyia fringillina*, a hippoboscid ordinarily found on passerines, be accounted for.

Dispersal of parasites is probably at its peak during the nesting season. Ectoparasites tend to desert parent birds and to attack nestlings, and some are left in the nest when the young birds fledge. Position and type of nest play a part in the degree of parasitism. Low nests of the Cliff Swallow appear to be more susceptible to attack by the tick *Ixodes baergi* than high ones (Baerg, 1944). Mud-constructed nests and nests in holes are favorable abodes for parasitic bugs, fleas, hippoboscid flies and *Protocalliphora*, for the life cycle of these may be passed within the nest itself. The single finding of *Ornithomyia fringillina* on an adult Black-capped Chickadee (*Parus atricapillus*) was correlated with the parasitic nesting habit of the Cowbird, for this hippoboscid was collected also from two young Cowbirds in this particular chickadee's nest (Herman, 1937). The usurping of nesting-holes accounts for much interchange of ectoparasites. *Ceratophyllus fringillae*, a flea of the English Sparrow (*Passer domesticus*), has been found in nests of the House Martin (*Delichon urbica*) and Barn Swallow (*Hirundo rustica*). The hen flea *C. gallinae* has been collected from nests of the House Martin, Barn Swallow, Bluebird (*Sialia sialis*), Tree Swallow (*Iridoprocne bicolor*), and Starling, and also from the chipmunk. Peters reported the hippoboscid *Ornithoica vicina* not only from certain passerines but also from the Screech Owl (*Otus asio*) and Downy Woodpecker. The tick *Ornithodorus* *parkeri* has been taken from burrows of rabbits, nests of Burrowing Owls (*Speotyto cunicularia*), and directly from mice, as well as from man. Among the mites, *Atricholaelaps megaventralis* has been found on foxes, squirrels, many woodpeckers, the Starling and English Sparrow, and in nests of the Cliff Swallow.

Hippoboscids are believed by Herman to be unimportant as disseminators of Mallophaga, though such dissemination has been reported repeatedly. Other factors determining host-parasite relationships are the mechanical limitations of the host and the availability of food provided by the host. Eichler (1939–40) demonstrated that the presence of certain lice and mites may depend upon the dimensions of the various components of feathers and hair. A certain louse has been successfully reared on isolated feathers of its own host, but not on feathers from a different species of bird.

Serious harm may be inflicted on animals by infestations of ectoparasites. Their irritating presence produces a rundown condition in the host, lowering its resistance to disease, and skin lacerations caused by them may act as portals of entry for bacteria. In poultry and other birds parasites may decrease egg-production. Deplumation may result from presence of itch mites (e.g., *Syringophilus bi-pectinatus* and *Microlichus avus*), blood-sucking mites (*Dermanyssus gallinae* and *Liponyssus sylviarum*) and other vermin. Tumor formation around feather follicles may result from attacks of *Harpyrynchus* mites, and a condition of 'scaly leg' on legs and bill from attacks by six species of *Cnemidocoptes* (Turk, 1950). The host has been known to die in the act of swallowing, suffocated through pressure on the windpipe by a dipterous larva (*Apaulina hirundo*) buried in the dermis of the neck (George and Mitchell, 1948).

Animals may suffer seriously from anemia as a result of haematophagous parasites. Anemia in birds may be caused by ticks, blood-sucking mites, Mallophaga, fleas, hippoboscid flies, or dipterous larvae. Death of fledglings from infestations of *Protocalliphora* has been reported repeatedly. A Great Horned Owl (*Bubo virginianus*), believed to have been too weak to hunt normal prey because of a heavy infestation of over 100 hippoboscids, attacked domestic turkeys. The tick *Ixodes brunneus* may be so voracious that the avian host becomes unable to fly and even dies. Webster (1944: 612) reported that 65% of young Prairie Falcons (*Falco mexicanus*) starved during their first month through weakness from tick attacks. Williams (1947) reported young raptors so heavily infested by *Ornithodorus aquilae* that their eyes were almost closed. *Ixodes baergi* appears to cause only slight damage to nestling Cliff Swallows, though as many as 18 have been taken from a single bird (Baerg, 1944). Baerg observed, however, that nestling Starlings reared in holes previously occupied that same year were heavily infested with mites.

Many disease-producing organisms are dependent on arthropods for transmission. Mosquitoes of the tribe Culicini are intermediate hosts for bird malaria, and experimentally *Anopheles* is also. Mosquitoes may transmit trypanosome protozoa and filarial nematode worms. The latter may be dependent on mites, since mites are the vectors for the *Filaria* of the cotton rat (*Sigmodon*). Certain species of hippoboscid and simuliid flies probably act as intermediate hosts for *Haemoproteus* and leucocytozoon protozoa respectively. Ticks such as *Argas persicus* and the mites *Liponyssus sylviarum* and *Dermanyssus gallinae* are known to transmit the spirochaete *Treponema gallinum*. This causes relapsing fever, fowlpox, or spirochaetosis. Mites may also transmit the bird protozoa, *Hepatozoon* and *Toxoplasma*, and the cholera-producing bacterium *Pasteurella*. Toxoplasmosis of birds may be identical to that of mammals. Tularemia is a bacteria-produced disease affecting rabbits and other warm-blooded animals including birds and man. Several species of ticks constitute the primary vectors of this bacterium. Of these, four genera, *Dermacentor*, *Amblyomma*, *Ixodes* and *Haemaphysalis*, have been collected from birds.

Some avian ectoparasites with slight host specificity have been known to attack man. Various bugs at times desert birds' nests and invade human dwellings. The chicken mite and northern fowl mite may cause dermatitis in human beings. Some ectoparasites that are carriers for disease-producing organisms in humans may attack avian hosts. Birds may harbor the immature stages of ticks responsible, as vectors, for Rocky Mountain spotted fever, Bullis fever and relapsing fever. The reservoir for Tsutsugamushi disease, common in certain parts of the world, may be increased through avian mites, while the virus for equine and St. Louis encephalomyelitis has been isolated from the chicken and northern fowl mites. Bacterial plague may be spread through infected fleas attacking vultures as they devour their prey. In this manner, birds, on occasion, may indirectly aid in the prevalence of certain human diseases through increasing the animal reservoir of the particular micro-organism involved.

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Report of Treasurer for 1950

Balance as shown by last report, dated December 31, 1949	$ 244.04	

Receipts

Dues:		
Associate	1,464.50	
Active	2,033.00	
Sustaining	770.00	
Subscriptions to "The Wilson Bulletin"	217.95	
Sale of back issues and reprints of "The Wilson Bulletin"	552.90	
Interest on bonds	155.36	
Transferred from Endowment Fund (Special Fund, interest, etc.)	34.43	
Contributions to Library Book Fund	20.54	
Gifts; miscellaneous	306.68	
Total receipts		$5,799.40

Disbursements

"The Wilson Bulletin"—printing, engraving, mailing	$3,265.92	
Purchase of back issues of "The Wilson Bulletin"	99.30	
President's expense—printing, postage	19.53	
Editor's expense—reprints, postage, secretarial aid	156.09	
Secretary's expense—stationery, postage, clerical aid	102.20	
Treasurer's expense—stationery, postage, clerical aid	285.49	
Membership Committee expense—postage, printing	186.15	
Endowment Committee expense—postage, printing	2.40	
Dues to International Committee for Bird Preservation	10.00	
Annual Meeting expense	108.15	
Bank charges, foreign exchange, corporation papers, and miscellaneous expenses	3.30	
Total disbursements		$4,238.53
Balance on hand in The Worthington Savings Bank, Worthington, Ohio, December 31, 1950		1,560.87
		$5,799.40

Endowment Fund

Cash balance in Savings Account December 31, 1949		$ 637.72
Received during year:		
Interest on U. S. Bonds and on Savings Account	$ 155.36	
Life Membership Payments	750.00	
		905.36
		$1,543.08

Disbursed during year:

Purchase of U. S. Savings Bonds—Series "F", dated April 1, 1950.	$ 740.00	
Transferred to checking account (Special Fund, interest, etc.)....	34.43	
Louis Agassiz Fuertes Research Grant payment................	100.00	874.43
Balance Cash in Savings Account December 31, 1950....................		$ 668.65

*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)..	961.00	
U. S. Savings Bonds, Series "G", dated September 20, 1944 (maturity value $1,500.00)....................................	1,432.50	
U. S. Savings Bonds, Series "G", dated June 1, 1945 (maturity value $500.00)..	476.00	
U. S. Savings Bonds, Series "G", dated July 1, 1945 (maturity value $900.00)..	856.80	
U. S. Savings Bonds, Series "G", dated October 1, 1945 (maturity value $1,400.00)..	1,328.60	
U. S. Savings Bonds, Series "F", dated February 1, 1947 (maturity value $2,000.00)..	1,534.00	
U. S. Savings Bonds, Series "F", dated April 1, 1948 (maturity value $2,000.00)..	1,508.00	
U. S. Savings Bonds, Series "F", dated October 1, 1948 (maturity value $1,450.00)..	1,086.04	
U. S. Savings Bonds, Series "F", dated April 1, 1950 (maturity value $1,000.00)..	740.00	
Total, securities owned*		$10,702.94
Total Endowment Fund..		$11,371.59

* Bonds carried at redeemable value December 31, 1950.

In reserve:

Louis Agassiz Fuertes Research Grant Fund (special gift).......	$ 225.00
S. Morris Pell Fund (special gift)...........................	75.00

Respectfully submitted,
JAMES H. OLSEN, *Treasurer*

December 31, 1950
Approved by Auditing Committee:
LEONARD C. BRECHER
BURT L. MONROE
R. ALLYN MOSER

Announcement of Annual Meeting

Note: This is the official announcement of the annual meeting. No individual letters of announcement will be mailed, but, as in the past, the completed program will be sent to members a short time in advance of the meeting.

Place and time. The Thirty-third Annual Meeting of The Wilson Ornithological Club will be held in Gatlinburg, Tennessee, Friday and Saturday, April 25–26, 1952. Headquarters will be at the new Greystone Playhouse, adjacent to the Greystone Hotel in Gatlinburg. On Thursday evening the Executive Council will meet. On Sunday, April 27, there will be organized field trips.

Gatlinburg and how to reach it. Gatlinburg is on the northern border of the Great Smoky Mountains National Park. For those driving to the meeting, it may be reached by highways from Sevierville or Maryville, Tenn., or Cherokee, N. C. By bus it may be reached via Knoxville, Tenn., or Asheville, N. C. The nearest train and plane terminal is Knoxville, from which Gatlinburg may be reached by the Trailways Bus Company.

Gatlinburg is primarily a tourist town, serving visitors to the Great Smoky Mountains National Park. It is famous as a center of mountain crafts and hand industries.

The Greystone Playhouse. All sessions will be held in this new auditorium, site of the 1951 Governors' Conference.

Sessions. Sessions will be held on Friday and Saturday. Because of the exceptional attractions of the area, morning sessions will not begin until 10:30 to permit short field trips each day.

Special Events. On Friday evening there will be a short program at the Playhouse, followed by an informal get-together.

At 4:30 on Saturday afternoon there will be a demonstration of pottery making by Douglas Ferguson at the Pigeon Forge Pottery. This will be held at the Mountain View Hotel, and will be accompanied by a display of mountain crafts.

The Annual Dinner will be held in the Greystone Playhouse at 8 o'clock Saturday evening. It will be served buffet style by the Greystone Hotel, well known in this region for its good food. This will be followed by entertainment and the President's address.

Meeting of the Council. The meeting of the Executive Council will be held at 7:30 p.m., Thursday, April 24, at the Greystone. The secretary requests that the chairmen of the standing committees send their written reports to him by April 15 so that these may be discussed by the Council. Chairmen are invited to present their reports in person at the Council Meeting.

Accommodations. The Gatlinburg Chamber of Commerce will send out to the Wilson Club membership by early April a folder describing the accommodations available. This will be accompanied by a folder describing the Great Smoky Mountains National Park and its camping facilities. All hotels are within easy walking distance of The Greystone Playhouse, as are the following tourist courts: Bearskin Cottages, Conner's Motel, Cooper Court, Edgepark Motel, French Village Cottages, Huff's Tourist Court, Laurel Springs Cabins, Park Tourist Court, Rocky Waters Court, Zoder's Court. All members are urged to write directly to the hotel or tourist court for reservations.

Field Trips. On Sunday there will be field trips to two general regions, one to the high-altitude spruce-fir forest in the vicinity of Newfound Gap and one to the low altitudes of Cade's Cove and the Giant Forest. On Friday evening, weather permitting, there will be a special trip to Newfound Gap and beyond for the chance of hearing the Saw-whet Owl's song. There will be a short field trip in the vicinity of Gatlinburg early Saturday morning.

Hosts. The host organizations for this meeting are the Tennessee Ornithological Society, the Carolina Bird Club, and the Georgia Ornithological Society. The chairman of the local committee is Arthur Stupka, Gatlinburg.

Application for a Position on the Program

Members who have not yet published on their research, or who have motion pictures or slides of special interest, are urged to apply for a place on the program. Papers will be selected for their timely interest and their contribution to ornithology. In selecting papers, the Secretary will be assisted by the Local Committee and by other officers of the Club. Members who have nothing themselves to present may be able to suggest outstanding papers which the Secretary can secure for this meeting.

If you would like to appear on the program at Gatlinburg, please write to the Secretary, Harold F. Mayfield, 2557 Portsmouth Ave., Toledo 13, Ohio, not later than March 1, 1951. Please note that no more than one paper may be presented by any one member. A paper accompanied by motion pictures must not exceed 30 minutes. A paper accompanied by slides must not exceed 20 minutes. A paper without pictures must not exceed 15 minutes. A limited time for discussion will follow each paper.

In writing the Secretary, please supply *all* of the following information:

1. *Title of paper.* Give the title exactly as you want it to appear on the program.

2. *Abstract.* Prepare an abstract of your paper—brief, but sufficiently complete so that it may be used by the Local Committee for publicity and by the Secretary in preparing the meeting's proceedings.

3. *Time required.*

4. *Position.* State if it is essential that you appear at a particular time.

5. *Special equipment needed.* Blackboard, map hanger, pointer, etc.

6. *Motion pictures.* If your paper is to be illustrated with motion pictures give the following information: Size (16 mm. or 35 mm.). Color or black-and-white. Total footage. Number of reels. Size of reels.

7. *Slides.* If your paper is to be illustrated with slides, give the following information: Size ($3\frac{1}{4}''$ x $4''$, or $2''$ x $2''$). Color or black-and-white. Number of slides.

8. *Name.* Please write your name exactly as you wish it to appear on the program. Titles before names will not be used.

9. *Address.* Include the name of the institution with which you are associated, if any. The name of this institution will appear after your name on the program.

INDEX TO VOLUME 63, 1951

BY ESTHER BYERS

This index includes references to the following topics: abnormalities, adaptation, age determination, anatomy, banding, breeding behavior, brooding, cowbird parasitism, display, ecology, egg laying, endocrinology, food, fighting, fledging period, genetics, histology, hybridization, injury feigning, internal parasites, migration, mortality, nest building, nesting success, photoperiodism, physiology, population cycles, range extension, sexual cycles, territorialism, voice, and localities (states, provinces, countries). A notable feature is the names of numerous avian ectoparasites.

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. Use figures for all definite weights, measurements, percentages and degrees of temperature (for example: 2 kgm., 1 inch, 20.5 cc., 300°C.). Spell out indefinite and approximate periods of time and numerals used in a general manner (for example: one hundred years ago; about two and one-half hours; seven times). 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. Follow carefully the style used in this issue in listing, after the paper, 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.

NOTICE OF CHANGE OF ADDRESS

If your address changes, notify the Club immediately. Send your complete new address to the Treasurer, Leonard C. Brecher, 1900 Spring Drive, Louisville 5, Kentucky. He in turn will notify the publisher and editor.

PAST PRESIDENTS
OF
THE WILSON ORNITHOLOGICAL CLUB

J. B. Richards, 1888–1889
Lynds Jones, 1890–1893
Willard N. Clute, 1894
R. M. Strong, 1894–1901
Lynds Jones, 1902–1908
F. L. Burns, 1909–1911
W. E. Saunders, 1912–1913
T. C. Stephens, 1914–1916
W. F. Henninger, 1917
Myron H. Swenk, 1918–1919
R. M. Strong, 1920–1921
Thos. L. Hankinson, 1922–1923
Albert F. Ganier, 1924–1926
Lynds Jones, 1927–1929
J. W. Stack, 1930–1931
J. M. Shaver, 1932–1934
Josselyn Van Tyne, 1935–1937
Mrs. Margaret Morse Nice, 1938–1939
Lawrence E. Hicks, 1940–1941
George Miksch Sutton, 1942–1943
S. Charles Kendeigh, 1943–1945
George Miksch Sutton, 1946–1947
Olin Sewall Pettingill, Jr., 1948–1950
Maurice Brooks, 1950–

THIRTY THIRD ANNUAL MEETING
GATLINBURG, TENNESSEE, APRIL 25–26, 1952

In order to give members more time in the field, morning papers sessions will begin at 10:30 o'clock. The Great Smokies will be beautiful in late April. Every member should plan to attend. Complete details in this issue.

Date Due

~~APR 30 1958~~	
~~Recorde 4/72~~	