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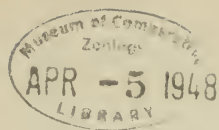
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# THE WILSON BULLETIN

A Quarterly Magazine  
of  
Ornithology

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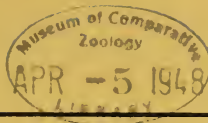
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## THE WILSON BULLETIN

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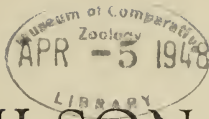
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ARIZONA JUNCO

*Junco phaeonotus palliatus*

## ARIZONA JUNCO

BY ROGER TORY PETERSON

DURING May 1947, while in the Chiricahua Mountains of southeastern Arizona, I was the guest of Herbert Brandt, who was making an intensive study of that area for his forthcoming book, "Arizona Bird Life." At an altitude of eight thousand feet the little rusty-backed, yellow-eyed Arizona Juncos (*Junco phaeonotus palliatus*) were our constant companions, and I could not resist painting a portrait of one for *The Wilson Bulletin* (Frontispiece).

This junco is restricted to the mountains of southeastern Arizona, southwestern New Mexico, and the adjacent area of Mexico. It is apparently completely sedentary, not making even altitudinal migrations.

There has been much discussion by systematists on the relationships among the various juncos. Some contend that there is no biological basis for specific separation of the *oreganus* and *hyemalis* groups and that it has been demonstrated that the gap between the two is bridged by the Cassiar Junco—*cismontanus*. They suggest also that most of the other juncos could probably be lumped with this one plastic group, but they are hesitant about including the Arizona Junco—and understandably so.

In addition to the bright yellow eye and pale yellow lower mandible that distinguish these little juncos of the desert mountains from all the other juncos of the United States—even from the neighboring Red-backed Junco, *dorsalis*, the Arizona Junco has characteristic and unmistakable traits of behavior. Whereas the Oregon Junco, *J. oreganus*, and the Slate-colored Junco, *J. hyemalis*, sing songs that to my ears are nearly identical, a single trill on one pitch, similar to the Chipping Sparrow's song, though less rapid and more musical, the Arizona Junco has a more complicated finch-like song, which involves two and sometimes three pitches—for example: *chip chip chip, wheedle wheedle wheedle, che che che che che*.

Furthermore, the Arizona Junco *creeps* along in strange mouse-like fashion. I have never seen it hop, whereas other juncos habitually hop. Alexander Wetmore tells me that he once saw a Carolina Junco (*Junco hyemalis carolinensis*) creep in this manner, but in my experience it is not characteristic behavior either for the Carolina or for any other of our juncos except the Arizona bird.

GLEN ECHO, MARYLAND

SOCIAL RELEASERS AND THE EXPERIMENTAL  
METHOD REQUIRED FOR THEIR STUDY<sup>1</sup>

BY N. TINBERGEN

## PART 1: REVIEW

SOME years ago, Dr. Rand (1941, 1942) published two short papers in which he criticized some of the hypotheses and conclusions of Lorenz (1935 and 1937), especially the releaser concept. Discussing my paper (1939b) on vertebrate social organization, Dr. Rand (1942:404) goes as far as to argue that "the data available hardly justify" me in assuming *even as a working hypothesis* a social, communicative function for conspicuous and highly specialized structures whose participation in non-social processes cannot be found. Though I am in complete agreement with Dr. Rand when he stresses the need for further experimental research on the function of conspicuous structures and movements, I cannot agree with his statement that "the probable existence of releasers has not been clearly demonstrated in any cases" (Rand, 1941:289). This astonishing statement can be explained only by assuming that a number of experimental facts published in American and European journals have escaped Dr. Rand's attention. In order to make these facts better known, it seems worth while to give, as the first part of this paper, a short review of the experimental and other evidence on releasers.

In addition, the experiments reported by Rand in his 1942 paper, which tend to show that the anal feather circling in nestling passerine birds does not function as a releaser, are not, in my opinion, conclusive (though I admit that they are useful as a warning against over-simplistic views). Therefore, in the second part of this paper, I shall discuss some general problems connected with the kind of experiments required in work of this type.

The releaser concept has sometimes been misunderstood even though Lorenz has given a clear definition of it. Rand (1941:289) is confusing matters considerably when he assumes that a releaser in Lorenz's sense is "that portion of the object which sends out the stimuli to which the bird responds." The cause of this misunderstanding lies in the paradoxical fact that not everything that releases a response is a "releaser" in Lorenz's sense.

A number of experimental studies on the nature of the external sensory stimuli necessary to release innate responses have shown that innate behavior is never a reaction to the environmental situation as a whole, but only to a few parts of it. Other parts—although they may be received by the animal's sense organs—are entirely ignored. This is not

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<sup>1</sup> Extension of an address delivered at the Annual Meeting of the Wilson Ornithological Club, Omaha, Nebraska, November 29, 1946.



the place to give a complete review of the pertinent facts, and I must refer the reader to the literature, especially to Lorenz (1940), to Russell's compilation (1943), and to my own paper (1942).

To cite a few examples: The escape reactions of many birds from passing birds of prey are a response to a type of movement and to a special characteristic of shape, namely, "short neck" (Figure 1); any



Figure 1. Cardboard models used by Lorenz and Tinbergen to test the reactions of birds to birds of prey. Only the models with a short neck (marked +) released escape reactions.

bird, or even a cardboard dummy, that has a short neck releases an escape response independently of the shape of wings, tail, etc., and of the color (Goethe, 1937b; Krätzig, 1940; Lorenz, 1940). The hunting response of a pike can be released by a shining silvery object pulled through the water. Gulls and many other ground-breeding birds will show incubation responses to many objects other than eggs, provided they have rounded shapes (Kirkman, 1937; Lorenz and Tinbergen, 1938; N. Tinbergen and Booy, 1937); size or color can be varied within very wide limits. Russell (1943) called these influential stimuli (the parts of the environmental situation to which innate behavior patterns respond) "perceptual signs" or "perceptual clues," but for various reasons I prefer the term "sign stimuli."

It should be emphasized that it is only *innate* behavior that is dependent on sign stimuli; as I will show below, many if not all *conditioned* reactions are dependent on quite another type of stimulus situation.

So far as we know at present, every unconditioned reaction of an animal is dependent on its own special sign stimuli, and different reactions respond to different sign stimuli. This shows that the release of every unconditioned reaction is dependent on a special central nervous mechanism, which is called the "innate releasing mechanism."

Lorenz (1935) put forward the theory, based on an unrivaled amount of observational facts, that in animals intraspecific social relations are dependent to a large extent on stimuli sent out by one individual (the "actor") releasing responses in another individual (the "reactor"). As a result of evolutionary adaptation, many species have developed special structures or movements that serve to send out stimuli especially adapted to act on innate releasing mechanisms of

the same species. It is these special structures, the exclusive function of which is to send out sign stimuli releasing social responses, that were called releasers ("Auslöser") by Lorenz.

To use Lorenz's own words: "The means evolved for the sending out of key stimuli may lie in a bodily character, as a special color design or structure, or in an instinctive action, such as posturing, 'dance' movements, and the like. In most cases they are to be found in both, that is, in some instinctive acts which display color schemes or structures that were evolved exclusively for this end. All such devices for the issuing of releasing stimuli, I have termed *releasers* (*Auslöser*), regardless of whether the releasing factor be optical or acoustical, whether an act, a structure or a color" (1937:249).

In the original German paper (Lorenz, 1935), of which the article in the 1937 *Auk* is only a much condensed version, the concept of the releaser is still more clearly defined: "I have used the term releasers for characters which are peculiar to individuals of a given species and to which responsive releasing mechanisms of conspecific individuals react and thus set in motion definite chains of instinctive actions" (p. 143). And again (p. 377): "Structures and instinctive actions that serve exclusively to send out key stimuli reach a high degree of specialization, paralleling the evolution of the correlated responsive mechanisms. We have called such structures and instinctive actions, for brevity's sake, releasers."<sup>2</sup> The starting point of Rand's criticism is, therefore, a misrepresentation of the basic definition.

As I said before, Lorenz's theories were interpretations of observational data, and although they appealed at once to the majority of field observers, experimental tests were highly desirable. As I hope to show, the experimental facts thus far obtained have confirmed Lorenz's views on the two main points: (1) intraspecific social relations in many animals are largely dependent on innate behavior, and (2) innate social responses are dependent on the display of releasers.

#### EXPERIMENTS ON VISUAL RELEASERS

Visual releasers have been investigated not only in birds, but also in lizards, fish, and cephalopods. It is well, therefore, not to confine ourselves exclusively to birds, and, since my own experimental work has mostly centered on a fish that has a number of well-developed releasers of different kinds, this fish will serve as my first example.

<sup>2</sup> "Merkmale, die dem Individuum einer Tierart zukommen und auf welche bereitliegende Auslöseschematen von Artgenossen ansprechen und bestimmte Triebhandlungsketten in Gang bringen habe ich . . . als Auslöser bezeichnet" (p. 143). And again (p. 377): "Organe und Instinkthandlungen die ausschliesslich der Aussendung von Schlüsselreizen dienen, erreichen eine hohe Spezialisierung, stets parallel mit der Entwicklung entsprechender, für sie bereitliegender aus[zulösender Schematen. Wir bezeichnen solche Organe und Instinkthandlungen kurz als Auslöser."

*The three-spined stickleback.* This stickleback (*Gasterosteus aculeatus*) displays visual releasers of movement, form, and color. Experiments on the function of these releasers have been published by Ter Pelkwijk and Tinbergen (1937) and by N. Tinbergen (1939b, 1940, 1942).

The male stickleback isolates himself in spring, develops a nuptial dress of whitish-blue on the back and brilliant red on throat and belly, selects a territory which it defends against other males, builds a kind of nest, and entices a female to enter the nest and spawn.

The red belly acts as a releaser both to other males and to females. To a male any fish with a red belly is a rival, that is to say, it elicits flight in a male that is outside its own territory and evokes attack in any male that is on its own territory. This is demonstrated by a series of experiments of which the crucial ones may be summarized here.

Two series of models of sticklebacks were prepared, each containing dead sticklebacks and more or less schematic models. The models of series "R" were red on the ventral side; those of series "N" were the neutral color of a male in the non-breeding season and of females throughout the year (silver, with a dark greenish-black dorsal shading).



Figure 2. Two models of the R series (left) and a model of the N series (right) for testing the releasing power of the stickleback's red belly. After N. Tinbergen, 1947.

Experiment 1 consisted of bringing a model into an occupied territory for a fixed period. This was done in over 20 territories, and the models were presented in irregular order with due intervals between. Models with a red belly were attacked much more intensely than neutral models.

In Experiment 2 a model was placed in a territory from which the owner had been removed, and the behavior of the neighboring male stickleback in the same tank was watched. A neighbor-male always tries to intrude in a territory as soon as the owner is removed. All R models could appreciably retard the intrusion whereas N models had scarcely any influence.

The females' reactions were tested by trying to induce them to follow a model. In this we succeeded only when playing the models of Series R; no reaction, except occasional avoidance, was obtained with Series N.

A glance at the R and N models (Figure 2) suffices to show that the exact form has little influence, if any at all; models of most realistic form but devoid of red (Series N) had little or no releasive value.

In boundary disputes, a male stickleback often shows a special threatening movement: standing nearly vertically with his head pointing downward, his broad side turned to the rival and (often) the ventral spine on that side erected, he thrusts his snout into the bottom with abrupt jerks (Figure 3), a movement that can easily be imitated



Figure 3. Male stickleback threatening reflection in mirror. Note the unilateral display of the ventral spine. Photo by N. Tinbergen.

with a model. In a group of tests with models from both the R and the N series, each model was presented alternately in threatening posture and in normal swimming position, both in the situation of Experiment 1 and in that of Experiment 2 described above. A "threatening" model, whether from the N or from the R series, had more influence than a model in horizontal position. Also, a male taken from his territory was returned as a captive in a glass tube before the neighbor had trespassed. The neighbor was much more intimidated when the owner was presented in a wide tube that allowed him to perform the threat motion than when he was confined in a narrow tube that forced him to stay in the neutral, horizontal position (Figure 4 A).

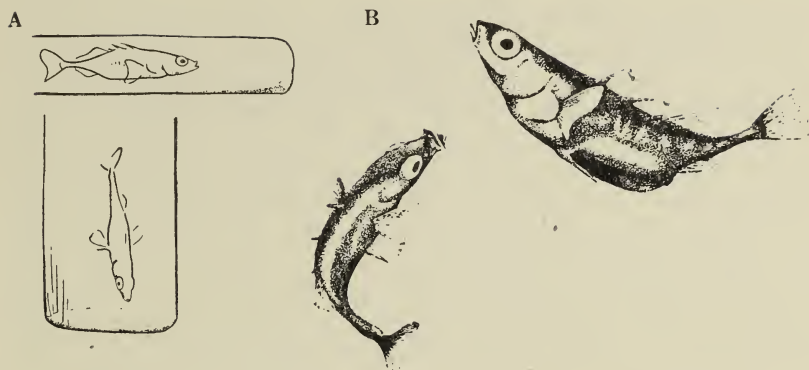


Figure 4. A, Tube-test for studying the influence of the threat posture in the stickleback. B, Courtship of the stickleback. Male below; female above. After Ter Pelkwijk and Tinbergen, 1937.

Another signal-movement is the "attitude of readiness" in the pregnant female (Figure 4 B), and the influence of this posture was also tested with models. A male can be induced by a rather crude model to take the lead and show the nest opening, provided that the model is presented in the right posture. Even dead fish of other species may be effective (Figure 5 A). The great importance of the *type* of movement or posture is well illustrated by the fact that it has been possible to induce either fighting or leading with the same model simply by presenting it either head down (which induces fighting) or head up (which induces leading). However, posture, or movement, is not the only signal for leading: shape is of no influence whatever

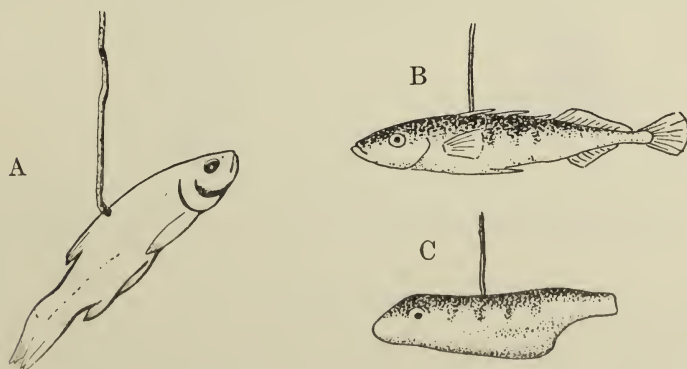


FIGURE 5. A, Dead tench, presented in courtship posture of the female stickleback to release the male's courtship. After Ter Pelkwijk and Tinbergen, 1937. B, Dead stickleback with normal abdomen. C, Crude dummy with swollen abdomen. After N. Tinbergen, 1942.

in releasing the male's fighting behavior, but for courting or leading, the swollen abdomen of the pregnant female has a strong releasing power—as demonstrated by comparing the influence of neutral models with that of “pregnant” models. It has even been possible to change live males into “pregnant” animals by excessive feeding, which caused the abdomen to swell to such an extent that not only the human observer but also the courting male sticklebacks mistook them for females. The relative unimportance of other particulars of form was also shown by comparing the influence of a dead stickleback (Figure 5 B) having a neutral abdomen with a highly simplified model having a swollen abdomen (Figure 5 C). Males invariably courted the “pregnant” dummy, while the dead stickleback affected them little.

The releasing mechanisms of these reactions are all innate. A male that was reared in isolation and built a nest was tested with models before it had ever seen another stickleback. The red belly, the threatening posture of a “male,” the upright posture of a “female,” and a “female's” swollen abdomen had the same releaser functions as in the experiments with normal males.

All these results exactly fit the original releaser theory as outlined by Lorenz.

*The English Robin.* Lack's results (1943) with the English Robin (*Erithacus rubecula*) show surprising parallels with our stickleback work. The red breast evokes furious attacks in any robin holding territory. It is by far the most effective of all the morphological characteristics of the bird. A mere bundle of red breast feathers is

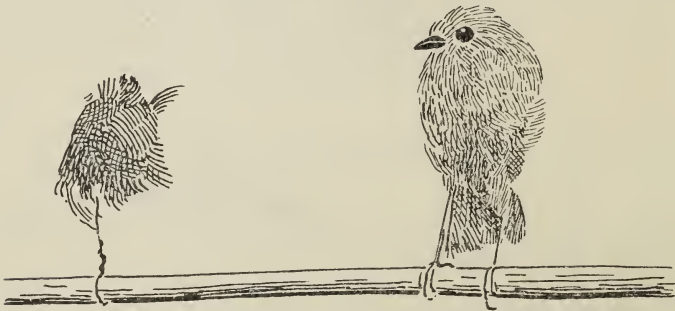


Figure 6. Tuft of red feathers (left) and complete mounted young robin (right).  
After Lack, 1943.

attacked, whereas a complete mounted young robin, having a spotted brown breast instead of a red one, is ignored (Figure 6). The red breast is a releaser just as the stickleback's red belly is, although the function of the releaser is not the same in the two cases, since, in the robin, both male and female have a red breast.

*The Flicker.* Noble (1936) studied the releasing value of the "moustache" of the male Flicker (*Colaptes auratus*). Male and female of a pair in his garden readily distinguished between a mounted male and a mounted female, which shows that morphological characters, though perhaps not necessarily the only means of recognition, were sufficient. When the female of the pair was given an artificial "moustache" by gluing black feathers on the area which the moustache occupies in the male, the female was vigorously attacked by her own mate. After removal of the moustache she was accepted again. It would be worth while to repeat and extend this experiment, but from Noble's descriptions of the male's behavior it seems certain that the moustache has an enormous influence on the male. It is not certain whether the male's response to the moustache is innate or learned. Noble thinks it is learned, but it is not clear on what evidence he bases this opinion.

*The Shell Parakeet.* The experiments of Cinat-Tomson (1926) with Shell Parakeets (*Melopsittacus undulatus*) are especially convincing. The color of the cere (Figure 7), brown in females and blue



Figure 7. Shell Parakeet. Arrow indicates cere, which is blue in males, brown in females. After N. Tinbergen, 1947.

in males, acts as a releaser. Females with cere painted blue are attacked by the males, males with cere painted brown are courted. It is not known whether these reactions are innate. The color of the cere is used as a recognition mark only in judging strangers—a bird recognizes its own mate, in spite of an artificial color change, as soon as it hears the mate's voice.

*The Herring Gull.* The red patch on the lower mandible of the Herring Gull (*Larus argentatus*) seems to be a releaser during feeding. Goethe (1937a) presented two stuffed Herring Gull heads to newborn chicks, two of which had been taken from the nest shortly after hatching, while two others were incubator-hatched. One of the gull heads had a bill in natural colors; in the other the red patch was painted yellow of the same shade as the rest of the bill.

In a number of tests the two first chicks pecked 66 times at the red patch and 26 times at the other model. The incubator-hatched chicks reacted 115 times to the red patch and 32 times to the other model. Moreover, Goethe (1937a) observed (as did Heinroth before him) that chicks will often pick at a variety of red objects such as cherries and red rubber soles.

These tests could well be extended; for instance, other colors could be presented, and the color patch could be put at the base of the bill, in order to determine whether the reaction is released by red only and whether the patch has guiding power, but Goethe's experiments proved the releasing value of the patch beyond doubt.

*Lizards.* Especially interesting work has been done with lizards. In addition to Evans' work (1938), lizards have been studied by Noble and Bradley (1933), by Kramer (1937), and by Kitzler (1941). In *Lacerta melisellensis* the male has a bright red belly; in *Sceloporus undulatus*, the male is blue underneath; *Lacerta v. viridis* has a blue throat in the male. In all three species, the colored underparts act as a releaser; females painted with the colors of the males evoke attack instead of mating attempts. However, in these cases it is not known whether the releasing mechanism is innate; Kramer suggests that it might not be.

Kitzler's work with *Lacerta agilis* and *L. v. viridis* contains a wealth of data on the functioning and the origin of releasers. Experimental proof of the releasing value of the male's secondary characters is given for both species. The blue throat of the male *viridis* has exactly the same function as the stickleback's red throat. A female with the throat painted blue is not only attacked by males, it attracts females. A male with its throat painted green (the female's throat color) is not chased even by the most aggressive male. A painted *agilis* male is treated as a rival by a male *viridis*. A crude yellow clay model with a blue throat is treated as a male *viridis* by both males and females.

Reviewing the results obtained with lizards, it is evident that the experiments should be supplemented. For instance, in Noble's work (Noble and Bradley, 1933) insufficient attention is given to the reactions of the female. In Kitzler's experiments we should like to know how the animals respond to models of other colors, etc. We should also like to know whether the releasing mechanism is innate or not. Nevertheless, in all these papers it is demonstrated clearly enough that the male's nuptial colors release responses in other males.

*Cichlid fish.* Valuable work has been done with cichlid fish of different species. Seitz (1940) showed that, in the sexually dimorphic species *Astatotilapia strigigena*, the male's fighting behavior is released when he is visually stimulated by another male. The releasing



stimulus situation is very simple, for the male fights against rather crude dummies provided that they are (1) laterally compressed, offering a large surface to the male, (2) glossy silver or blue, and (3) spotted with "jewels." Seitz also tested a male reared in isolation; its fighting response was evoked by exactly the same external situation as that of normal males, showing that the releasing mechanism of the fighting response is innate. On the other hand, the isolated male's courting response could also be evoked by very simple models, such as a silvery ball, whereas the normal males never courted any model at all, however accurate an imitation of the living female it might be. This proves that the releasing mechanism of the courting behavior is changed by conditioning. The female has no structures or movements that could be classified *a priori* as releasers. The splendid nuptial dress of the male, however, appears to be adapted to an innate releasing mechanism and acts as a releaser, a fact which could be predicted from the releaser theory.

In *Hemichromis bimaculatus*, the African jewel fish, male and female are not very different; both have a red nuptial dress and are spotted with "jewels." Seitz (1942) and Noble and Curtis (1939) showed that the red color is an important recognition mark to which both males and females respond, when in mating condition, by fighting and courting. Seitz tested the male's releasing mechanisms of fighting and courting; in both, special movements make sex-discrimination possible; a male will erect and display its fins, a female, after an initial display, has to "break down" and show a submissive attitude in order to be accepted as a female. The releasers on which sex-discrimination is founded, therefore, are not special morphological structures, but rather specialized movements, as could be expected in view of the similar (though not absolutely identical) coloration of the sexes. A further development of this sex-discrimination mechanism occurs during individual life: the fish learn to know their own mates individually; in other words, the releasing mechanism is made more specific by conditioning (Noble and Curtis, 1939).

*The cuttlefish.* The most striking demonstration of how far convergencies can go in these phenomena, is given by L. Tinbergen (1939) in his study of the mating behavior of the cuttlefish *Sepia officinalis*. Parallel with the development of eyes in cephalopods (convergent to those of fish) the courtship of the cuttlefish has evolved into a typically visual one closely resembling the courtship of certain sexually dimorphic fish, lizards, and birds.

A male *Sepia* in mating condition assumes a strongly variegated pattern of alternating white and dark purple bars, and displays the most conspicuous part, the broad, flattened lateral surface of the fourth arm, toward other individuals (Figure 8). Reactions of males

and females to this display differ essentially: a male returns the display, a female in mating condition keeps quiet and allows the male to copulate. A series of varied experiments with models showed that the male's nuptial colors, and especially the color and display



Figure 8. Male cuttlefish in neutral dress (upper) and in display (lower). After L. Tinbergen, 1939.

of the arm, released fighting in other males. The experiments did not determine whether the male's display acted on the female as a releaser. The males treated all models colored and "behaving" like females as if they were females.

This state of affairs closely resembles that found by Noble and Bradley (1933) in *Sceloporus*. In both species the male's display is primarily a means of threatening other males; in both species the stimulating influence on the female is apparently small. The male's nuptial dress is primarily a "gladiator's vestment" (Noble, 1934).

This review of experimental work, short as it is, shows that the releaser theory is not an "ideology" that has to be "accepted blindly" as Dr. Rand thinks. It is true that more experimental work is needed (though not to prove that releasers do occur, since that is clear). A further study of releasers will almost certainly give us an understanding of such diverse problems as the sociological structure of animal communities, the innate releasing mechanism, and last, though not least, the evolution of behavioral elements.

#### NON-VISUAL RELEASERS

*Auditory releasers.* There is good experimental proof of the releasing function of the chirping of crickets and grasshoppers. The

most spectacular experiment was carried out by Regen (1913), who kept males and females of *Gryllus campestris* in separate rooms in his house. The male's song was picked up in a telephone receiver which was connected with a loudspeaker in the females' room. Regen had the satisfaction of seeing the females jump right into the old-fashioned, trumpet-like loudspeaker.

So far as I know, no similar experiment has been carried out with birds. However, a number of simpler though nonetheless convincing experiments have been described in the literature, and "natural experiments" have been witnessed by every field ornithologist. Both natural and prearranged experiments concern situations in which a reaction to a call or sound is shown by a bird that is unable to see the calling individual.

The function of song, as the most spectacular of all bird calls, is strikingly similar to the function of the male stickleback's nuptial coloring: it repels other males and attracts females. Instances mentioned in the literature are too well known to need enumeration here, but one instance, from a recent work (Lack, 1943:29), may be quoted:

"On May 27th, 1937, an unringed newcomer robin, evidently wandering without territory, started to sing in a corner of the territory owned by a long-established resident male. The latter, then in a distant part of its territory, promptly sang in reply. The newcomer, which could not, of course, yet know that it was trespassing, sang again. The owner, having flown rather closer in the interval, sang again in reply. The newcomer again sang, the owner again approached and replied, now more vigorously, and this procedure was repeated twice more, the owner finally uttering a violent song-phrase from only some fifteen yards away, but still hidden from sight by thick bushes. At this point the newcomer fled, from an opponent it never saw, nor did it appear again."

It has further been observed in several species of hole-breeding birds that the begging calls of the young stimulate the parents to attempt to feed them, even when the young are concealed from view (N. Tinbergen, 1939a). Some Herring Gull chicks that I kept in my observation hide quite readily responded, by crouching, to the alarm calls of the adult birds; nestling thrushes (*Turdus m. merula* and *Turdus e. ericetorum*) stop begging as soon as the parents' alarm call is heard (Tinbergen and Kuenen, 1939). Further, every bird watcher knows that it is sometimes possible to attract birds by imitating song, call notes, distress calls of the young, etc. Especially in the case of birds whose calls have been mechanically recorded, the opportunity for more detailed study seems to be excellent.

*Chemical releasers.* In animals in which chemo-receptors are better developed than in man and birds (both exceptionally visual types),

special releasers may be found whose exclusive function is to act on the chemo-receptors of congeners. Several of these cases have been studied.

Von Frisch's classic work on the "language" of hive bees has shown that pioneer workers after discovering a new source of nectar perform a "dance" in the hive which stimulates a number of other bees. These react by leaving the hive and extensively searching the vicinity, eventually gathering on the species of plant that had been discovered by the pioneer. Experiments prove that the bees are attracted to the flower by its odor which was carried in the "fur" of the pioneer that had visited the flower before "dancing" in the hive. When flowers without a distinct odor are concerned, the bees that have been "given the cue" by the pioneer do not alight at once on the flowers when they find them but first perform a long ceremonial flight amongst the flowers while protruding their scent organs, which are located in the abdomen. This ceremony marks the exact spot with a typical scent which attracts other bees. (von Frisch, 1923; see also 1946.)

The male of the grayling butterfly (*Eumenis semele*) has a scent organ on the dorsal surface of the forewing (Figure 9). This is used during an elaborate courtship display, which reaches its climax in the male's characteristic bowing performance in front of the female, when her antennae, which bear chemo-receptors, are caught between the male's wings and are thus brought into contact with the scent organs (Figure 10). These act as the releaser necessary to secure the female's cooperation in coition. Males in which the scent organs have been removed have great difficulty in acquiring a mate in spite of intensive courting (Tinbergen, Meeuse, Boerema, and Varossieau, 1942).

In other animals, scent may be used, in much the same way as song and visual releasers are, as a means to advertise occupation of a territory. This was first discovered in the domestic dog, which erects "scent flags" on prominent places in its territory (von Uexküll and Sarris, 1931). Holzapfel (1939) discovered that the hyena (*Hyaena*) had a comparable habit, and recently Hediger (1944) listed a whole series of similar phenomena in a number of mammals.

*Tactile releasers.* Even tactile stimuli may serve as specialized releasers—for example, human courtship and human mother-infant relations are partly based on them. The mating of the snail *Helix pomatia* offers another example. As Szymanski (1913) showed, the characteristic movements and postures of each of the partners are reactions to tactile stimulation by the other. The "courtship" culminates in the thrusting out of the "dart" (Figure 11), the only function of which is the delivery of a powerful stimulus; the dart is a true releaser.

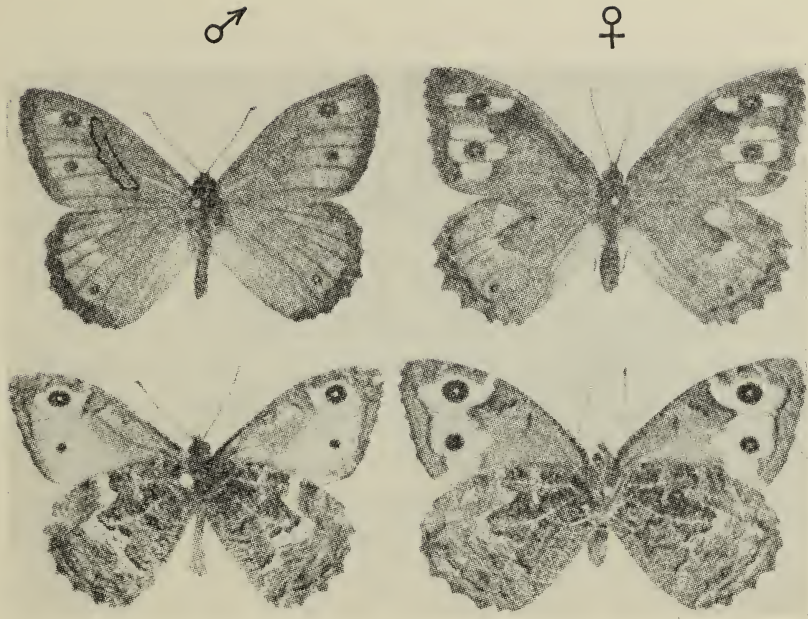


Figure 9. The grayling butterfly. Upper: dorsal side; lower: ventral side. Black line in upper left figure indicates position of scent organ on left wing. After N. Tinbergen, Meeuse, Boerema, and Varossieau, 1942.



Figure 10. Grayling butterfly male (right) bowing before female, so that the female's antennae come in contact with the scent organ of the male. After N. Tinbergen, Meeuse, Boerema, and Varossieau, 1942.

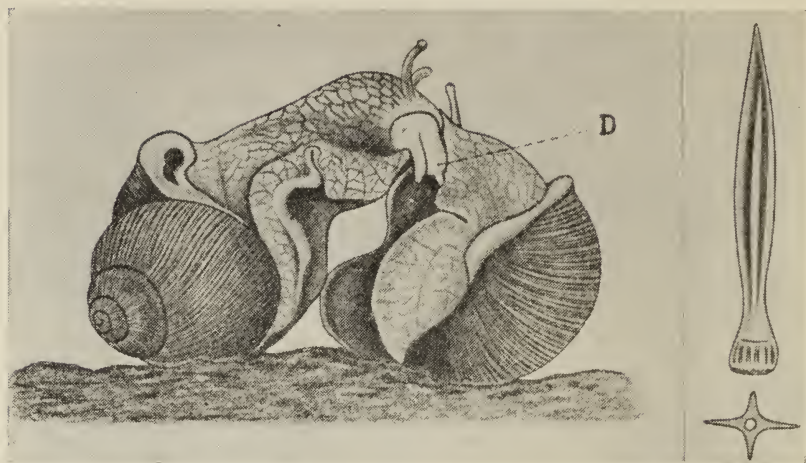


Figure 11. *Helix pomatia*. Extrusion of dart during mating (left). Detail of dart (right). After Meisenheimer, 1921.

These few instances suffice to show that releasers are not confined to the visual domain. It is a significant fact that visual releasers are found in groups with highly developed eyes, chemical releasers in animals with good chemical receptors, auditory releasers only in groups with specialized acoustic organs, and so on. It is even quite possible that in some cases the only function of certain sense organs is as a means of social intercourse. This might well apply to the Homoptera, for example, in which both stridulation organs and tympanal organs seem to be exclusively used in communication between members of the same species.

The visual releaser as a phenomenon, therefore, does not stand alone. It is only a special case of a widespread phenomenon, the existence and function of which has long been recognized. A criticism of the releaser theory as a whole would have meaning only if all categories of releasers were included in the discussion.

#### NON-EXPERIMENTAL EVIDENCE ON VISUAL RELEASERS

In the foregoing paragraphs it is evident that a "releaser" is part of a complex mechanism involving special movements, special effector organs, special receptors, and special innate releasing mechanisms. The syrinx of song birds, the stridulation organs of crickets and grasshoppers, the scent organs of bees, butterflies, and mammals, the red breast of the English Robin, all are highly specialized, "improbable," specifically adapted organs. Movements, effector organs,

innate releasing mechanisms are fitted together; they act as a wonderful, complicated system the only function of which is the construction of a means of social communication. In fact, such complicated structures are understandable—they “make sense”—only in connection with their function; the coincident presence in the same species of stridulation organs, the stridulating drive, and an innate tendency to react in certain “purposive” ways can be recognized as an adaptive feature only when the releaser function is recognized.

Hence, it is quite justifiable to conduct experimental work on the basis of the releaser hypothesis even when only parts of the whole mechanism are known, that is, for example, when only the effector organ (e.g., a conspicuous structure) is found, with a movement displaying this effector.

It is true, as Dr. Rand remarks, that one has to reckon with the possibility of “maladaptation.” However (apart from the question whether it is satisfactory to consider without proof a highly specialized structure such as the syrinx of song birds or the wing of an Argus Pheasant as a functionless error of evolution), there is a difference between a critical attitude and a defeatist attitude. Any hypothesis aiming at “finding the use” has to be seriously tested before it is abandoned in favor of a purely negative hypothesis. These considerations justify the following enumeration of cases in which only part of the mechanism has been investigated and the releaser function of the whole has not yet been experimentally tested. Since it is especially the existence of visual releasers that is doubted, I will confine myself to supposed visual releasers. The argument applied is: when we again and again observe that a conspicuous, highly “improbable” structure is used as an instrument by an equally conspicuous and “improbable” movement resulting in a display of this structure, we suppose that both structure and movement form part of an adaptive mechanism that has the *function* of display.

I will take the risk of being accused of “following ideologies blindly” and cite as significant the conclusion reached by Heinroth, who worked along these general lines and must in fact be considered one of the founders of modern ethology. This great observer, whose disinclination to formulate general conclusions is well known,<sup>3</sup> said, as early as 1900, that conspicuous structures in birds are always used in display. Huxley (1914:523) wrote: “The same instinctively displayed parts—wings and tail, throat and crown—are the parts which are especially singled out for the development, first of special colours,

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<sup>3</sup> Typical of Heinroth's attitude is the following anecdote, related to me by one of his intimate friends. Heinroth once delivered an address full of interesting facts arranged in such a way as to suggest a special and important conclusion. He did not, however, formulate this conclusion himself, but concluded his speech with: “Na, meine Herren, den Reim dazu können Sie Sich selbst machen.”

. . . then of special colours and structures combined." This sentence, while evolutionary in sense, is based upon descriptive evidence revealing the same general rule as that pointed out by Heinroth. The following facts serve to substantiate this general rule.

Of widespread occurrence is the type of display in which the body as a whole is laterally flattened and enlarged and made as high as possible, often with the help of erectile structures such as fins and feather fans. Correlated with this lateral flattening is an orientation toward the reactor which offers the most imposing view of the body as a whole. Further, the coloration of the body is localized in such a way as to be most conspicuous during the lateral display. Often the color pattern covers both body and extensions, such as fins. This is especially obvious in many fish, where, for instance, black bars or fields of "jewels" extend over the dorsal and anal fins. I often wondered in such cases which part of the coloration would be the re-

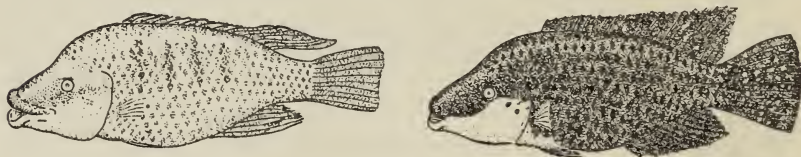


Figure 12. *Tilapia natalensis* male. In asexual (left) and sexual (right) coloration. After N. Tinbergen, 1947.

leaser until I realized that such a fish must be considered as one huge releaser. One could say: such fish "have" no releasers; they "are" releasers (Figure 12).

In fish, the stickleback is only one of the less prominent performers of lateral display. *Betta* (fighting fish), sunfish (Centrarchidae), cichlids, and many others offer extreme examples (Figures 13 and 14). In *Aequidens latifrons*, for instance, the dorsal, caudal, and anal fins, when erected, nearly double the visible surface. The caudal, anal, and hind part of the dorsal fins are also locomotory organs, but the forepart of the dorsal fin has no locomotory function and seems to have been adapted entirely to display purposes.

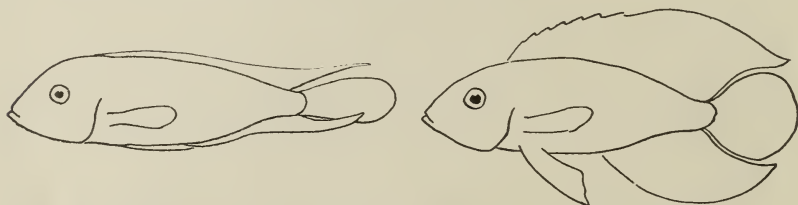


Figure 13. *Aequidens latifrons* male. In posture of inferiority (left) and in threat posture (right).



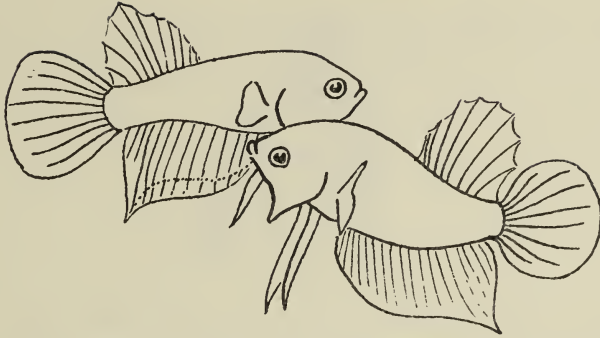


Figure 14. *Betta splendens*. Males in lateral threat display. After Bessiger in Holly, Meinken, and Rachow, 1936.

Orientation in respect to the adversary is very well demonstrated by one of Lissmann's experiments (1932) with *Betta splendens*. Like so many other visual types, *Betta* males threaten their own image in a mirror. When Lissmann turned the mirror on a horizontal axis, the fish followed the movement, keeping its lateral surface parallel to that of the reflection, even turning on its side in order to do so (Figure 15).

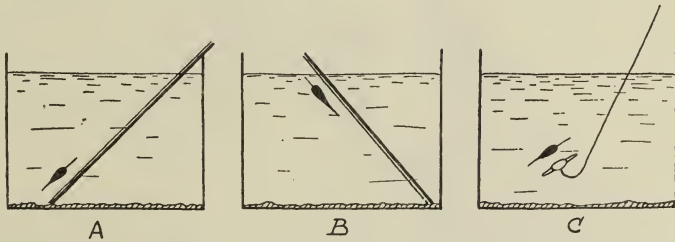


Figure 15. *Betta splendens*. Lateral display of male to reflection in mirror (A and B) and to dummy (C). After Lissman, 1932.

The male newt *Triturus vulgaris* begins its courtship with a visual, sideward display. The newt has to stand in a rather twisted posture to be able to display its lateral surface and yet fix the female with both eyes. This visual display is followed by a tactile stimulus: with a sudden leap (a surprising performance in a newt!) and a strong blow of the tail, the male throws a water current against the female which gives her no little difficulty in holding her ground. This is immediately followed by a third kind of display in which the male probably delivers a chemical stimulus.

A further example is *Anolis* in which the species have a special, conspicuously colored "dewlap" which tends to exaggerate the effect of the lateral compression of the body (Evans, 1938) as shown in Figure 16.



Figure 16. *Anolis carolinense* male. Dewlap display. After Evans, 1938.

Among birds, the lateral display is very common. Numerous instances are found in the Phasianidae, e.g., in the Golden Pheasant, *Chrysolophus pictus* (Figure 17), Amherst's Pheasant, *C. amherstiae*, Bulwer's Pheasant, *Lobiophasis bulweri*, the domestic fowl, and the turkey. But it is also observed, to a lesser degree, in other birds.

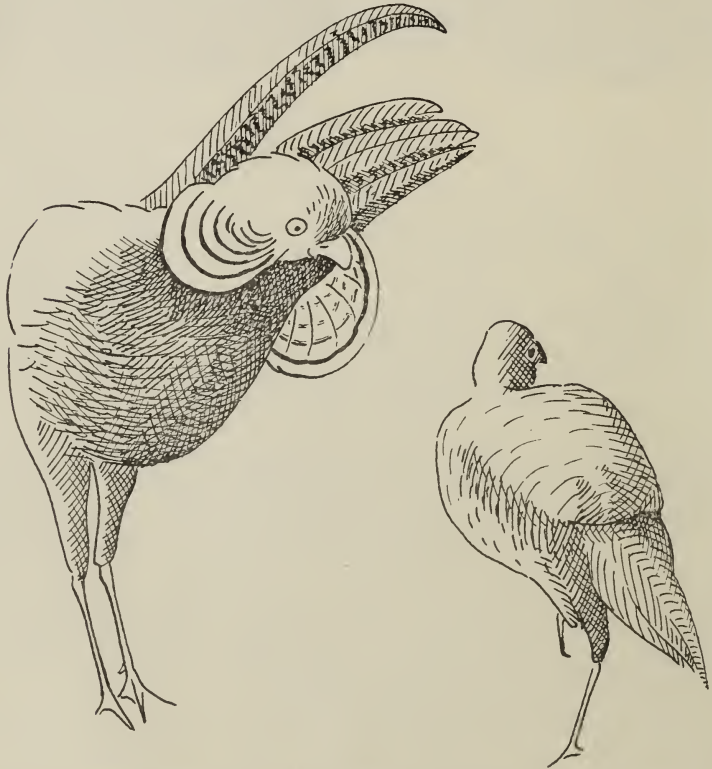


Figure 17. Golden Pheasant. Lateral display of male (left) before female. After Hagenbeck in Heilborn, 1930.

I have seen it in the European Jay, *Garrulus glandarius*, though this species has no feather fans especially developed for the purpose, and it is quite astonishing to see it render itself as flat as a knife.

Apart from the general pattern of lateral display, there are numerous instances of directed display of special parts of the body, some of which show a remarkable and grotesque correlation of movement with structure. Both the African jewel fish (*Hemichromis bimaculatus*) and the South American *Cichlasoma meeki* have a morphological releaser on the gill-cover, consisting of a black patch bordered by a yellowish or greenish golden ring. This structure is used during a frontal threat display which consists, as in so many fish, of erecting the gill-covers. Now in *meeki* the black patch is situated at the ventrocaudal edge of the gill-cover, in *bimaculatus* at the dorsocaudal edge. In conformity with this, *meeki* spreads especially the ventral part of the gill-cover (Figure 18, right), while *bimaculatus* displays its releaser by spreading especially the dorsal part of the gill-cover (Figure 18, left). Both movements are rather specialized forms of gill-cover display.

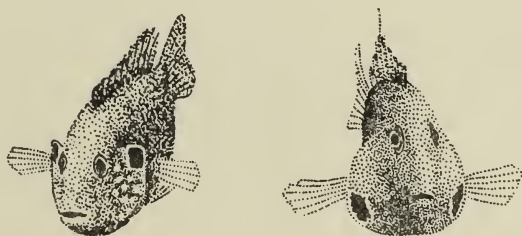


Figure 18. *Hemichromis bimaculatus* (left) and *Cichlasoma meeki* (right). Frontal display. After N. Tinbergen, 1947.

In birds, so many instances of visual releasers are known (see O. and M. Heinroth, 1928; Stresemann, 1927-34; Armstrong, 1942) that I will confine myself to a few rather unconventional types. The male Snow Bunting, *Plectrophenax nivalis*, displays the variegated black and white pattern of the dorsal surface (Figure 19A) and in doing so walks slowly away from the female (N. Tinbergen, 1939a). The threat movement of the Common Crane, *Grus grus*, consists of displaying the occiput, where a red wattle appears (Heinroth, 1928). A male Lapwing, *Vanellus vanellus*, when trying to attract a female to one of his scrapes, displays his under tail coverts, which are a warm chestnut-brown (Figure 19B). When the female moves, the male promptly turns his tail, presenting a full view (Rinkel, 1940). A Flicker, *Colaptes auratus*, also displays its under tail coverts in threat but uses quite a different method: it tilts the tail sideways and for-



Figure 19. *A*, Snow Bunting. Back display. After N. Tinbergen, 1947. *B*, Male Lapwing displaying under tail coverts. After Rinkel, 1940.

ward. The result is a sudden flash of yellow (Noble, 1936). The Red-wing (*Agelaius phoeniceus*) erects its "epaulets" in threat display (Noble and Vogt, 1935), as does also the Tricolored Red-wing, *Agelaius tricolor* (Lack and Emlen, 1939). Chaffinch (*Fringilla coelebs*) males make a similar use of their white epaulets (Lack, 1941).

Erection of crests and other parts of the plumage in birds is, as a rule, confined to conspicuously colored parts, as every bird watcher knows: goldcrests (or kinglets), birds of paradise, pheasants, grebes, ruffs, terns, ducks, etc. Lorenz's study (1941) of the courtship of the Anatinae contains numerous observations of quite unexpected details. For instance, in a special phase of the courtship, males turn the back of the head toward the female. The Pintail, *Anas acuta*, which has a brown lane running between two white stripes, erects the feathers of the brown field. The result is a remarkable strengthening of the contrast (Figure 20). Another movement, performed by nearly all species, serves to display the colored wing-shields and other gaudily colored parts.

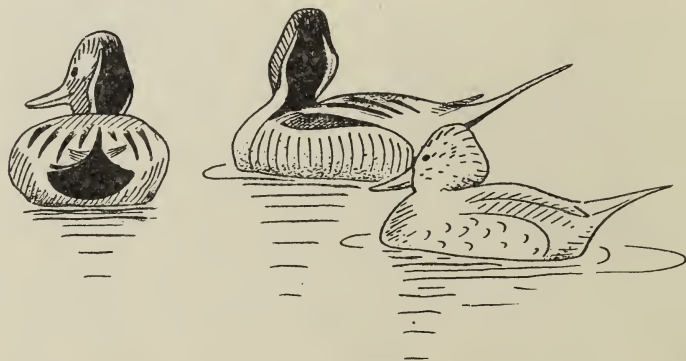


Figure 20. Pintail males displaying neck before female. After Lorenz, 1940 (from motion pictures).

It seems superfluous to enumerate still more cases. Every bird watcher knows instances from his own experience. Yet it would be advisable to publish such facts more often than has been done in the past. A short, accurate description, with a sketch or photograph, not taking, in all, more than one or two pages of an ornithological journal, would be sufficient and would materially help to extend our knowledge.

I am convinced that the correlation of structure and movement will be shown to be much more complex than is known at present. Comparative study would be especially valuable because it helps one to see the significance of a movement merely by stating that it is absent in related forms, coinciding with the absence of a morphological releaser. To cite an instance: one of 13 species of cichlids studied by Dr. and Mrs. Baerends (1948, in press) in the Leiden Zoological Laboratory, *Astronotus ocellatus*, showed a peculiar trembling movement of the tail during courtship. This is the only species out of the 13 that has an "eye" spot at the tail-base. By the trembling ceremony, attention was quite effectively drawn to this releaser. The fact that both trembling ceremony and visual structure were present in this one species and absent in all others strengthened the conclusion that they were correlated.

The best way to get an impression of the significance and importance of visual releasers is to concentrate on a family, or smaller group, of animals to which many species with gaudily colored dresses belong and make a careful comparative study of their behavior. Groups with specialized visual releasers in many differently evolved species are the ducks (of which only the Anatinae have been studied in detail), the birds of paradise, and the pheasants. The peacock, the Argus and Bulwer's Pheasants give us an idea of the host of interesting facts that await discovery in the last group. It is for the same reason that a research program on the cichlid family was started in several laboratories; this family is another instance of a great and varied group of bearers of visual releasers.

In studying such a group, the value of the releaser theory is most clearly demonstrated by the fact that after a short time one is able to predict the nature of the display movement in a newly encountered species after merely viewing its morphological equipment. Thus both Lorenz and I, quite independently, came to the same conclusion when we got our first *Cichlasoma meeki*, viz.: "That fellow must have a tremendous frontal threat display of the operculum." Actually, our letters describing our first thought and how it was proved correct by the fish (Figure 18) crossed in the mail.

Although I have mentioned only a very few of the known facts concerning the correlation between structural and behavioral components of releasers, I will let these suffice. In view of the evidence for the function of visual and other releasers, a rather strong bias would

be required to object to the releaser theory even as a *working hypothesis*. It is my opinion not only that the hypothesis is fully justified but that it has already demonstrated its value as a unifying principle covering a wealth of facts.

## PART 2: EXPERIMENTAL METHOD

Experimentation with releasers, as reviewed in Part 1, seems a very simple business indeed. However, this is true only in appearance. The technique is simple enough, but as a method of thinking and planning it has some treacherous pitfalls. It is easy to meddle with animals, to experiment in a vague and random way, but it requires some knowledge of ethology as a whole and some insight into the nature of a given problem to plan really convincing experiments that are relevant to the problem. I will attempt to point out some of the pitfalls to be avoided.

An experiment as such is never "wrong." It is only in connection with the problem and with the conclusion drawn that an experiment may sometimes be called wrong or inadequate. To cite an instance (which naturally takes the form of criticism): when Rand observed that adult Song Sparrows (*Melospiza melodia*) and Catbirds (*Dumetella carolinensis*) carry off feces without waiting for the typical display of the anal feather circlet by the young, it is only his conclusion—that the anal circlet has no releaser function—which must be called wrong. His experiments are interesting enough and not "wrong" in themselves, but they do not prove what Rand assumes them to prove; they merely show that the adult's reaction can be released by a stimulus situation in which the display of the anal circlet is lacking. This does not mean that the anal ring has no releaser function. As I have pointed out in a previous paper (Ter Pelkwijk and Tinbergen, 1937), Leiner's experiments (1929, 1930) in which female sticklebacks were willing to follow males in monochromatic light by no means proved that the nuptial colors of the male have no releasing power but only that the female's responses are not dependent on color alone. As we have seen, other experiments proved the male's red belly to be a very important releaser. Closer consideration of the releaser problem is necessary to understand why a releaser is not always easily detected by experiment.

## THE INNATE RELEASING MECHANISM AND RELEASERS

Because the releaser is, in a sense, a reflection of the reactor's releasing mechanism—the "angeborene auslösende Schema" (innate releasing pattern), as it was called by Lorenz—the first thing to do is to examine this mechanism.

One finds the first indication of the existence of something like a "Schema" when an animal appears to be noticeably unselective in its reactions to other animals and to dummies: a stickleback that readily fights any dummy that is red underneath (as every male stickleback in mating condition will do) shows that many "recognition marks" of the opponent male that exist for the human observer are not essential to the stickleback in this situation. In other words, the animal reacts to only a few recognition marks or "sign stimuli," while many other elements of the situation apparently have no influence. (This gives the impression that the animal's perception is "schematic," hence the word "Schema." But I prefer to use the terms "sign stimuli" and "releasing mechanism.") Experiments confirm this conclusion, and it even seems to be a general rule that innate releasing mechanisms are responsive to stimulus situations with only very few sign stimuli.

It is hard for the human observer to realize that an animal often does not use all the sensory signs which its sense organs put at its disposal. Yet it is clearly a fundamental fact of innate behavior in animals. A female stickleback, lured (with visual stimuli) into the nest by the male, will lay eggs only after the male has furnished a prolonged series of tactile stimuli: he repeatedly thrusts his snout against her abdomen, and after some time, this trembling movement induces her to deposit her eggs. Although the female, while in the nest, can see the male throughout this procedure, one can remove the male and replace his activities by producing the "trembling" movement with a glass rod; the female will lay as well after tactile stimulation by the glass rod as after stimulation by the male itself. It is only the tactile stimulus that counts in laying; visual stimuli, while of the utmost importance in other phases of the courtship, are wholly unessential now.

Similar facts have also been recorded in birds. A domestic motherhen will run to the rescue of a chick in distress. This reaction is entirely dependent on the distress call and not on visual stimuli: a struggling chick under a glass dome has not the slightest stimulating influence, but the sound of the distress call from behind a screen will instantly release the mother's reaction (Lorenz, 1935).

Still more astonishing is the fact that even within a single mode of perception (sight, for example), many elements in the situation are ignored. Young thrushes (*Turdus m. merula* and *Turdus e. ericetorum*), which we kept for investigation of their gaping responses, reacted, when still blind, to a slight jarring of the nest. Later, when about 10 days old, they would respond to visual stimuli. These were analyzed with dummies (Tinbergen and Kuenen, 1939). Form or size of the parent dummy did not count at all. Anything from 3 mm. diameter upward would do, provided it was moving. We were surprised, however, to discover that in order to evoke gaping an object had to be

above the horizontal plane through the nestling's eye. The same objects that induced excellent reactions when kept high were ineffective when lowered below eye level. The birds looked at it, thereby proving their eyes could "see" it, but they did not gape. The sense organs "saw" well enough; the bird as a whole did not "see" it. Obviously this is a problem of the nervous system rather than of the sense organs.

This is only one instance among many. Each reaction is susceptible to a rather vague stimulus situation, or a generalized situation, as it is often called. I think it is more accurate to describe it in terms of "releasing mechanism" and "sign stimuli." Each reaction has its own releasing mechanism, responsive only to stimulus situations with few sign-stimuli. Russell (1943) has collected a great number of examples from the literature.

A consequence of this restriction of each reaction to a few sign stimuli is that the releasing mechanisms for the different reactions of one animal may be entirely different from each other, even when the reactions are evoked by the same object. Thus the female stickleback is attracted to the nest by the sight of a red fish, but it is induced to lay eggs by a series of thrusts at the tail base. As a rule, both stimuli are administered by the same male.

Therefore, study of innate releasing mechanisms does not reveal the potentialities of the sense organs. Before I realized this, I had long thought that the grayling butterfly, *Eumenis semele*, was color-blind, simply because it did not respond differently to different colors in the one reaction I happened to study. The males of this species follow passing females in wild pursuit, thus inducing them to go down and watch the male's subsequent courtship. We analyzed the releasing mechanism of the male's first reaction and found that the color of the models we used could be varied at random without changing the male's behavior is not released by a visual stimulus—though the male can fervor. Yet he is far from color-blind. When his reactions to colors are tested during quite another instinctive activity, viz., during his foraging excursions which lead him from flower to flower, he appears to have a great preference for yellow and blue. Red, green, and 30 different shades of gray, which all released his mating flight, never released his foraging activities.

Sticklebacks provide another interesting example. After the female has laid, the male goes through the nest to fertilize the eggs. This behavior: he dashed after paper butterflies of all colors with equal see the fresh eggs clearly enough—but by chemical (and presumably also tactile) stimuli from the eggs: it is sufficient to bring some water in which fresh eggs have been kept for a time into the nest to induce the fertilizing behavior. On the other hand, foraging behavior in sticklebacks can be induced only by visual stimulation; worms



or *Daphnia* in a glass tube instantly attract them, but meat juice or other extracts that readily activate foraging behavior in many other fish such as the eel (*Anguilla*), for example (see Wunder, 1927), never affect the stickleback.

Von Uexküll's concept (1921) of the *Umwelt*—the [animal's] own world—is based on this fact, viz., that an animal often reacts to only part of the environment as we see it. Analyses of releasing mechanisms enable us to give step by step a precise description of the sign stimuli, which help in building up the animal's "own world." Thus the idea of the *own world*, which was at first rather a vague notion, is substantiated by experiment.

A different method is required for the study of the potentialities of the sense organs. Most reactions, however selective they may originally be in regard to sign stimuli, can be conditioned to respond to any stimulus that can be received by the sense organs. The study of conditioned reactions as indicators of sensory reception has been developed to a high degree of perfection by von Frisch and his collaborators.

The term *das angeborene auslösende Schema*, or innate releasing mechanism, has been abused in several ways, two of which must concern us here. First, it is misleading to speak of the "Schema" of any object in the environment, for instance, a "Schema of the sex partner," for we know that a sex-partner may be to the animal several entirely different things, depending on which instinctive activity brings the animal into contact with the sex-partner. For a female stickleback, the sex-partner "is" a red fish (visual) at one moment, and it "is" something hard in trembling motion (tactile) a mere few seconds later. A "Schema" belongs to a *reaction* of the behaving animal, not to the object in the outer world to which the animal is reacting. It is also for this reason that the term "releasing mechanism" is to be preferred to the word "Schema" with its more or less mystical tinge. It is for the same reason that the word *Kumpan* (companion) as originally used by Lorenz has to be either carried *ad absurdum* or abandoned, for—as Rand (1941:290) quite correctly pointed out—we ought to subdivide the sex companion into numerous sub-companions, such as (in the case of the stickleback) the "visual-courtship-sub-companion," the "tactile-egg-laying-sub-companion," and some five other sub-companions. This procedure is, of course, quite consistent and quite impossible. This was, indeed, clearly recognized by Lorenz himself; in his later papers he has abandoned the concept of "*Kumpan*" and has also accepted the idea that a "releasing Schema" belongs to a reaction, not to an object. However, these are only minor corrections, and it would be unfair to forget that this greater precision and further development in the work has only been possible on the basis of the *Kumpan* paper, which, in spite of its shortcomings ("I don't like

my *Kumpfan* paper any more," said Lorenz in 1937), has given a most powerful stimulus to animal ethology. In fact it is one of the classics.

The moral of all this is primarily that the experimenter must see the restrictions of his problem and of the subserving experiments. A releaser never affects the reactor's behavior as a whole, although it may affect an important part of it; a releaser often serves merely to activate one minor element of behavior, and only by studying that susceptible part can we find an answer to the question whether a given structure or movement is in fact a releaser.

#### REACTION CHAINS

The foregoing considerations deserve special attention when one has to do with a series or chain of successive reactions, each with its own releasing mechanism.

In order not to write exclusively of sticklebacks, though they offer a very convincing example in their chain of courtship activities (N. Tinbergen, 1942), I will relate another instance, discovered in insects. The female of the digger wasp, *Philanthus triangulum*, hunts bees and stores them as food for the larvae. By an experimental analysis of this hunting activity it was found that the wasp searches for bees by flying from plant to plant. Though other tests show that it can smell a bee from at least a meter's distance, no hunting wasp is ever attracted by the odor of a hidden bee, even if it is less than 5 cm. away. Visual stimulation by a moving object of about the size of a bee at once changes the wasp's behavior; it immediately takes a position at about 10 cm. to leeward of the moving object and then hovers like a syrphid fly for 2 to 10 seconds. During these seconds, the wasp "tests" the scent emanating from the bee. Whereas a wasp can easily be induced to hover by all kinds of visual substitutes for a bee (e.g., any other insect of the right size such as a fly or bumble-bee, or even a stick or stone hanging from a moving thread), the substitute must be given the typical scent of a honey-bee to be accepted as prey, that is, to elicit the next link in the behavior chain, namely a flash-like leap toward the prey by which it is seized at once. Sticks that have been given bees' scent by shaking them in a glass tube with freshly killed bees are seized. However, they are not stung; it was shown that the sting is the next link in the chain; it is only delivered after a new sense impression is received, probably from tactile stimuli. Thus the hunting of this wasp consists of a chain of reactions: searching, hovering, leaping, stinging—each of which has its own releasing mechanism. The restriction to the few sign stimuli characteristic of each reaction is not caused by limited capacities of the sense organs, since (for instance) the hovering reaction never responds to olfactory stimuli,

even though a wasp can smell the bee from a great distance—when it loses a bee it has just killed, it finds it again by smell.

The chain character of behavior is responsible for many cases in which a stimulus administered in experiment is capable of eliciting only a fragment of an activity. When, for instance, imitation of the song of a bird does not cause it to actually fight the imitator, it is not because the song has no releasing function. In many cases it will attract the bird at once, but since the visual stimulus from the imitator does not correspond with the visual sign stimuli necessary to evoke the next reaction, viz., the attack, the behavior breaks off. In the English Robin, song attracts a territory-holding male, but the sight of a red-breasted "something" is necessary for the bird to continue its behavior into real attack (Lack, 1943).

#### CONFIGURATIONAL QUALITY OF SIGN STIMULI

When the separate sign stimuli are studied in detail, it appears that the name "stimuli" can only be applied to them in a rather general meaning, for they are always complicated systems to which the term "Gestalt" may rightly be applied; they are "configurational" stimuli. Some examples may explain this statement. The gaping reaction of the young thrushes mentioned above, when they were in the visual phase, was influenced not only by *releasing* sign stimuli, but also by other stimuli which *directed* the reaction toward the head of the parent bird though they were without influence in releasing the gaping reaction. The head was recognized by a very few sign stimuli analyzed by experiment: the head was to the nestlings a thing higher than the rest of the parent bird (or model); it was a thing nearer to the nestlings than any other part of the model, and it was something protruding from the main outline of the model. The size of the head was unimportant in an absolute sense, but it was very important in relation to the size of the body. A "head" of 1 cm. diameter was more effective than one of 3 cm. when belonging to a "body" of 4 cm. (Figure 21A), but the gaping was directed to the larger head when both heads were mounted on a "body" of 8 cm. and presented to the nestlings (Figure 21B). It is size in relation to size of the body that counts.

Other studies of cases where a head provides the sign stimulus for the release of a reaction lead us to essentially the same conclusion. Portielje (1926) showed that the European Bittern, *Botaurus stellaris*, when cornered by an enemy without possibility of escape, will direct its flash-like, surprising thrusts of the bill toward the head of its enemy. A body without a head does not release the defense reaction, but as soon as a "head" is presented, for instance, by putting a crude cardboard model on the "body," the bird picks at this head. The shapes

of both head and body may vary within very wide limits, but the head must be smaller than the body. Probably there is an optimal relation in size between the two.

The cognition of a "head" has been investigated in still another instance. As mentioned above in the introductory paragraphs, Goethe (1937b), Lorenz (1940), and Krätzig (1940) have tested the innate releasing mechanism of the reaction of several birds, especially gallinaceous birds, to flying birds of prey. In this releasing mechanism, the short neck (i.e., slightly protruding head) plays a decisive part. All bird models, even very crude ones, with short necks elicited escape reactions (of varying intensity and also of different kinds); in some species, the four-week-old cocks assumed an aggressive attitude while the female chicks crouched. Here again, it is not the size or another more or less "absolute" (measurable, quantitative) stimulus that is essential, but the relative size, that is to say, size (length) of neck in relation to size of body.

The innate releasing mechanism of the stickleback's fighting response offers another example. Fighting is maximally elicited by a red male. Experiments with dummies show that the optimal stimulus is not: any red fish, but: any fish that is red *underneath*. Models with a red back instead of a red belly have a much lower releasing value than those with a red belly. This means that not the red as such is a sign stimulus, but a red part of the body in a definite spatial relation to the body as a whole.

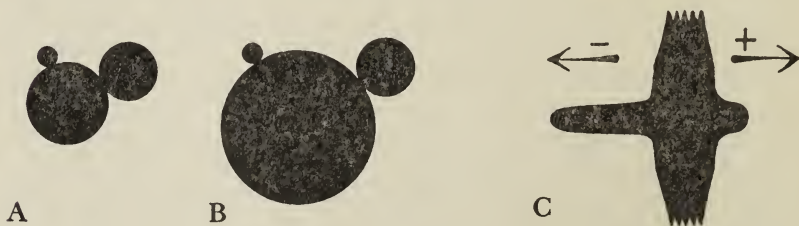


Figure 21. *A* and *B*, Two dummies used for analysis of "head" in directing the gaping responses of young thrushes. After Tinbergen and Kuenen, 1939. *C*, Card-board dummy that releases escape reactions when sailed to the right ("hawk") but is ineffective when sailed to the left ("goose").

Further, all stimuli in which motion plays a part are of a configurational character. The gaping reactions of young thrushes in the visual stage are released by moving objects. Motion toward the animals has an especially strong releasing value. Experiments proved that this type of motion was perceived, not as "growing size," but as true spatial, three-dimensional motion.

We are accustomed to consider configurational stimuli of this kind as relatively simple stimulus situations. By comparison, many other stimulus situations, especially those encountered in training- or conditioning-experiments, are of a much more complex nature. Yet even the relatively simple sign stimuli, when examined closely, are very complicated systems indeed. For instance, a sign stimulus "short neck" indicative of a bird of prey for inexperienced turkey chicks, is valent only in relation to the direction of motion. Lorenz and I made a cardboard model in the shape of Figure 21C. When pulled to the right, the model had a short neck and a long tail ("hawk"); when pulled to the left, it had a long neck and a short tail ("goose"). This model caused escape reactions, such as flight and crouching, only when pulled to the right; merely superficial interest was shown by the chicks when the model sailed in "goose" fashion.

It may be superfluous to stress the fact that these considerations which apply to sign stimuli in general are also relevant to the stimuli produced by releasers. The releaser is a special kind of source of sign stimuli. Probably owing to adaptive evolution, a specialized releaser is, so to say, a materialization of the innate releasing mechanism.

#### THE STIMULUS SITUATION: HETEROGENEOUS SUMMATION

A reaction of an animal to its environment, either to a "situation," an "object," or an animal, is rarely governed by only one sign stimulus. As a rule, several sign stimuli act together. The courting activities of a female stickleback are reactions not only to the red ventral parts of the male but also to its zigzag dance. A threatening male stickleback has an intimidating influence on its opponent not only through its red color but also through its threatening posture. In birds, color, movement, and voice may often work together. Thus the optimal situation may be a combination of two, three, or more releasers. Recent work shows how several sign stimuli act together to produce a combined effect.

The mating behavior of the grayling butterfly is initiated by a kind of courtship flight: the male follows each passing female. The innate releasing mechanism of this flight is responsive to a combination of sign stimuli, among which type of movement, degree of pigmentation, and distance are the most important (Tinbergen, Meeuse, Boerema, and Varossieau, 1942). The optimal stimulus situation is a dark female fluttering in the typical way of a butterfly, as near to the male as possible. A white model elicits fewer responses than a dark model, a sailing model fewer than a fluttering one, a distant model fewer than one presented near by. A model that was deficient in any one of these respects evoked only relatively few responses. In order to increase the frequency of the responses it was sufficient to "improve" the model by improving *any one* of the deficient stimuli. For instance,

a white, sailing model could be improved just as well by painting it dark as by presenting it in fluttering motion. In general, it was quite indifferent which parts of the situation were presented, as long as "a certain amount" of stimulus was presented.

Exactly the same phenomenon has been described by Seitz (1940) in the cichlid fish *Astatotilapia strigigena*, where the intensity of the reaction appeared to be dependent not on *which* sign stimuli but only on *how many* sign stimuli were presented. This was called the "Reizsummenregel" by Seitz; I will translate this by "rule of heterogeneous summation" to indicate that it is not successive summation of a *repeated* stimulus, but simultaneous summation of *different* stimuli. The importance of this has been stressed by Lorenz (1940).

In general, most responses of the type that are elicited by releasers are not subject to the all-or-none law; on the contrary, they may appear in almost any degree of intensity, depending on the intensity or completeness of the stimulus situation. The experiments summarized above show that incompleteness or low intensity in different sign stimuli does not result in *different types* of deficiency in the reaction, but that the reaction's intensity always decreases in the same way, independently of which part of the stimulus situation is missing. It is as if *a certain quantity* of stimulating "substance" were required. One is tempted to describe this in terms of a reservoir of some substance in which the effects of the several stimuli are thrown together indiscriminately. The contents of this reservoir stimulate the nervous motor center of the reaction in a purely quantitative way, dependent only on the level, not on the composition of the reservoir's contents. Needless to say, this is only an analogy; in reality, nervous centers and impulses are involved.

This discovery is not new. Only the explicit formulation is new. Anybody who is more or less acquainted with animals (including man) has often seen the dependence of the reaction's intensity on a number of different stimuli. Our appetite, for instance, may be slight for many reasons; it can be increased by the sight of food, by an animating companion, by an attractive table, and so on.

The principle of summation of heterogeneous stimuli is important for the correct understanding of our experimental procedure. Most reactions still occur, though at a lower intensity, when one or another of the stimuli is missing in the situation. The consequence is that the mere fact that a reaction occurs in the absence of a certain stimulus does not in the least prove that this stimulus is of no influence.<sup>4</sup> When

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<sup>4</sup> Yet this conclusion is often drawn. Reasoning of this type always reminds me of the case of a Herring Gull with one leg which I observed. This deficient individual lived successfully in the wild for several years. Apparently he could do without the missing leg, but certainly no one would say that Herring Gulls have one superfluous leg or consider nonsensical the conclusion that a leg is a functional organ.

Rand observes that a parent Song Sparrow removes feces from the nest rim without being stimulated by a display of the young's anal feather circlets, he is not entitled to conclude that the feather circlet is of no importance in the reaction. His observation merely shows that the reaction may occur in the absence of such display. This observation alone does not even justify the conclusion that the anal ring is of only minor importance.

In exceptional cases a particular releaser is indeed so all-important as to be the one indispensable factor—the “necessary and sufficient cause”—for a reaction. Lack (1943) found such an exceptional state of affairs in the English Robin. As I mentioned above, the red breast of this bird is such a strong “badge of hostility” that isolated tufts of red feathers, when presented to a territory-holding male, were attacked, whereas a mounted fledgling, which to the human eye was more robin-like than the mere tuft of feathers but had no red breast, was left alone.

A very instructive illustration of heterogeneous summation, exactly comparable with the Rand example, is seen in the contradiction I have already cited between Leiner's conclusion that the stickleback's red belly had no function and Ter Pelkwijk and Tinbergen's experimental proof that the red belly was a very important releaser.

Leiner's experiments demonstrated in a quite convincing way that the female's mating behavior may occur in complete form even when this important releaser is missing (*viz.*, in red light). The principle may be illustrated by the symbols of Figure 22. The column at the left is the optimal stimulus situation, in which the red belly, the zigzag dance, and other external (and internal) factors are all contributing their share. The heavy horizontal line (*th*) indicates the threshold of response, below which the reaction is too low in intensity to reach its goal or even is not forthcoming at all. Leiner's experiments consisted in omitting the red color. The total stimulative value of the other factors combined was still above the threshold. When the internal causes (the “motivation”) are lower (right column), or when the other releasers are not all presented (center column), omission of the red color may result in the lowering of the total stimulative value to below threshold-value. These considerations show that in order to prove the influence of the red color, or, in general, of any other alleged sign stimulus or releaser, one has to apply two methodological principles: First, one must always *compare* the response to Situation A with the response to Situation B. Had Leiner compared the female's behavior in red light with that in sunlight, he might possibly have seen that she was much more willing to act when the male's red releaser was visible than when it was invisible owing to red illumination. However, such a difference in degree is often difficult to observe or,

at least, to describe. Therefore a second measure has to be taken: the intensity of the other stimuli or of the internal motivation has to be lowered in such a way that loss of the one releaser will render the total situation subliminal. The result will be that a model with sign

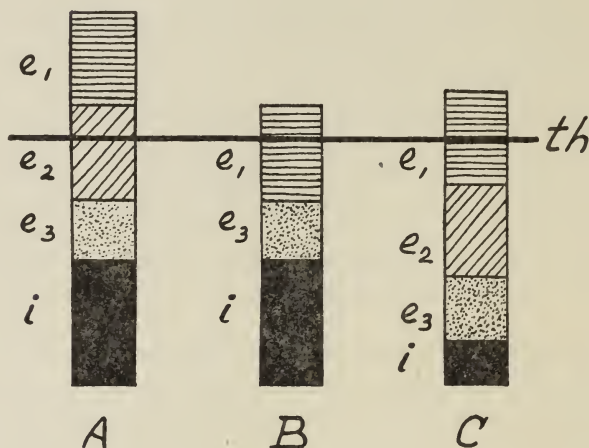


Figure 22. Diagram of responsiveness to sign stimuli.  $th$ , threshold of response,  $i$ , internal motivation.  $e_1$ ,  $e_2$ ,  $e_3$ , external stimuli.

stimulus  $e_1$  will evoke the response (Figure 22, center and right), while a model without this stimulus will not. Some trial-and-error experimenting, guided by a kind of intuition which is an indispensable element in the mental outfit of the successful experimenter, will serve to find the right procedure in each case. For instance, one can use models lacking important characters of form or of motion. Often motion is automatically deficient because it cannot easily be imitated with a dummy. (Hence it is often a definite advantage not to work with live animals as "models" but with crude imitations.) Or, because the internal motivation is adding to the influence of the sensory stimuli in the same summative way, it is well to experiment on individuals with more or less standardized, not too high, internal motivation. To take the instance of Leiner's sticklebacks again: it is possible to have a female lay her eggs without any stimulation by a male at all simply by keeping her isolated until spawning occurs as a "Leerlaufreaktion," or spontaneous discharge, for when an instinctive action is not released because of the lack of adequate stimulus; the threshold of stimulus is so markedly lowered that the instinctive action may at last occur without any perceptible stimulus (Lorenz, 1935:162). Hence it is not to be expected that omission of only one stimulus will prevent the female stickleback from spawning. But if one selects only such females as show a certain intermediate intensity of response to



a standard male, one reaches an intensity level of reaction in which presence or absence of one sign stimulus is the controlling factor.

Of course this procedure implies that a sign stimulus detected in this way is not always the only effective sign stimulus, even though the experiment may seem to indicate it. The very nature of this type of experiment, designed to discover a particular sign stimulus, leads to neglect of other possible sign stimuli. Therefore, each experiment of this kind has to be combined with a test in which the more effective of the two models is compared with the optimal situation, viz., the live "actor." As long as a difference in releasing value between the model and live actor exists, it is clear that the model still lacks one or more essential sign stimuli, and to discover exactly what it lacks other experiments will have to be carried out that compare its releasing value with that of a second model differing from it only in respect to one character not yet tested as a sign stimulus.

The reverse conclusion, however (viz., that optimal reaction intensity to a model proves this model to be optimal), is not true. Owing to the fact that internal and external factors (motivation, urge, or drive of varying intensity and sign stimuli, respectively) are cooperating according to the principle of heterogeneous summation, high internal motivation may cause the reactor to respond to all objects offering the minimum adequate external stimulation. The result of such extreme lowering of the reaction's threshold is that the animal reacts indiscriminately to "good" and "bad" dummies. This gives the impression that the animal "does not discriminate" between the dummies. Especially when an animal is dominated by an abnormally strong sex-drive (an unnatural state often encountered in isolated captive animals) such things may happen. Heinroth's observation of a captive Robin (*Erithacus rubecula*) mating with a dead companion and of a young Corn Crane (*Crex crex*), reared in captivity mating with Frau Heinroth's hand (O. and M. Heinroth, vol. 1, p. 13; vol. 3, p. 79), as well as Allen's observation (1934) of Ruffed Grouse (*Bonasa umbellus*) treading a dead grouse or a submissive male, are some of the numerous instances reported in the literature. A dead bird displays a releaser which demonstrates the female's readiness to pair: keeping quiet. The mere fact that a strongly sexually motivated male promptly reacts to the display of this single releaser does not prove that it does not discriminate between a dead animal and a live female. Under "normal" conditions (that is, when motivation is not extremely high), the bird may discriminate very well between a willing female and a corpse.

Further, it is a corollary of this same principle of heterogeneous summation that an object may readily evoke conflicting reactions. During experiments on egg recognition (or in more objective terms:

on the releasing mechanism of incubation responses) in Herring Gulls, it was found that the shape of the egg was important, but the effect of color was negligible, blue, yellow, black, and white eggs having equal releasing value (Tinbergen and Booy, 1937). Red eggs, however, were an exception. All red objects are invariably thrown out of the nest, a yet unexplained fact which has been noticed by several observers. Now it was quite interesting to observe the gull's behavior when an egg of normal size and shape but of an intense red color was offered. The bird repeatedly made incipient movements of sitting down, but again and again it was offended by the red color and vigorously pecked at the (wooden) egg. From my other experiments I knew that the shape was releasing the sitting response, the color the pecking response. If, in the course of this struggle between drives, the sitting drive dominated long enough to allow the bird to sit down, it came to rest, for the color lost its influence and tactile stimuli from the egg now controlled the situation.

Lorenz (1935) mentions similar observations in parent-chick relations in ducks. A female may run to the rescue of a chick of a foreign species as a reaction to the distress call, then may kill it at the sight of the chick's color pattern, which does not fit her innate releasing mechanism since her own species has a different pattern.

In short, we could describe the phenomenon upon which the rule of heterogeneous summation is based by saying that the animal, when it responds to the stimulation of an innate releasing mechanism, does not react to an object, or to a congener, but to a bundle of sign stimuli—a bundle of releasers. As Lorenz has pointed out (1935), the animal in this case does not "see" the congener as a whole; when its several social responses are directed to one and the same individual, it is because this individual carries all the necessary releasers. It is the releaser a bird is reacting to, not the individual that is carrying the releaser. Of course, I am speaking only of the type of behavior that is dependent on releasers, not of conditioned or higher types of behavior.

I have already indicated that not all releasers have the same extreme status as the red breast in Lack's robin. Other characteristics may have an influence, though perhaps a slight one. The degree of dominance may be very different. Again this may be detected by comparing the releasing influence of crude dummies displaying only one releaser with the optimal situation.

The pregnant female stickleback has one powerful releaser, acting on the male: the swollen abdomen. In addition, her special mode of swimming acts as a releaser. In order to compare the value of the swollen abdomen with other possible morphological sign stimuli, the influence of a very crude model with swollen abdomen was compared

with that of a complete (dead) female with a normal abdomen. The first model released courtship reactions of higher intensity than the second one. The swollen abdomen, therefore, had a higher releasing value than all other morphological characters together, but the fact that the second dummy was able to release responses at all showed that it contained some "recognition marks." Lack's experiments, in which he compared the effectiveness of the red breast of the robin with that of a complete bird lacking the red, revealed a much higher value for the releaser.

There can be little doubt that the relative value of the releaser is different in different species, varying from the extreme condition found in the robin to the other extreme, in which a releaser is of only slight importance. While in the former cases it is easy to demonstrate the releaser's function by experiment, there are increasing difficulties in the cases approaching the latter condition. The same difficulties are encountered in those cases where not one, but two, three, or even more releasers are cooperating. It seems to me quite probable that the releasive value of the anal circling in nestling song birds is rather slight, because there are two other sign stimuli that cooperate with it, viz., the wiggling movements of the young's abdomen and (according to Rand's experiments) the fecal pellets themselves.

For the same reason, it will not be easy to settle the question whether the "Sperrachen" (colored throat and mouth lining) of passerine nestlings are releasers, because they are supported by gaping movements and by sounds. It will require quite an amount of insight, feeling, and trial-and-error experimenting to settle questions like these. They are a challenge to the ambitious experimenter.

The phenomenon of varying relative importance of releasers among different species and even among different releasers of one species suggests an evolutionary interpretation. In my opinion there can be little doubt that the extreme condition, as found in the robin, where one releaser is so important as to control the releasing mechanism, is the end-result of an evolutionary process directed toward specialization of releasers into very specific, highly "improbable" structures. For more detailed discussions of this problem, see Lorenz (1940) and N. Tinbergen (1940).

#### INNATE AND CONDITIONED RESPONSES

I have already mentioned that the available evidence strongly suggests that innate releasing mechanisms are always responsive to a combination of only very few sign stimuli. We have reason to believe that this is valid especially for innate, as against conditioned, releasing mechanisms. Seitz's experiments (1940) with *Astatotilapia strigigena* are very instructive in this respect. As mentioned above, a normal

male, reared among other members of its species, responds by fighting to very simple imitations of a male. However, Seitz did not succeed in making any dummy that evoked courting responses in the normal male; it responded only to live females. In a male reared in isolation, courting responses could be evoked by very simple models. The fighting reactions of this male had the same releasive mechanism as those of normal males. Thus the innate releasing mechanism of the courting behavior is originally very simple, but it is changed by conditioning and thereby becomes highly specific or selective, that is to say, it requires stimulation by a very complicated system of many stimuli. The innate releasing mechanism of the fighting remained unaffected by conditioning. Coinciding with this, the male of the species bears releasers which, as a matter of fact, provided the sign stimuli to which the fighting reaction responded, whereas the female does not have any structures that could be classed *a priori* as releasers.

Laboratory experimenters know how difficult it may be to force an animal to react to exactly that stimulus which the experimenter wants to impress upon it. As a result of conditioning, the animal always begins to react to the situation as a whole, including many of even the minutest details, and it is only by continually changing all possible stimuli except the one stimulus wanted that one can get the animal to confine its reactions to this one stimulus.

This all points to the conclusion that the reason the releaser is always a relatively simple thing is that the limitations of the innate releasing mechanism force it to be simple. It will be clear that it is of the highest importance for our insight into these matters not to stop an investigation as soon as the releasing influence of a releaser is demonstrated, but to carry it on by breeding the species, rearing young in isolation, and testing their innate releasing mechanism in exactly the same way as was done with the normal individuals, in order to detect where conditioning steps in.

Of course, these conclusions and considerations are based on relatively scanty evidence, and there are observations that may throw doubt on them. For instance, Kramer (1937), as also Noble (1934), is not sure whether lizards' reactions to the fight-evoking releaser are innate or conditioned.

#### NATURE OF THE REACTOR'S RESPONSE

So far, our discussion of the experimental method has considered only part of the releaser problem. I have been focussing attention on the problem of the sensory stimulus releasing the reactor's behavior. Something should be said now about another side of our problem, viz., the response of the reactor. This will lead us to a study of other phenomena of great importance for experimental procedure.

*Latent responses and repeated stimulation.* Every observer knows by experience that an animal does not always and invariably show a prompt response to a releaser. Sometimes the display of a releaser evokes an immediate reaction; at other times the same releaser must be displayed repeatedly before the reactor responds; in other instances, no response is shown at all. As we have seen, these differences in responsiveness are due to fluctuations of the other factors, usually the internal ones.

The cases of a reaction following repeated stimulation are of especial interest to us. The absence of any outward response to the first stimulus might give the impression that the stimulus has no effect at all. However, the very occurrence of responses after several repetitions of the same stimulus clearly proves that there is a certain summation over time, in other words, that the effects of the repeated stimuli have been accumulating within the animal. Though no outward response was observable, there must have been an internal, latent response, resulting with each renewed stimulation in a lowering of the threshold—in an increase in readiness to respond to the next administration of the stimulus.

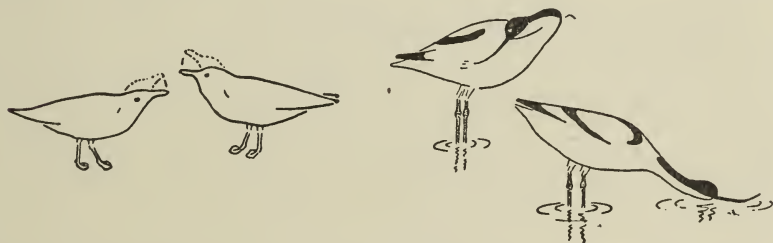


Figure 23. Herring Gulls (left). Begging movements preceding coition. After N. Tinbergen, 1942. Avocets (right). Preening in male preceding coition. After Makkink, 1936.

The tactile stimulus given the female stickleback by the "trembling" of the male is a clear case. In bird courtship, we often observe the same phenomenon; one has only to think of the "begging" movements preceding copulation in Herring Gulls (Figure 23, left; Goethe, 1937a; N. Tinbergen, 1940), the preening movements shown by Avocets (*Recurvirostra avosetta*) in the same situation (Figure 23, right; Makkink, 1936), and many other instances.

This is of importance in two respects. First, it is obvious that one has to be very careful in drawing negative conclusions about the effectiveness of a stimulus when no immediate reaction is observed. Second, it shows that a stimulus may have a more or less lasting after-effect, for without this after-effect no successive summation of stimuli would be possible.

*After-effect of stimulation.* A few words must be said about this phenomenon of a continuing effect, for it may have a strongly disturbing influence on our experiments. When, for instance, the fighting reactions of a male stickleback are released during an experiment in which a dummy is presented for a certain fixed time, let us say five minutes, the reaction does not stop abruptly with removal of the dummy. It is true that the fish does not actually fight after his "opponent" has disappeared, but for several minutes following the conclusion of the test the threshold of the fighting responses remains lower than usual; in other words, the fighting drive is still activated, and it only gradually dies down to "normal" again. This means that it is necessary to give the animal a rest before a new test is begun in which a second model is presented for comparison of its effect with that of the first model. If we should begin the second test before the after-effect of the first has disappeared, we might get a high intensity of response to a relatively weak model; the weak dummy might, so to speak, profit from the intense effect of the strong model, and we would get a much too favorable impression of the effectiveness of the weak dummy.

*Inhibitory interaction among different drives.* Closely related to the phenomenon of a drive's after-effect is the fact that activation of one drive has an inhibiting effect on all other drives. A fighting animal is not very susceptible to food-stimuli or to the stimuli that usually evoke escape. This phenomenon can be used in dummy experiments for the purpose of breaking down the after-effects of each test. The easiest way to do this and thus to standardize the tests, is to alternate tests on two different drives, for instance, the mating and the fighting drives. This can be done by presenting models of males and of females in turn. If this method is combined with regular rests between successive tests, the disturbing influence of after-effects can easily be overcome. To prevent loss of time through these forced rests, it always pays to work with a number of individuals at the same time. Each of them gets plenty of rest between successive tests if the experimenter turns from one individual to another in sequence.

*Various motor responses correlated with one releaser.* A study of, for instance, the alarm call of a Herring Gull shows that the reactor's response is not always one special type of movement. At the sound of the alarm call, uttered by a gull on the discovery of a dog, different individuals behave differently. Some gulls fly up in a panic and begin to call the alarm themselves, or to attack the enemy once they spot him. Other gulls walk from the nest to a look-out post to get a good view of the surroundings. Others merely wake up and stretch their necks. The actual motor response is different in these

various cases, but they all belong to one group—they all form part of the total pattern of alarm and nest-defense behavior. In other words, the function of this releaser is not to release one single reaction but a whole pattern with a special function or purpose: the major instinct of nest-defense. Once this instinct (this "mood") has been aroused, it is (1) the intensity of response, and (2) additional stimuli, such as actual discovery of a predator, that determine which type of motor reaction will result.

These and many similar facts show that the term *releaser* cannot be used in the narrow sense of a device evoking one special motor response. In many cases, a releaser rather evokes what Heinroth calls a "Stimmung" (mood), a readiness to respond with one group of functionally related motor patterns. This is in accordance with the results of instinct studies in general, which have shown that "a reaction" may be a special motor response in one case, a change in readiness to react with a special motor response in another case, or even a change in readiness to respond with a whole pattern of functionally related movements in many other cases. It is an enormous over-simplification to identify "reaction" with "motor response." Again, this cannot be elaborated here; for particulars I must refer to my 1942 paper. It must suffice to say that the motor responses of one instinct are not only functionally related but are also dependent on the same causal mechanism, on the same nervous center.

*Successive tests and "choice" experiments.* In many of the tests described thus far the effects of different dummies have been studied and compared by presenting them in succession. Outsiders watching such work often ask why the two models are not presented simultaneously and the choice of the reactor watched. This question, natural as it seems to be, is based on a wrong assumption, viz., that the reactor will always show a preference for the "strongest" model. This is by no means the case, as a few instances will show.

First, an animal often reacts to the dummy it happens to see first. Slight differences in position between the two dummies presented will influence their relative conspicuousness, and the result is that now one dummy arouses all or most of the reactions, now the other one. In this way, position, or—since "position" is rarely analyzed—"accident," plays much too large a part in our final statistics, and our result is unreliable or at least confused. This could perhaps be overcome by very careful experimenting, but it would take much more time than the "successive" method would, and gain of time is the only reason for the inclination to prefer "choice" tests.

There is, however, a more fundamental objection to the "choice" method. In an experiment designed to settle the question whether the

so-called scent organs of male grayling butterflies served to stimulate the female's mating responses, we presented a number of females with double the number of males, in half of which we had removed the scent organs. This, therefore, was a "choice" test. The result was not according to our expectations: the females accepted scentless just as frequently as normal males. Close observation of the behavior during the experiments showed that some of the matings with scentless males occurred when a female was surrounded by males of both kinds. Even while a normal male was courting a female, a scentless male would approach her and succeed in attaching its copulatory organs to hers. We suspected that the cooperation of the female in such cases was due to the stimulating effect of the normal male's courtship. We then carried out a series of successive tests in which scentless males and normal males were presented in turn, and found a marked difference in success between them. Although the number of tests was rather small, the obvious conclusion seems to be that the display of the scent organ raises the female's excitability in a general way but does not *direct* her activities to the displaying male. Once she has been excited and her copulatory reactions have been released, she accepts any male, provided he presents the stimuli necessary for the next link in her reaction-chain.

The wing display of a male *Drosophila* seems to have the same kind of general excitatory influence. Sturtevant's results (1915), though perhaps not entirely conclusive, at least point in this direction.

This is not the place to discuss the ethological background of this phenomenon. Referring again to a previous paper where I discussed it at length (Tinbergen, 1942), I must content myself with the statement that there are two types of sign stimuli and, therefore, two types of releasers: those that *direct* the response, and those that merely *release* it without giving spatial guidance. If the latter type is involved, "choice" experiments are of no use, because one dummy may release the response, while another dummy may be "chosen."

As an instance of a simple releasing signal, the alarm call and alarm movements of the Herring Gull may be cited. When a female Herring Gull (with half-grown chicks) that I was observing was disturbed by some careless movements I made in my hide, her alarmed behavior alarmed the chicks too, but since the mother's behavior had no *directive* influence, the chicks did not know where the danger lay, and when the mother's behavior increased in intensity, the chicks actually went to shelter by crouching in my hide.

An instance of a releaser with the double function of releasing and directing the response is the peculiar movement by which the male stickleback indicates the nest's entrance to the female (Figure 24). Turning on its side, the male points its head into the entrance. With



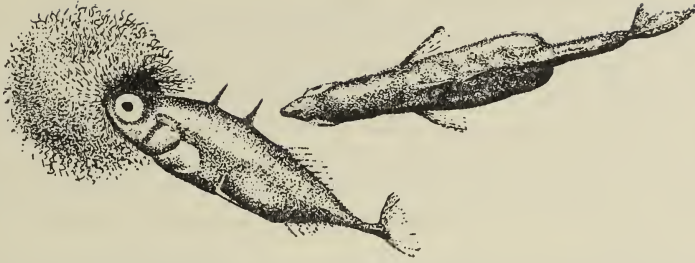


Figure 24. Male stickleback showing nest entrance to female. After Ter Pelkwijk and Tinbergen, 1937.

a dummy played in about the same way, one can get a pregnant female to attempt to "enter" at any place in the aquarium.

It is not necessary to discuss this point further, because I do not want to deny the value of "choice" experiments in all cases. I merely want to point out the fact that it is not a matter of personal preference whether one uses successive tests or "choice" tests; the relative value of the two methods depends on the nature of the releaser to be tested, and a decision on which method should be used can be taken only after trial-and-error attempts in each new case. Needless to say, a systematic study of this problem would be of the greatest value.

#### SUMMARY

This discussion of the releaser concept has two objects: first, to draw attention to a number of experimental facts proving the releaser function in those cases that have been critically studied with adequate methods; second, to stimulate further research, by pointing out the many requirements to be fulfilled in a really critical procedure, and by showing the incompleteness of the work thus far done.

Part 1 defines the releaser concept and discusses experimental results in the fields of visual releasers (stickleback, robin, Flicker, Shell Parakeet, Herring Gull, lizards, cichlid fish, cuttlefish), of auditory releasers (crickets, birds), of chemical releasers (honey-bee, hyena, butterflies), and of tactile releasers (snails). A selection of observational (non-experimental) evidence on visual releasers is added.

Part 2 presents certain principles which are of importance for planning experiments and for evaluating the results:

Each innate reaction of an animal responds to a limited set of "sign stimuli," which do not influence the behavior as a whole but only special reactions or reaction patterns.

What appears to be "a reaction" is often a chain of reactions, each of which is dependent on its own set of sign stimuli. The function of

a releaser may be confined to any one link of such a chain, as, for example, in the chain of mating reactions of the stickleback.

The "rule of heterogeneous summation," the additive effect of different stimuli, has important implications for experimental practice. Many reactions may occur even in the absence of one of the sign stimuli, provided the motivation, dependent on internal factors, is high enough. Any experiment on the value of releasers, therefore, has to compare the effect of two dummies that differ only in the one releaser to be studied.

The releaser is an adaptation to the innate releasing mechanism, which, for reasons unknown, is dependent on a "simple" stimulus situation. Conditioned behavior responds to a much more complicated stimulus situation.

Many reactions are dependent on repeated stimulation, each stimulus slightly raising the excitatory state, which by accumulation of the effects of repeated stimulation reaches a final state in which the reaction is released.

Many of the so-called reactions released by releasers are not simple "motor responses" but are internal reactions by which the centers of whole patterns or major instincts are activated.

Some releasers have a general excitatory influence and do not direct the reactor's response; in these cases experiments should be of the "successive," not of the "choice," type.

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ZÖÖLOGISCH LABORATORIUM DER RIJKSUNIVERSITEIT TE LEIDEN

## GENERAL NOTES

Early nesting and Cowbird parasitism of the Goldfinch in Michigan.—The Eastern Goldfinch (*Spinus t. tristis*) is well known as a late nester, and few June nests have been recorded. In his study of the Goldfinch in southern Michigan, Walkinshaw (1938. *Jack-Pine Warbler*, 16 No. 4: 3-11) gives June 30 as the earliest date of nest building for 111 nests from 1919 through 1938 (p. 9). In other parts of the range, early nests have been recorded as follows: E. A. Samuels (1867. "Ornithology and Oölogy of New England," p. 289) states: "The earliest nest that I ever heard of was found June the 10th, and very few are found as early as the middle of that month." T.S. Roberts (1936. "The Birds of Minnesota," 2nd ed., vol. 2, p. 368) lists three early nests: May 20, 1930, 2 eggs; June 4, 1923, "nest"; June 23, 1928, building.

On June 11, 1947, I found a nest which, at first glance, I assumed to be a two-storied nest of the Yellow Warbler (*Dendroica petechia*). The nest appeared complete but contained no eggs; nor were the owners present. I saw nothing unusual about the nest other than its exceptional depth. On June 13, I found a female Goldfinch on the nest. She was reluctant to leave and did so only after I bent the nest tree slightly in order to observe the nest contents. Two Goldfinch eggs were present. Within two minutes the bird returned to the nest (while I was standing about 20 feet away).

Summer classes made it impossible to make more than scanty observations at the nest, but the following information was obtained: On June 28, the nest contained one nestling and three eggs. After this date I visited the nest almost daily at 5:00 p. m. On July 1, for the first time, I noticed a Cowbird (*Molothrus ater*) egg in the bottom of the nest with only about a fifth of the egg protruding above the lining. I believe that during the 21-day interval since the discovery of the complete, empty nest, enough lining had been dislodged to expose the Cowbird egg. Since I had never removed the host eggs from the nest, they may have been covering the Cowbird egg for some time. I am positive, however, that the Cowbird egg was completely covered by nest lining on June 11, when I discovered the nest. On July 2, I removed and opened one of the three host eggs; there was no visible indication of development. The one young Goldfinch left the nest on July 10, 1947, before 5:00 p. m.

I removed and examined the nest on July 10. The two remaining host eggs showed no indication of development. Closer examination of the nest revealed a second Cowbird egg completely covered by a thin layer of lining; this egg had a hole in the upper surface about 5 mm. in diameter. A third Cowbird egg lay a little deeper in the lining between the other two, so that all three eggs were on the original nest floor.

The nest, which is now in the University of Michigan Museum of Zoology, measured when collected: outside diameter, 81 mm.; outside depth, 85 mm.; inside diameter, 53 mm.; inside depth of upper story, 35 mm. These figures correspond closely to averages found by Walkinshaw except for the outside depth, which is nearly 15 mm. greater and can be accounted for by the second story. The nest was 7 feet 11 inches from the ground in a four-way crotch of a box elder (*Acer Negundo*) 37 feet from Fuller Road near the northwest corner of the Arboretum, Ann Arbor, Washtenaw County, Michigan.

On August 21, 1947, I found a second Goldfinch nest (now in the University of Michigan Museum of Zoology), containing three young, 22 yards east of the early nest. The young were fledged August 23, after which I removed the nest from its location 16 feet 7 inches from the ground in a box elder. This nest, too, proved to be a double-storied structure and contained one Cowbird egg in the lower story. Using Walkinshaw's data on the incubation and nestling period, I estimated that the Cowbird egg was laid about July 25—a notably late date.

Norris (1947. *Wils. Bull.*, 59:86-87), reporting on 96 Cowbird eggs laid during two seasons at Butler, Pennsylvania, gives July 12 as the latest laying date.

I have found only two previous records of a Goldfinch building over Cowbird eggs. J. L. Davison (1887. "Birds laying their Eggs in the Nests of Other Birds," *Auk*, 4:263-264), speaking of Cowbird eggs, writes: "I have found them covered up, except in this instance [*Sayornis phoebe*], only by the Goldfinch and the Summer Warbler." Samuels (p. 340) writes on the same subject: "I have in my collection a nest of the Yellow Warbler thus doubled, and another of the Goldfinch."

Walkinshaw (p. 10) states: "I have never observed a Cowbird's egg in any of the 111 nests which I have observed." W. B. Barrows (1912. "Michigan Bird Life") makes no mention of Cowbird parasitism of the Goldfinch. Alexander Wilson (1810. "American Ornithology," vol. 2, p. 158) quotes Nathaniel Potter, of Baltimore, who reported finding a Goldfinch nest with one host egg and one Cowbird egg. E. D. Wintle (1896. "The Birds of Montreal," p. 91) reports a nest at Montreal, July 25, 1886, containing one egg of the Goldfinch and five of the Cowbird. J. K. Jensen (1918. "Notes on the Nesting Birds of Wahpeton, North Dakota," *Auk*, 35: 344-349) reports a nest found on August 6, 1917, "with a set of four fresh Goldfinch eggs and one Cowbird's egg." Other references consist, for the most part, of a general statement that the Goldfinch is parasitized by the Cowbird, with no definite records.

The incidence of Cowbird parasitism in the immediate vicinity may be indicated by the following records: On May 23, 1947, a Song Sparrow (*Melospiza melodia*) nest about a half mile away contained four host eggs and four Cowbird eggs; a fifth Cowbird egg was on the ground behind the nest. On May 24, a Yellow Warbler nest in the same region contained three Cowbird eggs in the process of being covered over. On June 4, a Song Sparrow nest about 200 yards from the Goldfinch nest contained two host eggs and three of the Cowbird. And on June 9, another Song Sparrow nest, about 600 yards distant, contained one host egg and two Cowbird eggs; two additional Cowbird eggs were on the ground a few inches below the nest, which was on a grassy slope.—A. J. BERGER, *Department of Zoology, University of Michigan, Ann Arbor, Michigan.*

Bald Eagle eating shoat on highway.—On April 24, 1947, while driving toward St. Mary's on Georgia Highway 40, I saw an adult Bald Eagle (*Haliaeetus leucocephalus*) feeding on a freshly killed shoat in the middle of the highway. The eagle was undisturbed when I stopped the car not over 50 feet away, but trucks approaching from St. Mary's flushed it into a long-leaf pine at the edge of the right of way (here 100 feet wide). On my return about two hours later, the eagle flushed when I was still more than 100 feet away—but only into a long-leaf pine on the other side of the highway. The next morning all that remained of the shoat were the entrails and the skin.—FREDERICK V. HEBARD, *1500 Walnut Street Building, Philadelphia 2, Pennsylvania.*

Bald Eagle captures tern.—On December 16, 1947, at about 7:45 a.m., I was driving north between Daytona Beach and Marineland, Florida, when I saw a flock of Caspian Terns (*Hydroprogne caspia*) and Royal Terns (*Thalasseus maximus*) feeding in the breaker zone. An immature Bald Eagle (*Haliaeetus leucocephalus*) was circling about 300 feet above the water a little farther offshore. Suddenly the eagle dove in the direction of the terns and caught one at the water surface just as the tern was rising with a fish. The eagle carried the tern (apparently a Royal) to the beach and alighted. I left the car and advanced over the dunes. This frightened the bird, and it flushed, carrying its prey about 75 yards farther down the beach.—G. W. NOELL, *Marine Studios, Marineland, Florida.*

## EDITORIAL

We are grateful to Roger Tory Peterson for his splendid painting of the Arizona Junco reproduced as the frontispiece of this number and of the sixtieth volume of *The Wilson Bulletin*.

Our Endowment Fund Committee has been working steadily to increase our roll of Life Members (whose payments are added to the Club's Endowment Fund), and the Committee had a remarkable report to make at the end of 1947. During the year the number of Life Memberships increased by thirteen, bringing the total to fifty-seven.

The 1947 Annual Meeting held in November at Columbus, Ohio—one of our largest and most successful—is described in later pages of this issue of the *Bulletin*. Members who failed to attend the 1947 meeting should begin now to plan for the 1948 meeting, which will be held in Madison, Wisconsin; those who participated in the 1947 meeting will need no reminder.

## OBITUARY

HUBERT LYMAN CLARK died at Cambridge, Massachusetts, July 31, 1947, aged seventy-seven. A world authority on echinoderms, he was also an ornithologist of distinction whose some two dozen publications on birds include notable contributions to our knowledge of bird anatomy, distribution, and pterylography.

JOHN B. SEMPLE, trustee of Carnegie Museum and of Carnegie Institute of Technology, died on November 13, 1947, at Sewickley, Pennsylvania, at the age of seventy-nine. The published results of the several ornithological expeditions that Mr. Semple conducted to Canada, Mexico, and the Western States represent major advances in ornithological study.

## ORNITHOLOGICAL NEWS

Robert W. Storer has been appointed Assistant Editor of the *Condor*.

We are sorry to report that the plan for distributing copies of the Aves section of the *Zoological Record* through an American agent—announced earlier in *The Wilson Bulletin* (September 1944)—has been abandoned. Copies can be purchased from the Secretary, Zoological Society, Regent's Park, London, N.W. 8, England.

The Louisiana Ornithological Society was founded on December 6, 1947. Officers elected at the initial meeting were: *President*, Earl R. Greene, of New Orleans; *Vice-President*, George H. Lowery, Jr., of Baton Rouge; *Secretary-Treasurer*, Gladys S. King, of New Orleans. One of the new society's chief objects is "to unite interests and activities of bird students over the state in gathering information on selected projects concerning bird life within its boundaries."

## A COOPERATIVE STUDY OF NOCTURNAL BIRD MIGRATION

To the Editor of *The Wilson Bulletin*:

Studies in recent years at Louisiana State University have demonstrated the practicability and desirability of making counts at night of migrating birds by use of a small telescope focused on the moon. The number of birds seen in this measurable portion of the sky furnishes an index to the total number passing over a given observation station. The telescopic method also provides a means of computing the direction and altitude of flight. From these data it will be



eventually possible to determine to what extent night migrants follow set paths, whether the flights are continuous in equal volume throughout the hours of darkness, and in what way certain meteorological conditions affect the density and direction of migration. However, large numbers of observations are necessary to obtain results of statistical significance. An intensive program of study in the spring of 1948 is being directed from Louisiana State University. Observation stations ranging from Florida to eastern Mexico and from the Yucatán Peninsula north to southern Michigan are already scheduled for operation. But many more such stations are urgently needed. Any Wilson Ornithological Club member with access to a spotting scope or a low-powered astronomical telescope who is willing to collaborate in this project, is asked to communicate immediately with George H. Lowery, Jr., Museum of Zoology, Louisiana State University, Baton Rouge, Louisiana. Detailed instructions and data sheets will be provided at once so as to permit observations in the full moon period of April.

George H. Lowery, Jr.

#### THE LOUIS AGASSIZ FUERTES RESEARCH GRANT

LEONARD R. MEWALDT, who recently joined the Wilson Ornithological Club as an Active Member, has been chosen by the Louis Agassiz Fuertes Research Grant Committee to receive the 1947 grant. The grant will assist him in continuing an extensive study, begun in 1946, of the Clark's Nutcracker in Montana. Mr. Mewaldt has detailed observational data on the complete breeding cycle of this nutcracker from nest building through nest leaving, with photographs and kodachrome motion pictures of the brooding and feeding of the young. In addition, he is collecting during every month of the year material for a detailed study of the reproductive cycle, food habits, body weights, plumages, and parasites. Because Clark's Nutcracker nests only at higher altitudes, usually above 4,000 feet in Montana, Mr. Mewaldt's field work has involved regular drives into mountainous areas, with further climbs on foot. He expects to complete the nesting study for publication in 1948. Mr. Mewaldt is at present Graduate Assistant in Zoology at Montana State University.

#### NEW LIFE MEMBER



GUY EMERSON, Director and former President of the National Audubon Society, first became interested in birds at the age of ten through Reginald Heber Howe, of the Nuttall Ornithological Club, and since then has come to know the birds and birdmen of thirty states—in 1939 he recorded 497 species of birds. Meanwhile, he found time to earn election to Phi Beta Kappa, to become one of the leading bankers of the United States, to help edit the "Economic World" (1914-1916), act as director of a number of National economic committees and organizations and as President of the Association of Reserve City Bankers.

Among other honors and decorations he has received from foreign countries is the Ribbon of Chevalier of the Legion of Honor of France.

## ORNITHOLOGICAL LITERATURE

ORNITHOLOGY LABORATORY NOTEBOOK. By Arthur A. Allen. Comstock Publishing Company, Inc., Ithaca, New York, fifth edition, 1947: 8 × 10½ in., vi + 256 pp., 301 figs., 131 maps. \$4.00.

The fifth edition of Allen's well-known Ornithology Laboratory Notebook differs little from the previous edition reviewed by Frederick H. Test (1941. *Wilson Bulletin*, 53:135-136). Test's thoughtful and adequate description of the book can be consulted by readers desiring more information than is given here.

The more important changes in this new edition are: first, the inclusion of a three-page list of "Reference Works to Consult in Completing the Life History and Identification Charts"; second, the transfer of 104 outline drawings of birds (from an appendix of 188 such drawings in the fourth edition) to the life-history charts, one species per chart—as they were arranged in the earliest edition. To the synopsis of "Summer and Winter Ranges of North American Birds [that occur in central New York]" have been added the Mute Swan, Long-tailed Jaeger, American Three-toed Woodpecker, Audubon's Warbler, European Goldfinch, Hoary Redpoll, and Greater Redpoll, because of recent occurrences in the Ithaca region. Also, the "races" of the Black Duck have been dropped, and, in general, changes recommended by the Supplements to the A.O.U. Check-List appear to have been adopted insofar as they are pertinent to this synopsis. The frontispiece, Merriam's life-zone map of North America, is reproduced as a half-tone rather than in color; as a result, it loses both in forcefulness and usefulness.

The preface to this edition is the same as that to the fourth except for minor details and three new paragraphs in which the author excuses the absence, in his version of an ornithological notebook, of detailed material on anatomy, classification, speciation, and ecology, on the grounds that it would "tend to confuse the beginner who is interested primarily in learning how to recognize the local birds and to interpret their behavior." Also, the author states that he "clings to the life zone theory of C. Hart Merriam, not in the belief that it explains everything, but because it is the most convenient, the most orderly, and the most compact method of expressing the irregularities of occurrence of our nesting bird populations." These excerpts speak for themselves. The various editions of this notebook have hardly kept up with advances in knowledge, teaching, and viewpoints in modern ornithology. The fact is that the main laboratory work of the student using this edition in 1947 is, as it was in the 1920's, compiling detailed life-history material for as many as 130 species. I do not doubt that this will keep a student busy for a semester, but what progress will he make in understanding fundamental biological problems as they relate to birds?—Frank A. Pitelka.

FLASHING WINGS. By Richard M. Saunders. Illustrations by Terence M. Shortt. McClelland and Stewart Limited, Toronto, 1947: 6 × 9 in., xii + 388 pp., one insert table, two end-paper maps, colored frontispiece, and 36 line drawings. \$4.50.

This book is composed mainly of selections from the journal of an enthusiastic bird watcher at Toronto, Ontario (not the late W. E. Saunders of London). The journal covers the period 1935 to 1946, but the entries have been grouped in twelve chapters, one for each month of the year, rather than in the sequence of the years. This arrangement has been used in order that the book may serve "as a guide to the birds that one may expect to see in this region at any time of the year." The value of the book as a local report on the birds of Toronto is enhanced by two appendices containing tables summarizing migration records extending over 27 years, Christmas bird counts for the years 1925 to 1945, and an index.

Saunders writes with clarity and vigor. His attitude toward bird study is typical of that of the large group of people to whom bird watching is a field sport. He describes effectively the serene enjoyment of the solitary walk and the high spirits of the hike with congenial companions. To him and to his associates there is adventure in discovering a rare bird, in identifying an unfamiliar song, in counting the species during a wave of migrants, or in observing an interesting bit of behavior. All of this activity is carried on with no immediate aim other than recreation; that is, there is little suggestion of scientific study in any phase of ornithology. Nevertheless, Saunders contributes some original observations of bird behavior which are of interest, for example: the attack on a Bald Eagle by a Herring Gull (pp. 35-36); Black Terns scooping up polliwogs (p. 175); Pigeon Hawk eating a sparrow (p. 265); and tree drilling by the Arctic Three-toed Woodpecker (p. 323).

The book is attractively printed and bound, and Shortt's illustrations are excellent.—Harold Mayfield.

CANADIAN SPRING. By Florence Page Jaques. Illustrations by Francis Lee Jaques. Harper & Brothers, New York, 1947: 6½ × 8½ in., xii + 216 pp. \$2.50.

Those readers who have perused "Canoe Country," "The Geese Fly High," "Birds Across the Sky," or "Snowshoe Country," earlier productions of the Jaques couple, will welcome this latest of the series, a report of a trip they made together through Manitoba, Saskatchewan, Alberta, and the Canadian Rockies during the stirring weeks of a Canadian spring. The collaboration is practically perfect. The illustrations are decorative and, of course, scientifically accurate. Aside from the little sketches that serve as embellishments for chapter headings, there are about sixty drawings, large and small, that are scattered very much apropos through the pages of the book, aiding the reader to visualize the entrancing scene that the author is describing in adjacent paragraphs. Florence Page Jaques is an engaging writer, and she had an attractive subject in "Canadian Spring." Those of us who never have been in that territory in the spring season—or perhaps any other season—must envy travelers who had the thrill of seeing the teeming wildlife of the prairie provinces of Canada, with some of the fauna, flora, and scenery of the Canadian Rockies thrown in for good measure. We read about—and see drawings of—Wilson's Phalaropes, Marbled Godwits, Water Ouzels, Harlequin Ducks, Avocets, Curlews, Richardson's ground squirrels, pikas, Whistling Swans, Pintails, Gadwalls, grebes—the list is overwhelming. In fact, the list is so imposing that an index should have been included in the volume. There are also some passages in which scientific names and exact dates would be comforting to readers deeply interested in the subject matter. But these are small drawbacks in a book that is beautifully written and illustrated and that contains, in addition to a colorful and often poetic presentation of "the rites of spring" in western Canada, a considerable amount of intimate observation of wildlife, particularly of water birds and their breeding behavior, that will be of interest to serious students of natural history.—John Kieran.

WILD WINGS. By Joseph James Murray. John Knox Press, Richmond, Virginia, 1947: 6 × 9½ in., 123 pp., 15 photographic plates (unnumbered, except for a double-page frontispiece which serves also as title page). \$2.50.

This is a collection of forty brief sketches which, with one exception, appeared originally in *Onward*, the young people's paper of the Presbyterian Church. The typical sketch, two or three pages in length, offers general information and a bit of personal observation about the several species of birds seen by Murray at a given time or place. The first nineteen sketches pertain to Murray's home locality, western Virginia; the next eighteen tell of excursions in other southeastern states

and six countries of Europe; the last three touch on the life of Audubon and on Biblical references to birds.

Murray is a competent and interested observer, who writes about nature in a spirit of calm appreciation. However, although these sketches have been "somewhat revised" since their original publication as separate articles intended for an audience of young people, the critical reader of the book may feel that the comments are often rather fragmentary and that sometimes, when a bird is mentioned in more than one chapter, the statements are so much alike as to seem repetitious (for example, the remarks about the Carolina Wren, Rose-breasted Grosbeak, and Duck Hawk). In the main, the facts about birds are given accurately, but there are a few minor statements which might be questioned by an ornithologist, for example: a mention of wood warblers "weighing a bare ounce or two" (page 27); the assertion that ducks are the "favorite food" of the Duck Hawk "where he can get them" (page 52); and the explanation that most migrants are driven south by "lack of insect food" (page 54).

The binding and typography of the book are exceptionally attractive, and the plates—eleven of the fifteen are from photographs by Allan Cruickshank—are printed artistically in a shade of greenish-black.

The book is entirely unrelated to "Wild Wings" by Herbert Keightley Job (Houghton, Mifflin and Co., Boston, 1905), describing Mr. Job's adventures in bird photography.—Harold Mayfield.

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THE WILSON ORNITHOLOGICAL CLUB LIBRARY

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PROCEEDINGS OF THE TWENTY-NINTH  
ANNUAL MEETING

BY JAMES B. YOUNG, SECRETARY

The Twenty-ninth Annual Meeting of the Wilson Ornithological Club was held November 27-29, 1947, on the campus of The Ohio State University, Columbus, Ohio, at the invitation of Capital University, the Columbus Audubon Society, the Ohio State Museum, The Ohio State University, and the Wheaton Club.

Business and Papers Sessions were held at the Ohio State Museum and in the Auditorium of Haggerty Hall.

The Executive Council met at the Deshler Hotel on Thursday evening, November 27. Club members and visitors met on Friday and Saturday for two short business sessions, three sessions of papers, and one session of papers, natural color slides, and motion pictures. A tea was given on Friday afternoon by the wives of the Trustees and women of the staff of the Ohio State Museum for the wives of visiting members of the Club. Saturday evening the Museum held open house. Following the Annual Dinner on Friday, there was an auction of bird paintings for the benefit of the ornithologists of Europe. On Sunday, there were field trips to Buckeye Lake, O'Shaughnessy Reservoir, and Hocking County.

## MEETING OF THE EXECUTIVE COUNCIL

At the Executive Council meeting on Thursday evening there were present the following Council members: Maurice Brooks, Albert F. Ganier, Lawrence E. Hicks, George H. Lowery, Jr., Burt L. Monroe, R. Allyn Moser, Olin Sewall Pettingill, Jr., Milton B. Trautman, Josselyn Van Tyne, James B. Young, and George Miksch Sutton, who presided. Also present were the following Chairmen and Members of Committees: Harold F. Wing and Frederick W. Haecker (Endowment Fund Committee), Harold F. Mayfield (Library Committee), F. N. Hamerstrom, Jr., and Charles A. Dambach (Conservation Committee), Frances Hamerstrom (Committee for Relief of European Ornithologists), and Edward S. Thomas (Local Committee on Arrangements).

Josselyn Van Tyne was unanimously re-elected Editor for 1948.

The Council accepted the invitation of the Kumlien Club and the Wisconsin Society for Ornithology to hold the 1948 Annual Meeting at Madison, Wisconsin, the date of the meeting to be determined later.

The Secretary read a letter from the American Association for the Advancement of Science, inviting the Wilson Ornithological Club's affiliation. Decision on the matter was deferred.

Reports were read by the Secretary, the Treasurer, the Editor, and by the Chairmen of the Endowment Committee, Conservation Committee, Library Committee, and the Committee for Relief of European Ornithologists. Reports of the Chairmen of the Affiliated Societies Committee, Illustrations Committee, and Membership Committee were read by the Secretary, the Chairmen of these committees being absent.

In order to establish a closer bond with the eight Affiliated Societies, the Council directed the Secretary to invite each of the Societies to elect or appoint at their next Annual Meeting a representative (with two alternates) to meet with the Wilson Ornithological Club Executive Council at the Annual Meetings.

Charles A. Dambach reported on the September meeting of the Natural Resources Council of America. Affiliation with the Council is under consideration.

The Executive Council made available to the Committee for Relief of European Ornithologists the sum of fifty dollars to assist in defraying the expenses of stamps, stationery, and similar items during 1948.



BUSINESS SESSIONS

President George Miksch Sutton called to order the first Business Session on Friday morning at nine o'clock. The minutes of the 1946 meeting, as published in *The Wilson Bulletin* for March 1947, were approved.

Reports of the Secretary, Treasurer, and the Chairman of the Library Committee were read and approved.

The President appointed the following temporary committees: *on Resolutions*, Frederick W. Haecker, H. W. Hann, Lawrence I. Grinnell; *on Auditing*, Harold F. Wing, Russel Burget. He announced the appointment of A. W. Schorger as Trustee, to serve for a term of three years.

The Secretary read the report of the Nominating Committee, proposing the following officers for 1948: *President*, Olin Sewall Pettingill, Jr.; *First Vice-President*, Maurice Graham Brooks; *Second Vice-President*, Walter J. Breckenridge; *Secretary*, James B. Young; *Treasurer*, Burt L. Monroe; *Elective Members of the Executive Council*, George H. Lowery, Jr., Milton B. Trautman, Richard H. Pough. The report of the Nominating Committee was accepted and the nominees duly elected.

A list of persons nominated to membership during the current year was placed on the table for approval.

The thanks of the Club were voted to Fred T. Hall for his drawing of the Wilson Petrel reproduced on the menu of the Annual Dinner.

The second and final Business Session was called to order at 4:00 p.m., Saturday, November 29, by President Sutton. Persons nominated to membership during the current year were formally elected.

The Auditing Committee reported favorably on the books of the Treasurer, and the report was accepted.

The Resolutions Committee presented the following resolutions, which were then adopted:

1. *Resolved*: That the Wilson Ornithological Club gratefully thank Capital University, the Columbus Audubon Society, the Ohio State Museum, The Ohio State University, the Wheaton Club, and the Local Committee on Arrangements for the high quality of the entertainment, arrangements, and organization which has made this Twenty-ninth Annual Meeting of our society so successful.

2. *Resolved*: That the Wilson Ornithological Club express its sincere appreciation to Dr. George Miksch Sutton for the leadership and inspiration he has given to the society during his more than two years tenure as president. In this period our organization has gained markedly in importance and national influence, and has become of greater usefulness and interest to its members and affiliated organizations.

3. *Resolved*: That the following be sent to Dr. Waples, Chief, Publication Control Branch, Office of the Military Government of the United States, Berlin, "The Wilson Ornithological Club strongly urges that the publication of accredited ornithological journals in Germany be approved and recommends that they receive the necessary allotment of paper. The reestablishment of international scientific cooperation is essential for world peace and better understanding."

4. *Resolved*: That the Wilson Ornithological Club urge all its members and friends to support vigorously those projects pertaining to the establishment and preservation of Wilderness Areas in the United States and Canada.

At this point, Dr. Sutton turned the meeting over to Dr. Pettingill, the new President, who called upon Dr. John T. Emlen, Jr., Chairman of the Fuertes Research Grant Committee. Dr. Emlen stated that the Committee had decided to award the annual one hundred dollar Fuertes Research Grant to Leonard R. Mewaldt, who is conducting a study of the Clark Nutcracker in Montana.

President Pettingill then announced the following appointments: Burt L. Monroe, *Representative on the American Ornithologists' Union Council*; Harold F. Wing, *Chairman*, Endowment Fund Committee; Frederick W. Haecker, *Chairman*, Affiliated Societies Committee; Harold F. Mayfield, *Chairman*, Library Committee; T. M. Shortt, *Chairman*, Illustrations Committee; James B. Young, *Chairman*, Annual Meeting Program Committee; John T. Emlen, Jr., *Chairman*, Fuertes Research Grant Committee, and *Chairman* of the Local Committee on Arrangements for the 1948 Annual Meeting.

The session was formally adjourned at 4:30 p.m.

#### PAPERS AND MOTION PICTURES SESSIONS

The opening session began on Friday morning, November 28, with addresses of welcome by Dr. Howard L. Bevis, President of The Ohio State University, and Mr. E. C. Zepp, Director of the Ohio State Museum. A response was given by President George Miksch Sutton of the Wilson Ornithological Club.

The remainder of the Friday morning session, the Friday afternoon and Saturday morning sessions, as well as a portion of the Saturday afternoon session, were devoted to the presentation of papers, slides, and motion pictures. Altogether, there were 30 papers and 3 motion pictures. The papers covered the following subjects: life history and behavior (8); distribution and taxonomy (6); banding and migration (4); food habits (3); ornithological history (3); physiology (2); bird populations (2); ectoparasites (1); and techniques in recording bird sound (1).

#### OPENING SESSION, FRIDAY MORNING, NOVEMBER 28

1. EDWARD S. THOMAS, Ohio State Museum. *Ornithology in Ohio* (10 minutes).

A brief historical outline of ornithological work in Ohio, from the account by Alexander Wilson (who listed 14 species), through the work of Kirtland, Wheaton, and others of the late nineteenth century and that of Lynds Jones and W. L. Dawson at the beginning of the twentieth century, to the studies of present-day ornithologists in Ohio.

2. LAWRENCE E. HICKS, Columbus, Ohio. *Recent Progress in Ohio Ornithology* (10 minutes).

A review of Ohio's ornithological literature, following the remarkable lag in Ohio work that occurred from 1903 to the first World War, with a summary of the present status of Ohio ornithology, enumerating species that are decreasing, such as marsh birds; species that are increasing, such as ducks; new additions to the State list; and recent records of rare and accidental occurrences. The talk included remarks on fall migration of nighthawks, the nesting of the Hooded Merganser near Columbus, and some interesting sidelights on Swainson's Warbler.

3. FREDERICK W. HAECKER, Kemmerer, Wyoming. *A Study of the Mountain Bluebird* (15 minutes).

Notes on nest building, egg laying, incubation, feeding, growth of young, and roosting places, made at Kemmerer, Wyoming, at 7,000 feet elevation. Arriving in mid March, the Bluebirds selected a nest site but delayed building for almost a month. The paper concluded with a discussion of delayed nesting after choice of nest site in the Mountain Bluebird and related species.

4. JOHN W. LARCOMB, The Ohio State University. *A Technique for Recording and Reproducing Sounds in Nature* (10 minutes).

A demonstration of the "Sound Mirror," a machine that records sounds by means of a carbon-coated paper tape instead of a wire. It is lighter, more compact, and easier to use than wire recorders, but the recordings cannot be studied

microscopically. Records of the Indigo Bunting, Chimney Swifts, and various crickets reproduced the sounds with excellent fidelity, even to the highest cricket notes.

5. ELEANOR SIMS and W. R. DEGARMO, Charleston, West Virginia. *Notes on the Swainson's Warbler in West Virginia* (15 minutes).

An account (given by the junior author) of the records of Swainson's Warbler in West Virginia since 1939, with a statement of the differences between West Virginia habitats and those of more southern areas; data on nest sites and materials, egg laying and incubation, care of young, behavior at nest, and nesting success; as well as a discussion of the question whether this warbler is extending its range or has been missed until recent years.

6. M. GRAHAM NETTING, Carnegie Museum. *Opportunities for Cooperative Research in Ornithology and Herpetology* (15 minutes).

A discussion of reptiles as an item of food for birds (e.g., a hellbender eaten by a Great Horned Owl and a Red-backed Salamander by a hawk), with observations on the feeding techniques and food preferences of a captive Broad-winged Hawk.

7. HARRISON B. TORDOFF, University of Michigan. *Additions to the Avifauna of Jamaica, B.W.I.* (10 minutes).

A report of ornithological investigations in Jamaica in 1946 and 1947, with comments on the number of mainland birds present as wintering species; an enumeration of interesting specimens collected, including the first Jamaica specimens of the Indigo Bunting, Catbird, Magnolia Warbler, and Black-billed Cuckoo; and remarks on Swainson's Warbler, which was found in two types of habitat, moist and relatively dry.

#### FRIDAY AFTERNOON

8. ARTHUR E. STAEBLER, University of Michigan. *Color-banding and Other Methods of Marking Birds* (10 minutes).

A discussion of the merits of four methods of marking birds. Color-banding, because of its relative permanence, is probably the most satisfactory. Dusting birds with "malachite green" is effective for light-colored birds. Imping brightly colored feathers and painting feathers are good methods but relatively temporary. In discussion after the paper, it was mentioned that some types of celluloid bands deteriorate in salt water and are therefore not completely satisfactory for use on marine birds.

9. ROBERT A. McCABE, University of Wisconsin. *The Song Flight of the Alder Flycatcher*. Illustrated by slides (10 minutes).

Alder Flycatchers sing while ascending in a spiral to a height of 30 to 50 feet, when they dive to the ground. No correlation of flight song with a particular part of the nesting cycle is apparent.

10. PEGGY PORTER MUIRHEAD, University of Illinois. *Territory and Song of the Least Flycatcher*. Illustrated by slides (10 minutes).

Song of Least Flycatchers can be classified as morning or twilight song, spontaneous and rhythmic; daytime song, unpredictable and irregular; and flight song—heard only once, possibly part of courtship. In uncompressed territories, song perches are not fixed; in crowded territories, males sing most often at the edges. Song decreases gradually as the season advances and ceases completely when the young disperse from the nest territory.

11. FREDERICK V. HEBARD, Philadelphia, Pennsylvania. *'Injury Feigning' of Night-hawk and Ground Dove Compared* (10 minutes).

Observations made during May and June in Camden County, Georgia. Both species feigned injury when flushed from the nest—in a remarkably similar manner. The injury-feigning behavior seemed to be wholly instinctive.

12. OLAUS J. MURIE, Moose, Wyoming. *Food of the Great Horned Owl and Its Place in the Fauna* (15 minutes).

A study based on analysis of pellets and nest debris of Great Horned Owls. The food of Wyoming owls was 88 per cent mammals and 8 per cent birds; of Nevada owls, 80 per cent mammals and 12 per cent birds. In both States, the remaining percentage consisted of cold-blooded vertebrates, including fish, and invertebrates. Small rodents constituted the bulk of the mammals eaten, but many rabbits were taken.

13. ROWLAND S. WILSON, Columbus, Ohio. *The Birds of Attu, Westernmost of the Aleutian Islands*. Illustrated by slides (15 minutes).

Observations made from mid September 1944 to October 1945, including records of four Tufted Ducks, a new bird for the Aleutian list, and one of the Falcated Teal, the second record for North America.

14. ROBERT M. MENGEL, University of Michigan. *Some Remarks on the Birds of Veracruz, Mexico* (10 minutes).

A discussion of the birds of coastal Veracruz that included a first record for the Purple Gallinule, additional records for several species whose status has been in doubt, and critical comments on the taxonomy of the Chachalaca, nighthawk, and Bob-white. The one breeding specimen of *Chordeiles minor* from Veracruz is apparently not *chapmani* as it has been identified, but either an undescribed race, or an individual variant of an already named race, possibly *aserriensis*. Further collecting of Bob-whites in Veracruz is needed, since the subspecific identity of at least the coastal birds is in doubt.

15. GEORGE J. WALLACE, Michigan State College. *Further Studies of Michigan Barn Owls*. Illustrated by slides (12 minutes).

For an 11-month period 99.7 per cent of the food of Barn Owls near Lansing, Michigan, was small mammals, mostly *Microtus* (89 to nearly 97 per cent). When *Microtus* populations were low, the take of *Peromyscus*, *Blarina*, and of birds increased. Norway rats were seldom eaten.

16. VICTOR COLES, University of Cincinnati. *Returns from Banded Turkey Vultures*. Illustrated by slides (15 minutes).

A report on Turkey Vultures banded in Virginia and Ohio, 8.7 per cent of which were recovered. Returns from Virginia birds were mainly from Virginia and northward, while Ohio birds seemed to go south. Recoveries were from 2 months to 10 years after banding, with the bulk in the first 4 years.

17. WILLIAM A. LUNK, University of Michigan. *Some Notes on Hawaiian Birds* (10 minutes).

A review of the status of several of the interesting Hawaiian endemic species, with remarks on breeding and wintering water birds recorded during a stay of 39 months. Introduced species are now the most conspicuous part of Hawaii's bird fauna.

SATURDAY MORNING, NOVEMBER 29

18. FRANK A. HARTMAN, The Ohio State University. *The Bird Adrenal*. Illustrated by slides (10 minutes).

A report on the structure and function of the adrenal in birds, with similarities and differences in related and unrelated species illustrated by drawings and kodachrome slides of microscopic sections. It has been found that the Pelican is the best subject for adrenal study, since its adrenal is relatively the largest among birds. Size of adrenal and size of bird are not directly correlated.

19. DONALD J. BORROR, The Ohio State University. *Analysis of Repeat Records of Banded White-throated Sparrows*. Illustrated by slides (20 minutes).  
*In press, Ecological Monographs, 1948.*

20. ERNST MAYR, The American Museum of Natural History. *Is the Great White Heron a Good Species?* (10 minutes).

A preliminary study of the question whether the Great White Heron is a valid species. The criteria which would be invoked in a study of this form according to the new systematics are: a) Do birds with this plumage occur throughout the range of the Great Blue Heron (of which they are suspected of being a color phase), or are they concentrated in a circumscribed range? b) Are birds with this plumage reproductively isolated from the Great Blue Heron? Three of the five reasons given by Ernest G. Holt for considering the Great White Heron a separate species may be disregarded as disproved or immaterial. Color phases in other species of Ardeidae, possible correlation of feather structure with albinism, and genetic aspects of the problem were discussed. Thus far the evidence seems to indicate that the Great White Heron is the white phase of a localized dimorphic subspecies of the Great Blue Heron, but further field studies are necessary before final conclusions can be drawn.

21. MARGARET M. NICE and RUTH H. THOMAS, Chicago, Illinois, and North Little Rock, Arkansas. *A Study of a Nesting of the Carolina Wren* (15 minutes).  
*In press, Wilson Bulletin, 1948.*

22. W. W. H. GUNN, University of Toronto. *Reverse Migration over Lake Erie*. Illustrated by slides (15 minutes).

Harrison Lewis first noted, in 1937, the southward flight in the spring of small birds from Pelee Island on the north shore of Lake Erie. This is now known to be a common phenomenon in this region in the spring when the wind is from the south, and at least 60 species are known to exhibit this behavior, mostly passerines. No explanation yet offered seems to fit all of the facts. Migration waves arriving from the south tend to concentrate here, but, possibly owing to limited food supply, many birds apparently strike out in various directions, some being funneled southward from Pelee and Fishing Points because of the peculiar geographical formation.

23. JOHN W. HANDLAN, Charleston, West Virginia. *A Brief History of the Brooks Bird Club*. Read by Mrs. Elizabeth Etz (10 minutes).

The Brooks Bird Club, founded in 1932, now has 165 members. "The Red-start," published monthly, monthly meetings, regular field trips, Christmas censuses, and recording of migration data are its chief activities.

24. CHARLES L. CONRAD and JAMES H. OLSEN, Wheeling, West Virginia, and Columbus, Ohio. *Activities of the Brooks Bird Club*. Illustrated by slides (15 minutes).

A summary (read by the junior author) of the results of a series of annual one-week "forays" undertaken by the Brooks Bird Club for the purpose of studying intensively the flora and fauna of selected areas.

25. ELIZABETH M. BOYD, Mount Holyoke College. *Ectoparasites of the Starling in North America*. Illustrated by slides (15 minutes).

Of 10 Starling nests and 300 Starlings examined, 95.1 per cent were infested; 12 ectoparasites (including 2 species of mallophaga and 8 species of mites) were found, bringing to 18 the total number of ectoparasites recorded from the Starling. At least 4 of these species are known to have been brought by the Starling to North America, and at least 5 are known to have been acquired by the Starling since its arrival in this country.

26. HENRI C. SEIBERT, Ohio University. *The Effect of Photoperiod and Temperature on Energy Intake*. Illustrated by slides (10 minutes).

Juncos, White-throated Sparrows, and English Sparrows were subjected to temperatures varying from 34° to -13° C. and to a varying photoperiod. The calories of the food consumed and the feces were determined, the differences being the food energy actually employed. The results obtained, while preliminary, seemed to be significant and to be correlated with the observed hardiness of the different species.

SATURDAY AFTERNOON, NOVEMBER 29

27. JEANNE MOORE, University of Michigan. *Young Caspian Terns in Captivity*. Illustrated by slides (15 minutes).

A study, made in the summers of 1944 and 1947, of young terns taken from a Lake Michigan colony either in the egg stage or as day-old chicks. Observations in 1944 were continued until the young were 36 days of age and in 1947, until the young could fly. Body temperatures, body weights and measurements, and plumage development were recorded daily. Natural color slides showed the colony; the protective coloration of the eggs; the color phases of the young, white and buff; the growth rates of the young terns; and the enclosure built to house the young.

28. JOHN J. STOPHLET, Toledo, Ohio. *Birds of the Alaskan Tundra* (20 minutes).

Kodachrome slides taken in June 1947 during a three-week visit to Askinuk Range and a two-day stay on Egg Island. Five to ten thousand birds, principally puffins, Paroquet Auklets, kittiwakes, and murrees were seen on Egg Island. Askinuk Range is rich in shore birds, diving ducks, and other waterfowl.

29. EDWARD MORRIS BRIGHAM, JR., Kingman Museum of Natural History, Battle Creek, Michigan. *Some Photographic Experiences with the Spruce Grouse and Trumpeter Swans*. Kodachrome motion pictures (15 minutes).

The title might well include the Kirtland Warbler, for three nests of this species with the adults carrying on nesting activities were shown. These pictures, as well as those of the Spruce Grouse, were taken in northern Michigan; the pictures of the Trumpeter Swans with cygnets were made at Grebe Lake, Yellowstone.

30. S. B. HECKLER, St. Louis, Missouri. *The Growth and Development of a Bird Club* (12 minutes).

The history of the St. Louis Bird Club, particularly during the last eight years, when its membership increased from 100 to more than 1400.

31. KARL MASLOWSKI, Cincinnati, Ohio. *Filming Owls at Night* (15 minutes).

Kodachrome motion pictures of one Screech Owl and two Barn Owl nests, showing adults feeding young. The films were taken with three to five photo floodlights after gradually conditioning the owls to light.

32. ERNEST P. EDWARDS, Cornell University. *Birds in the Vicinity of Lake Patzcuaro, Michoacan, Mexico* (10 minutes).

A report of two expeditions to Mexico. Innumerable waterfowl winter near Lake Patzcuaro, whose shallow waters provide abundant food, although the long hunting season (November to May) gravely endangers them. American Egrets, Black-necked Stilts, and the Glossy Ibis were observed in March in the nearby marshes; and in dryer habitats, typical Mexican birds, such as Mexican Trogons, Mexican Chickadees, and Red Warblers. This paper was illustrated by the following motion picture (No. 33).

33. ERNEST P. EDWARDS, Cornell University. *Mexican Primavera*. Kodachrome motion pictures (50 minutes).

An unusually fine film, primarily of birds, but showing also a few insects, in their natural settings. Included were excellent portraits of the Macaw, now almost extinct; of the extremely shy Tinamou; and of the Inca Dove, Golden-fronted Woodpecker, Caracara, Black and Turkey Vultures, Vermilion, Sulphur-bellied, and Beardless Flycatchers, Red-crowned Parrot, Boat-tailed Grackle, Motmot, Crimson-colored Grosbeak, Green Jay, Wood Ibis, and the Red Warbler.

#### ANNUAL DINNER

The Annual Dinner was held on Friday evening, November 28, at the Faculty Club on the campus of The Ohio State University, with President George Miksch Sutton as Toastmaster. On President Sutton's suggestion, Dr. Lynds Jones was chosen Honorary President by unanimous acclaim. Dr. Jones, one of the two living Founders of the Wilson Ornithological Club and its first Secretary and Editor, has been three times President of the Club (1890-1893; 1902-1908; 1927-1929). Except for a brief interval (1901), he edited *The Wilson Bulletin* and its predecessors from 1892 to 1924. He was presented at the dinner with a memory book for letters and autographs of Members of the Club.

#### AUCTION OF BIRD PAINTINGS

After the Annual Dinner, an auction of bird paintings was held at the Ohio State Museum, the proceeds to be used for the benefit of the ornithologists of Europe. The forty-seven pictures had been contributed by a number of American bird painters, including Roger Tory Peterson, George Miksch Sutton, and F. L. Jaques; others were by European ornithologists. James B. Young acted as auctioneer, and the total proceeds were \$1,058.00.

#### FIELD TRIPS

Although during the Meeting it had appeared advisable to cancel one of the scheduled field trips, enthusiastic members gathered on Sunday for all three trips originally planned. One group, led by Milton B. Trautman, visited Buckeye Lake; a group led by Donald J. Borror went to O'Shaughnessy Reservoir; and Edward S. Thomas took a third group to Hocking County. Despite the season and particularly unpromising weather, reports of the trips were extremely favorable, and all the participants felt well rewarded. The Buckeye Lake group were fortunate enough to observe 150 Mallards in pursuit of a hawk.

## ATTENDANCE

Two hundred and thirty-eight members and guests registered at the Meeting, representing twenty states and the Province of Ontario, Canada. Next to Ohio, the State with the largest attendance was Michigan.

The list of Members and visitors follows:

From Illinois: 6—Mr. and Mrs. Paul E. Downing, *Highland Park*; Margaret D. Feigley, *Winnetka*; Peggy P. Muirhead, Margaret M. Nice, *Chicago*; Mrs. W. D. Petzel, *Olney*.

From Indiana: 9—Rev. John W. Baechle, *Collegeville*; Mrs. Ferd Barnickol, Mildred Campbell, Edna Collins, Mrs. Dorothy Hobson, *Indianapolis*; Mr. and Mrs. Merle L. Kuns, *West Lafayette*; Clara Alma Moore, *Indianapolis*; Margaret Umbach, *Fort Wayne*.

From Kentucky: 18—Helen Browning, William M. Clay, Mr. and Mrs. Dulaney Logan, Harvey B. Lovell, Esther Mason, *Louisville*; Mr. and Mrs. Burt L. Monroe, Burt L. Monroe, Jr., *Anchorage*; Marie Pieper, Evelyn J. Schneider, Ann Slack, Mabel Slack, Mrs. F. W. Stamm, Audrey A. Wright, *Louisville*; Grace Wyatt, *Murray*; Mr. and Mrs. James B. Young, *Louisville*.

From Louisiana: 2—Mr. and Mrs. George H. Lowery, *Baton Rouge*.

From Maryland: 1—Stephen W. Simon, *Towson*.

From Massachusetts: 2—Elizabeth M. Boyd, Dorothy Cogswell, *South Hadley*.

From Michigan: 30—Mr. and Mrs. H. Lewis Batts, Jr., *Ann Arbor*; Hazel L. Bradley, *Jackson*; Edward M. Brigham, Jr., Edward M. Brigham, III, *Battle Creek*; John D. Goodman, *Ann Arbor*; Mr. and Mrs. F. N. Hamerstrom, *Pinckney*; Harry W. Hann, Mr. and Mrs. P. B. Hofslund, *Ann Arbor*; Agnes Kugel, *Grand Rapids*; Mr. and Mrs. William A. Lunk, *Willow Run*; Mr. and Mrs. Robert M. Mengel, Jeanne Moore, *Ann Arbor*; Mr. and Mrs. Walter P. Nickell, *Bloomfield Hills*; R. A. O'Reilly, Jr., *Detroit*; Miles D. Pirnie, *Battle Creek*; Arthur E. Staebler, George M. Sutton, Harrison B. Tordoff, Mr. and Mrs. Josselyn Van Tyne, *Ann Arbor*; G. J. Wallace, *East Lansing*; Robert A. Whiting, Mr. and Mrs. Harold F. Wing, *Jackson*.

From Minnesota: 2—Kathryn Ann Grave, *Minneapolis*; O. S. Pettingill, Jr., *Northfield*.

From Missouri: 5—Bill Bremser, Richard P. Grossenheider, R. B. Harkness, S. B. Heckler, Jack Van Benthuyzen, *St. Louis*.

From Nebraska: 2—Dr. and Mrs. R. Allyn Moser, *Omaha*.

From New Jersey: 2—Mrs. Herbert Carnes, *Tenafly*; Ruth Sargent, *Lebanon*.

From New York: 10—William C. Dilger, Stephen W. Eaton, Lawrence I. Grinnell, *Ithaca*; Fred T. Hall, *Rochester*; Ernst Mayr, Theodora Nelson, *New York City*; Kenneth C. Parkes, *Ithaca*; Walton B. Sabin, Mr. and Mrs. L. S. Trimm, *Syracuse*.

From Ohio: 107—G. Ronald Austing, *North College Hill*; Clinton S. Banks, *Steubenville*; Howard L. Bevis, Mrs. Ralph Billett, *Columbus*; Mr. and Mrs. Ben J. Blincoe, Joseph Blincoe, Louis Blincoe, Sarah J. Blincoe, *Dayton*; Helmut W. Boenheim, Donald J. Borrer, *Columbus*; Raymond D. Bourne, *Oxford*; Ellen F. Boyer, *Columbus*; Florence Branum, *Lancaster*; George H. Breiding, *Columbus*; Forest W. Buchanan, *Amsterdam*; Mrs. G. W. Buchanan, *Columbus*; Mr. and Mrs. Russel L. Burget, *Toledo*; Mrs. H. E. Burt, *Columbus*; Louis W. Campbell, *Toledo*; Vera Carrothers, *East Cleveland*; Victor Coles, *Cincinnati*; Charles A. Dambach, *Columbus*; Mrs. R. C. Doe, *Cleveland*; Ywvon Doenges, *Defiance*; Julian L. Dusi, *Blacklick*; Joseph P. Eagleson, *Columbus*; Earl Farmer, *Steubenville*; E. V. Folger, *Oxford*; Robert M. Geist, *Columbus*; Maurice L. Giltz, *Columbus*; E. E. Good, *Van Wert*; Robert M. Goslin, Margaret Halenkamp, Lee B. Harris, Mr. and Mrs. A. R. Harper, *Columbus*; Albert T. Hartley, *Columbiana*; Frank A. Hartman, *Columbus*; Lawrence D. Hiatt, *Toledo*; Mr. and Mrs. Lawrence



E. Hicks, *Columbus*; George T. Jones, Lynds Jones, *Oberlin*; Caroline Keiper, Bruce H. Kennedy, Arthur S. Kiefer, Doris M. Klie, *Columbus*; Paul Knoop, *Clayton*; Reba D. Lee, *Circleville*; Daniel L. Leedy, Ernest O. Limes, Laura E. Lovell, *Columbus*; Karl H. Maslowski, *Cincinnati*; Harold Mayfield, *Toledo*; Robert H. Miller, *Bryan*; Paul J. Miller, *Lancaster*; E. L. Moseley, *Bowling Green*; H. B. McConnell, *Cadiz*; Floyd McKenna, *Newark*; James P. Nettle, *Toledo*; Mrs. Cecil C. North, James H. Olsen, *Columbus*; Margaret Perner, *Cleveland Heights*; George A. Petrides, *Columbus*; Robert Price, *Westerville*; John W. Price, Loren S. Putnam, Gene Rea, Carl Reese, *Columbus*; Gertrude Rennecker, *Akron*; Alice F. Reynolds, Ralph J. Reynolds, Mr. and Mrs. Irvin B. Rickly, *Columbus*; Margaret Rushmer, *Westerville*; Emil A. Saari, *Columbus*; Blanche Scott, *Cleveland Heights*; Henri C. Seibert, *Athens*; Haven H. Spencer, *Cincinnati*; Esther Stewart, Paul Stewart, *New Waterford*; John J. Stophlet, *Toledo*; Louis Sturm, *Springfield*; Jeff Swinebroad, Mr. and Mrs. Edward S. Thomas, Nelson P. Thomson, *Columbus*; Mr. and Mrs. Milton B. Trautman, *Put-in-Bay*; Janice Tucker, Mr. and Mrs. Walter A. Tucker, Loretta Tyler, *Columbus*; Laurel F. Van Camp, *Genoa*; Mrs. Anne Warner, Miss Bernice Warner, *Worthington*; Carmen H. Warner, *Columbus*; Danny Warner, Mrs. Mary Wise Watts, *Worthington*; L. Marguerite Werner, Kaj Westerskov, *Columbus*; Nathaniel R. Whitney, Jr., *Glendale*; R. S. Wilson, *Columbus*; John G. Worley, *Cadiz*; Olga Zurcher, *Columbus*.

From Ontario: 8—Ann M. Fowle, C. David Fowle, *Toronto*; George Fetherston, *London*; Mr. and Mrs. W. W. H. Gunn, Mr. and Mrs. J. Murray Speirs, *Toronto*; R. D. Usher, *King*.

From Pennsylvania: 8—Hal H. Harrison, *Tarentum*; Frederick V. Hebard, *Chestnut Hill*; Thomas N. Morgan, *West Grove*; M. Graham Netting, Tony Netting, *Pittsburgh*; F. W. Preston, *Butler*; Robert Leo Smith, *Reynoldsville*; George B. Thorp, *Pittsburgh*.

From Tennessee: 3—Albert F. Ganier, *Nashville*; Mr. and Mrs. Arthur Stupka, *Gatlinburg*.

From Virginia: 1—Ernest P. Edwards, *Sweet Briar*.

From West Virginia: 14—W. Hughes Barnes, *Wheeling*; Maurice Brooks, *Morgantown*; Virginia G. Cavendish, *Huntington*; Carolyn Conrad, Mr. and Mrs. Charles Conrad, Dorothy Conrad, *Wheeling*; W. R. DeGarmo, *Charleston*; R. M. Edeburn, *Huntington*; Elizabeth Etz, N. Flouer, *Wheeling*; N. Bayard Green, *Huntington*; Maxine Thocher, *Charleston*; R. Van Blaricom, *Huntington*.

From Wisconsin: 6—John T. Emlen, Jr., Frederick Greeley, Ruth Louise Hine, Robert A. McCabe, Robert Rausch, Howard Young, *Madison*.

From Wyoming: 2—F. W. Haecker, *Kemmerer*; O. J. Murie, *Moose*.

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Officers' and Committee Reports for 1947 will be published in later issues of the *Bulletin*.

#### WILSON BULLETIN REPRINTS

A few separates of the painting of the Arizona Junco by Roger Tory Peterson that appears as the frontispiece of this issue, with the accompanying note, will be available to Members at twenty-five cents each. Orders, accompanied by payment (in stamps if preferred), should be sent to the Editor.

## OFFICERS OF THE WILSON ORNITHOLOGICAL CLUB

## PRESIDENT

- |                            |                                      |
|----------------------------|--------------------------------------|
| J. B. Richards, 1888-1889. | Thos. L. Hankinson, 1922-1923.       |
| Lynds Jones, 1890-1893.    | Albert F. Ganier, 1924-1926.         |
| Willard N. Clute, 1894.    | Lynds Jones, 1927-1929.              |
| R. M. Strong, 1894-1901.   | J. W. Stack, 1930-1931.              |
| Lynds Jones, 1902-1908.    | J. M. Shaver, 1932-1934.             |
| F. L. Burns, 1909-1911.    | Josselyn Van Tyne, 1935-1937.        |
| W. E. Saunders, 1912-1913. | Mrs. Margaret Morse Nice, 1938-1939. |
| T. C. Stephens, 1914-1916. | Lawrence E. Hicks, 1940-1941.        |
| W. F. Henninger, 1917.     | George Miksch Sutton, 1942-1943.     |
| Myron H. Swenk, 1918-1919. | S. Charles Kendeigh, 1943-1945.      |
| R. M. Strong, 1920-1921.   | George Miksch Sutton, 1946-1947      |
- Olin Sewall Pettingill, Jr., 1948-

## FIRST VICE-PRESIDENT

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|------------------------------|------------------------------------|
| C. C. Maxfield, 1893.        | Thos. H. Whitney, 1925-1928.       |
| R. M. Strong, 1894.          | George Miksch Sutton, 1929-1931.   |
| Ned Hollister, 1895-1903.    | Edwin L. Moseley, 1932.            |
| W. L. Dawson, 1904-1905.     | Josselyn Van Tyne, 1933-1934.      |
| R. L. Baird, 1906-1908.      | Alfred M. Bailey, 1935-1936.       |
| W. E. Saunders, 1909-1911.   | Mrs. Margaret M. Nice, 1937.       |
| B. H. Swales, 1912-1913.     | Lawrence E. Hicks, 1938-1939.      |
| Geo. L. Fordyce, 1914-1919.  | George Miksch Sutton, 1940-1941.   |
| H. C. Oberholser, 1920-1921. | S. Charles Kendeigh, 1942-1943.    |
| Dayton Stoner, 1922-1923.    | Olin S. Pettingill, Jr., 1944-1947 |
| Wm. I. Lyon, 1924.           | Maurice Brooks, 1948-              |

## SECOND VICE-PRESIDENT

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|-----------------------------------|-------------------------------------|
| Josselyn Van Tyne, 1932.          | S. Charles Kendeigh, 1940-1941.     |
| Alfred M. Bailey, 1933-1934.      | Olin S. Pettingill, Jr., 1942-1943. |
| Mrs. Margaret M. Nice, 1935-1936. | Harrison F. Lewis, 1944-1946.       |
| Lawrence E. Hicks, 1937.          | Maurice Brooks, 1947.               |
| George Miksch Sutton, 1938-1939.  | W. J. Breckenridge, 1948-           |

## SECRETARY

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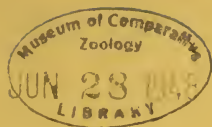
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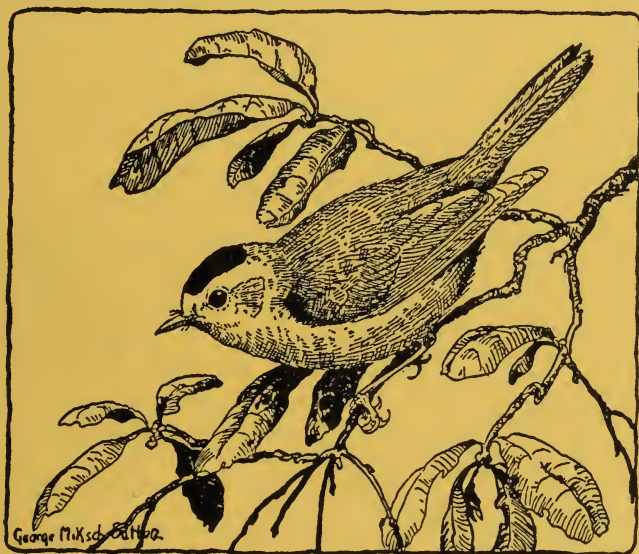
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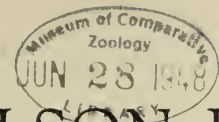
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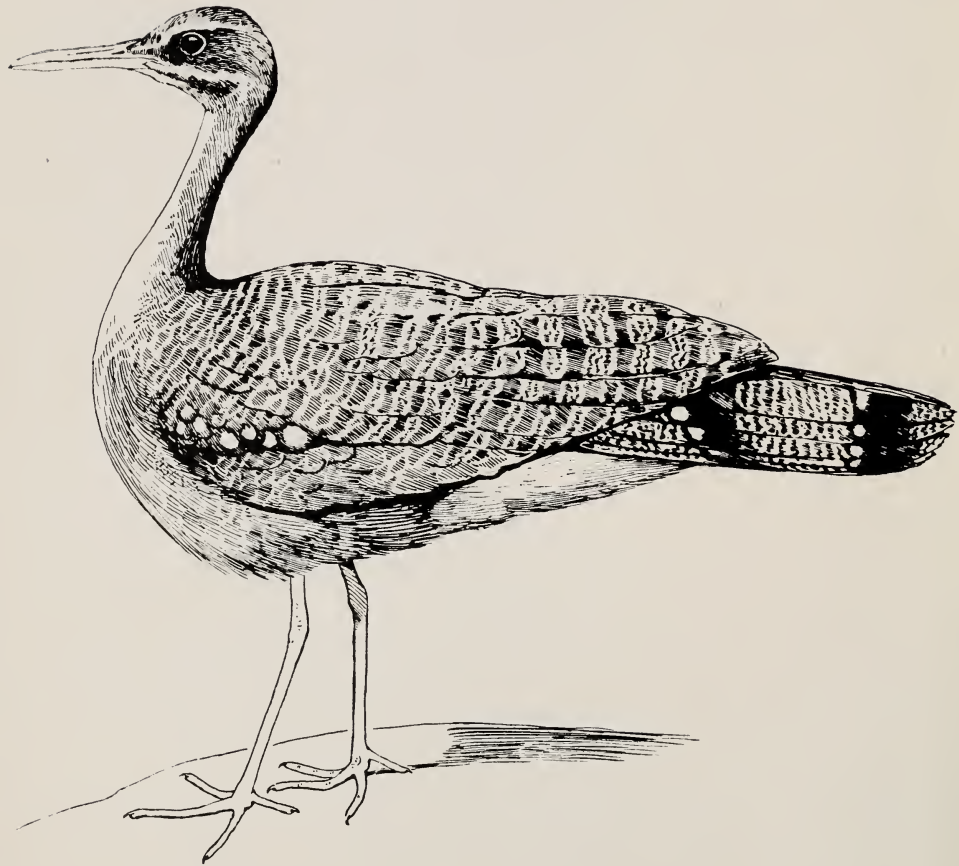
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SUN-BITTERN  
*Eurypyga helias*

From a drawing made by George Miksch Sutton for John Wiley and Sons  
and first published here by their kind permission.



## THE FAMILY EURYPYGIDAE: A REVIEW

BY CARL D. RIGGS

AS with many neotropical bird groups, little has been published on the family of Sun-bitterns (Eurypygidae), and the findings of one author often seem to contradict the findings of another. It seems worth while, therefore, to summarize the various reports for the benefit of those bird students who are trying to complete our knowledge of neotropical ornithology.

The family consists of a single species, *Eurypyga helias*, in which are recognized three subspecies, *major*, *meridionalis*, and *helias*; these occupy tropical Central and South America from the Caribbean slopes of Guatemala southward to south-central Peru, eastern Bolivia, and northern and central Brazil, the southern limits being southern Goyaz and Piauhy (Peters, 1934:215-216).

Sun-bitterns inhabit the dense tropical forests of the coast, as well as those of the interior (Cabanis, 1848:752), and are most commonly found along the wooded, muddy banks of rivers and smaller streams, around springs and ponds, and in boggy or swampy areas. In Venezuela, according to Delacour (1923:140), they are especially numerous along the smaller streams, "where they live on the mud, generally under the cover of trees." Cabanis (1848:752) reports that in British Guiana they frequent sunny places, particularly along the banks of rivers. Skutch (1946:453) observed a Sun-bittern walking "deliberately" over the surfaces of a steeply inclined rock face between two pools in a stream, picking small objects from among the rocks, and flying from boulder to boulder. The Sun-bittern is usually seen on the ground, but if disturbed it sometimes takes refuge in the lower branches of trees (Carriker, 1910:426). To combine the descriptions of various authors—the Sun-bittern is a slender, graceful bird, walking with slow, precise steps, body horizontal, and neck outstretched. Evans (1899:266) thought that it "probably flies but little"; Finn (1908:158) describes the flight as light and butterfly-like. Goudot (1843b:4) says of the flight that it is not like that of herons, but more rapid and more prolonged.

Sun-bitterns are not gregarious, and according to Cabanis (1848:752—British Guiana), they are found almost always singly, seldom in pairs. Carriker (1910:426—Costa Rica) states just the opposite, that they are almost always to be seen in pairs. The Penards (1908:193—Dutch Guiana) reported finding them either alone or in pairs.

Delacour (1923:140—Venezuela) says that Sun-bitterns are shy but not wild and that "one can very well watch them without disturbing them." Carriker (1910:426) states that they "are not very shy, but with caution can be approached quite closely." The Penards (1908:193) often found the birds standing in shallow water, frequently

dipping themselves; when approached too closely, the birds would fly a little distance away. They are easily tamed and apparently thrive in captivity (Knowlton, 1909:347); a Sun-bittern in the Sophia Zoological Garden lived for 17 years (Flower, 1938:221). Often these birds are kept as pets in houses and courtyards, where they consume numerous roaches, flies, and other insects (Taylor, 1864:95; Delacour, 1923:140).

The few published accounts of food habits indicate that the Sun-bittern is strictly carnivorous. Insects are the most commonly reported item of diet (Knowlton, 1909:348); Newton (1899:925) mentions small fishes as well. Waterton (1891:321) says that the Sun-bittern does not live upon fish, that flies and insects are its food, and that the bird captures them as a heron captures fish. The Penards (1908:193) describe the method of feeding on insects as careful stalking in which the bird, with neck drawn in, approaches its prey until sufficiently close, when it suddenly thrusts its bill forward and captures the insect. From the stomachs of two freshly killed specimens, Deignan (1936:188) took shrimp, crabs, and other small crustacea; Goudot (1843b:4) also found small crustacea in the two stomachs that he examined.

Sun-bitterns have a peculiar but striking habit of spreading and elevating the tail and expanding the wings so that the tail and wings together form an almost complete circle about the bird (Newton, 1899:925; Alexander, 1936:481, 482). This is part of a sort of dance, believed by Finn (1908:158) and Pycraft (1931:669) to be courtship display. Rusby (1933:175) observed this dance and gave a good description of it. He says that *Eurypyga* "inhabits the dense shrubbery, but seeks patches of bright sunshine to perform its acrobatic dances. The one I saw occupied a brilliant patch of sunshine some ten or twelve feet in diameter in the middle of the road. He ran rapidly around in a circle from right to left, with his right wing stretched upward, apparently as a restraint, enabling him to circle more rapidly and securely, and then reverse the movement. Then he leaped into the center of the space and hopped up and down, sometimes with both feet and then one at a time. He stretched his head upward as far as possible, and then suddenly brought it down close to the ground, at the same time arching his back. Besides these regular movements, he indulged in the most erratic series of leaps and capers imaginable. There was evidently no relation between these actions and any practical objective, such as securing food." Rusby attributed this dance, not to courtship, but to indulgence in pure delight.

The voice of the Sun-bittern has been described by Newton (1899:925) as a "plaintive piping," and Finn (1908:158) states that it is a metallic whistle and, in alarm, a grating hiss. The Penards (1908:193) describe the call as *foe foe foe* or *so-le r r r*, often accompanied by a rattling of the bill. According to Bates (1863:82), although the bird

is difficult to see because of its somber plumage and dark habitat, its hiding place is often betrayed by its note—a soft, long-drawn whistle.

According to the Penards (1908:194), the nest of the Sun-bittern “is sometimes on the ground, but usually placed in trees, about two or three meters from the ground; it consists of a mass of mud and dry leaves with a semicircular entrance at the side” [translated from the Dutch]. Goudot (1843a:1) says the nest is placed in marshy areas, built of mud on low intertwined branches, about five or six feet (*pieds*) above the ground. Skutch (1947:38) observed a nest March 26, 1945, in Costa Rica, located in a stream-side tree, about 20 feet above the ground and about 10 yards back from the water’s edge. It was a large, bulky, roughly globular structure, approximately 12 inches in diameter, precariously saddled on an apparently unbranched portion of an obliquely ascending limb about two inches in diameter. “It was composed of decaying leaves, stems, and other vegetation, a small amount of green moss, and apparently also some mud. In the top was a shallow depression lined with green leaves.”

The most complete account of the nidification of Sun-bitterns is that by Bartlett (1866:76) concerning a pair in the Gardens of the Zoological Society of London. These birds had been in the Gardens for about three years. Early in the month of May 1865 “they began to show signs of breeding, by carrying bits of sticks, roots of grass, and other materials about; they were constantly walking round the pond, evidently in search of materials to compose a nest, and appeared to try and mix wet dirt with bits of moss, etc. This suggested the idea of supplying them with wet clay and mud, which they at once commenced to use. After a short time they settled to make a nest on the top of a pole or tree about 10 feet from the ground, on which was fixed an old straw nest. Both birds carried up mud and clay mixed with bits of straw, roots of grass, etc. The sides of the nest were raised, and thickly plastered inside with mud.”

After completion of the nest, the female laid three eggs: The first, laid shortly after the nest was built, was found broken on the ground beneath the nest. Early in June a second egg was found in the nest. Of the incubation of this egg, Bartlett (p. 77) says, “The two birds were very attentive, and took turns at incubation, and in twenty-seven days the young bird was hatched (July 9th). On the following day I ventured to look at the young bird . . . it is certainly one of the prettiest young birds I ever saw. It is thickly covered with fine short tufts of down, and much resembles the young of Plovers and Snipes, with this addition, that the head and body was thinly covered with rather longer hairs than are to be seen in the former-mentioned birds. [The pattern of the downy young, as shown in Bartlett’s accompanying plate, is an intricate one of spots, stripes, and marbling.] The young bird remained in the nest and was fed regularly by both parents, the food consisting principally of small live fish, a few insects, etc. The

mode of taking its food was somewhat peculiar: it did not gape and call or utter any cry like most nestlings; but as soon as the old birds flew upon the nest with the food in their bills, the young one snapped or pecked it from them and swallowed it at once. The young bird remained in the nest twenty-one days, by which time its wings were sufficiently grown to enable it to fly to the ground. It was there fed as before, and never afterwards returned to the nest; it grew quickly, and at the end of two months was indistinguishable from the old birds. Early in August the old birds began to repair the nest, and added a fresh lining of mud and clay, and at the end of August laid a third egg. The male bird now appeared to attend to the duties of incubation with much greater care than his partner, who fed the now nearly full-grown young one; they, however, managed to hatch the second young bird on the 28th of September." Since the conditions in which these breeding activities took place were completely different from those of the Sun-bittern's natural haunts, it is not necessarily true that its activities in the wild would be the same.

As to the time of breeding: The Penards (1908:194) state that in Dutch Guiana, *E. helias* breeds during the season of the big rains (mid-May or June to July or August). Deignan (1936:188) took a pair of Sun-bitterns in Honduras on April 23, the male with "right testis greatly enlarged, the other only slightly so." The ovaries of the female were also greatly enlarged and contained a fully developed egg—lacking only the shell. Goudot (1843a:1) reported birds fairly well formed within the egg in August.

The Penards (1908:194), Stresemann (1934:770), and Goudot (1843a:1) report the number of eggs to be two, and there were two eggs in the nest discovered by Skutch (1947:38). Nehrkorn (1899:206) described the *Eurypyga* eggs in his collection as having a reddish clay-colored background with large uniformly distributed violet-gray spots underneath and sparse rust-brown spots above ("underneath" and "above" referring, not to the position of the spots on the oval of the egg, but to the depth of the spots within the shell); the shells are described as delicate and moderately glazed; the measurements: 44–45 × 34–35 mm. This description is similar to that given by the Penards (1908:194). The egg figured by Goudot (1843b:pl.38) seems to correspond in size but does not otherwise fit this description very closely. The general background color of this egg is between Pale Pinkish Cinnamon and Pinkish Buff. Large irregular spots and blotches, between Light Purplish Gray and Pale Purplish Gray, occur irregularly upon the larger end, along with somewhat smaller spots of Olive-Brown and Dark Bone Brown.\* Small spots of the last two colors are intermingled with the larger blotches and are scattered over the smaller end of the egg. The shape of the egg is nearly oval.

\* Capitalized color names are taken from Ridgway, 1912, "Color Standards and Color Nomenclature."

That the young are downy when hatched has been pointed out above. Chubb (1916:143) says young Sun-bitterns "differ from most young birds by gaining the adult plumage direct from the nestling down without passing through an intermediate stage." Another unusual thing is that—though hatched with the down of precocial birds—they remain in the nest and are fed there by the parents. Bartlett (1866:77—see above) and also Salvin and Godman (1903:334) report that the young are fed by the parents for some weeks. Stresemann (1934:770), however, says the young leave the nest within a few (possibly two) days.

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## LIFE HISTORY NOTES ON PUFF-BIRDS

BY ALEXANDER F. SKUTCH<sup>1</sup>

THE Bucconidae, or puff-birds, are a family of about 30 species of small or middle-sized arboreal birds confined to the tropical American mainland. Abundant loose plumage, relatively big heads, and short tails give many of the species a stout, "chunky" appearance. The puff-birds are rather somberly colored in shades of brown and deep grays, often conspicuously spotted and streaked, or with boldly contrasting areas of black and white. The bill is short or medium, often notably stout, terminally decurved or more or less strongly hooked. The feet are zygodactyl—with two toes directed backward. The family is best represented in the Amazon Valley and northern South America, and only three species occur in Central America, north of Panamá.

Despite infinite searching through the forests of Central America, I have found but two nests of puff-birds, one of the Black-breasted Puff-bird and one of the White-whiskered Soft-wing; both were destroyed before life history studies could be completed. But in view of the paucity of our information on the breeding habits of this family, it seems desirable to publish my notes (though more or less fragmentary) on these two nests. In an attempt to round out a picture of this interesting family, I present also brief notes on two puff-birds of South America: the Black-fronted Nun-bird and the Swallow-wing.

### BLACK-BREASTED PUFF-BIRD

*Notharchus pectoralis* (Gray)

The Black-breasted Puff-bird is of medium size—about eight inches in length. In both sexes the plumage is predominantly black, with conspicuous areas of white on the auricular regions, on the chin, throat, and hind neck, and on the abdomen. A black band across the breast extends upward between the white of the auricular regions and the throat. The black feathers of the head, upper back, and breast are glossy, with a bluish tinge; those of the lower back, rump, upper tail coverts, tail, and wings are duller, more slate-colored than black, many of them with narrow white margins at the tips. The eyes are dark, the bill heavy and black, the legs and feet dusky. The bird is well illustrated by F. L. Jaques (in Sturgis, 1928:pl. 14) and by Sclater (1882:pl. 24). It inhabits a restricted area of lowland forest extending from the Canal Zone to central Colombia.

I have found the Black-breasted Puff-bird only on Barro Colorado Island, Canal Zone, and even here I saw it only rarely except while I was watching at a nest. Apparently it remains most of the time well up in the trees, where it is seldom seen from the ground; the nesting pair that I watched, when approaching or leaving the nest, flew

<sup>1</sup> This paper was prepared for publication while the writer held a fellowship of the John Simon Guggenheim Memorial Foundation.

through or even above the treetops, but the woods of the nest area were low. Like other puff-birds, the Black-breasted Puff-bird sits for long periods on the same exposed bough, its feathers fluffed out, a picture of stupid lethargy. But although outwardly motionless, it is ever alert. Let any edible insect appear, whether flying in the air or crawling over leaf or bark, the "stupid" puff-bird darts swift and straight, seizes the insect in its strong bill, returns promptly to its perch, and pounds the victim loudly against the branch before gulping it down. Then the bird remains quietly perching until another morsel tempts it into action.

*Voice.* Even with its voice, the puff-bird appears never to expend its energy unnecessarily. The construction of the nest calls forth outbursts of song from many birds, especially from the related jacamars; but my pair of Black-breasted Puff-birds voiced only low, whispered *peep*'s while so engaged. This, and a nasal sound uttered when they were disturbed at the nest, were the only notes I heard from them during many hours of watching.

*Nest-building.* While wandering through an area of second-growth woodland on Barro Colorado Island on March 28, 1935, I heard a low tapping sound which led to the discovery of my first pair of Black-breasted Puff-birds. They were digging into the side of a very large black nest of termites (the species was determined by Dr. A. E. Emerson as *Nasutitermes pilifrons*), which was situated about 30 feet above the ground, far out on an ascending branch of a small tree that was leafless but apparently living. The tree grew beside a narrow open space amidst the woods, which facilitated subsequent observations. Since the morning was already far spent, I went away, after noting that the birds had made a very shallow depression in the side of the termitary. Evidently they were just beginning to excavate their nest-chamber.

When I returned next morning at a few minutes before eight o'clock, I failed to find the puff-birds in the vicinity; I wandered about but at 8:45 heard tapping and returned to the observation post that I had already chosen, a fallen log from which I had a good view of the termitary. I found the pair perching quietly on a slender, leafless branch in front of their hole in the side of the black mass. They appeared not to notice my approach, although I made no attempt to conceal myself. Soon one flew to the excavation and clung to its rim; it clutched the lower edge of the shallow depression in the side of the termites' nest, its short black tail propped against the outside of the nest, and its head bent forward into the hole, so that from my position on the

ground I could not see it. In this attitude it remained almost motionless, but at fairly long intervals took a few pecks at the termitary. Four taps were the most that I heard at a time; and each short spurt of activity was followed by a relatively long period of silence and immobility. I could not see the head of the bird, and it is possible that it was devouring the termites which came out to defend their nest. After clinging in this manner for about 15 minutes, the bird flew out and rejoined its mate on the leafless branch. A few minutes later the mate flew to the termitary and behaved as the first had done. It hammered audibly at the structure more frequently than the first, yet still very little. It remained only six minutes and, upon leaving, darted to the trunk of the tree, plucked an insect from the bark, and flew with it to a horizontal swinging vine not far distant. It knocked the insect against the vine, then swallowed it. Six minutes later the first bird returned to the termitary. So long as I watched them (8:45-10:12 a.m.), the two thus alternated, remaining from less than one minute to as much as 12 minutes clinging in front of their excavation. Sometimes they hammered more, sometimes less; but always their tapping came between long periods during which, so far as I could see or hear, they were inactive; and neither tapped more than four times together.

The member of the pair not at work usually sat motionless on the bare limb with feathers puffed out in characteristic fashion. At intervals it made a long dart to pick some insect from a distant branch or leaf. Both members of the pair were perfectly silent, except for a low, whispered *peep* that I heard at times. At 10:12 the bird which had been at the termitary flew out and away, and five minutes later the mate followed. What a contrast these stolid birds made with alert and lively jacamars, timid trogons, noisy kingfishers, hard-working woodpeckers, and all other birds I have watched dig their nest-chambers in earth or wood or termites' houses!

By April 3 the hole in the side of the termitary had become so deep that when the puff-birds were at work in it the tip of the tail just reached the rough black outer surface of the structure. They devoted long hours to their task, and I found them at the termitary both morning and afternoon. They flew away just as I approached at about 8 a.m. on April 3, but their departure was evidently spontaneous, since they seemed completely indifferent to my presence. In 15 minutes one of the pair returned and went promptly to work, while a moment later the second arrived on the perch where they always awaited turns at the task. They alternated at the work as before, but one spent considerably more time in the termitary than the other. Between 8:15 and 9:53 this bird gave 57 minutes to the task, while the mate, which I could distinguish by a disarranged tail feather, remained at work a total of only 30 minutes. The greater time given by the first was accounted for

by two long shifts of 16 and 17 minutes, respectively. The other periods of work of this bird were of 5 to 7 minutes' duration, and those of the mate lasted from 2 to 6 minutes.

While at work, they frequently uttered the low, soft peeping, which was the only vocal sound that I had so far heard from them. The bird waiting outside sometimes darted after insects, often to a considerable distance; but there was no courtship feeding. During the longer shifts, the puff-bird sometimes emerged from the cavity and rested for a short time while it clung to the lower edge of the hole. Perhaps when I first watched I had underestimated the amount of work that they actually performed while inside the cavity. With my ear pressed against the trunk of the supporting tree, I could hear sounds from within the termitary which were otherwise inaudible to me. The tapping was far more frequent than I had supposed from the louder taps which alone had reached me where I had been sitting. There were also sounds which seemed to indicate that the puff-birds crunched or tore at the substance of the termitary, in addition to pecking at it.

Returning between four and five o'clock that afternoon, I found the puff-birds at work. They stayed in the termitary for briefer periods than in the morning, and changed about more frequently. In the morning I had been obliged to watch the birds against the sun, but now I had the sun behind me and received a far more striking impression of their contrasting white and glossy bluish-black plumage.

The puff-birds were still working at their hole in the termitary in the middle of the afternoon of April 10, at least 14 days after they had begun it. On April 13, I managed to reach the nest. I nailed cleats to the trunk to facilitate frequent visits; and since the branch that supported the termitary seemed too slender to bear my own weight in addition, I braced it with a rope tied to the central trunk. Even after I had climbed to the termitary I could not see into the puff-birds' nest, whose entrance opened on the outer side, away from the trunk. To overcome this difficulty, I laid a stout pole between the nest-tree and the crotch of a neighboring tree. Then, standing upon the horizontal beam and steadying myself with one hand upon the branch that supported the termitary, I could at length look into the opening. The next day I noticed that the termites were eating away the supporting rope and the lashings, and I replaced all the cordage with wire for greater safety.

When examined on April 13, the puff-birds' nest-cavity seemed to be completed. A narrow, horizontal tunnel, about 7 inches in length by  $1\frac{7}{8}$  inches in diameter, led into the top of a spacious, neatly rounded chamber in the heart of the termitary. To see anything in the dark interior it was necessary to use artificial illumination, in the form of a small electric bulb attached to the end of wires leading to an electric

torch that was hung close by. A small mirror, pivoted transversely on the end of a long handle, revealed portions of the chamber that could not be viewed directly.

When I began to nail the cleats to the trunk of the tree, the puff-birds, which were resting on their favorite perch in front of their nest, remained where they were until the vibration as I advanced higher drove them away. During the next 10 days I visited the nest on alternate days. I usually found one of the pair of puff-birds standing guard on the perch in front of the entrance. Despite the shaking of the slender branch as I climbed toward the bird, it stayed quietly where it was until I came within two or three yards of it, when it flew silently away. Twice I chanced to find a bird in the nest, where it remained, considerably shaken by the swaying of the termitary caused by my movements, until I had seated myself on the cross-piece in front of the nest and begun to arrange the lighting apparatus, when it flew out past my ears, uttering a nasal sound.

*The eggs.* On April 23 I was delighted to find that the first egg had been laid. It was placed so near the back of the chamber that when I put in the light I could see it without the mirror. The egg seemed small in proportion to the puff-bird. It was pure white, with a beautiful glossy shell, and resembled the egg of a woodpecker. It reposed on some chips of the hard black substance of the termitary, which had not been removed; no material of any kind had been brought into the chamber to line the nest. On April 24 I found the second egg; and the third and last was laid on April 26, indicating that the eggs were deposited at two-day intervals. During the period of egg-laying one bird stood guard in front of the nest, as during the 10-day interval between the completion of the nest and the deposition of the first egg. I made all my visits during the afternoon, in order to be less likely to disturb the female while she was laying.

*Incubation.* On the morning of May 3 I took up a position in view of the nest at 5:45, just as the darkly overcast sky was beginning to brighten from black to gray. At 6:16 the puff-bird which had passed the night on the eggs appeared in the doorway of the nest. The pure white throat was the only part of the bird which was plainly visible as it paused in the entranceway to look out upon the forest dripping after the night's hard showers and still dim beneath a dense mantle of clouds. After a minute's delay, the bird launched forth and flew with short, swift wing-strokes over the treetops and beyond my range of vision. At 6:33 a member of the pair arrived and, after a brief survey of the immediate surroundings, entered the nest. It was impossible to tell whether this was the bird which had left 17 minutes earlier or (which

is more probable) the mate. This bird sat in the nest for nearly three hours while I watched, drenched by the heavy showers that had meanwhile begun to come down. At 9:15 it came to the doorway, looked about with its head framed in the round aperture, then flew forth. It paused for many minutes among the branches near the nest, then flew out of sight over the low trees. Since, without seeing one bird relieve the other, I could not make certain whether one or both incubated, I decided to leave. Just as I was passing beneath the nest, at about 9:30, a puff-bird arrived to enter it. I stood still to watch, but I was too near, and after a little hesitation the bird flew away again.

Arriving at the nest at 1:57 p.m. on May 5, I found a puff-bird perching quietly in front of it. Here it remained for half an hour, sometimes stretching its wings, and once catching a big flying insect, but mostly it sat motionless. The record of the following hour and a half is given below:

- 2:30 The puff-bird entered the nest.
- 3:03 It left, paused a few minutes on the perch in front of the nest, then joined its mate in the next tree.
- 3:25 After pausing for some time in the vicinity of the nest and catching two insects, a bird entered.
- 3:32 It left and rested in front of the nest.
- 3:50 It entered again.
- 4:01 It left and perched in front of the nest.

This was most erratic behavior on the part of birds that had been incubating their eggs for nine days and that were capable of sitting nearly three hours at a stretch. I decided to look into the nest and see whether anything was amiss. The puff-bird that had just left the nest remained perched in front of it while I climbed the tree. When I was only about six feet away, it flew to a more distant perch in the next tree, and sat, silent and stolid, only turning its head from side to side as it watched me, during the entire time I was at the nest.

The electric light revealed the eggs safe and sound in their usual position. A few small black ants were crawling around the interior of the chamber, and in and out through the entrance tunnel, but they had been present since before the eggs were laid and were, moreover, perfectly innocuous. I could see no cause at all for the puff-birds' uneasiness.

Upon reaching the nest on the afternoon of May 6, I found one of the pair perching quietly on the pole that I had fixed transversely in front of the termitary. The bird retained its position despite shaking until I came within six feet. At this distance I paused to look at the chubby little creature, so oddly marked with black and white, and

to gaze into its large, alert dark eyes. Only when I began to move closer did it take wing and dart over to a perch in the next tree, about 12 or 15 feet away, where it remained to watch my proceedings. The eggs were not in their usual position, where I could see them the moment I switched on the light. I stuck in the mirror, and turning it and the electric bulb from side to side, explored all the darker portions of the chamber to learn whether the eggs had been displaced there. But the result of all my searching was negative. I spent about half an hour at the nest; and all this time the puff-bird that was present when I arrived lingered in the same spot, intently and silently watching me, turning its big head at intervals from side to side. Before I descended, the mate arrived and perched near the first bird.

I had hardly reached the ground when one of the puff-birds flew to the perch in front of the nest, where it was soon joined by the mate. Then the first bird flew to the entrance of the nest and clung there, apparently wanting to enter, yet fearing to do so. It pushed its head in a little way, then backed out, then pushed in again, a little farther. It was plainly torn between two conflicting impulses. At length, without having penetrated to the nest-chamber, the bird retreated and joined its mate on the perch. The latter then went to the entrance, repeated the same performance, and came back without having entered. Then the first flew again to the doorway, but was no more courageous this time than last, and rejoined its mate on the branch in front of the nest. Finally the second puff-bird went the second time to the entrance and, slowly and cautiously, sometimes advancing, sometimes retreating, arrived at last at the chamber. While these explorations were in progress, the two birds uttered occasional monosyllabic *peep's*, somewhat louder than I had heard them voice before, but still not loud.

After a minute the puff-bird came out head first, proving that it had gone all the way into the chamber, where alone there was room to turn around. It joined the mate on the perch, and after four minutes the other went inside, though not without considerable hesitation. This was its third attempt to enter. It remained within for two minutes, then emerged head first, as the other had done. Then the second, which meanwhile had withdrawn to a more distant perch, flew again to the entrance, uttering a peculiar, low, nasal sound as it went past its mate, which had remained on the branch in front of the nest. It went inside, came out after a minute, then after a pause went in once again, making three times in all. After its third exit it flew off to a more distant perch. The first puff-bird went yet again to the entrance, where it clung and called with weak *peep's*, then flew off to join the mate, without having entered the nest. The birds devoted 40 minutes to their apparent hunt for the vanished eggs, before at last they flew off over the treetops.

And what could have taken the eggs? No hawk nor owl nor toucan could have entered the chamber, nor reached the eggs through the long, narrow entranceway. Any mammal slender enough to creep in would have been too small to remove the eggs in its mouth, and must have devoured them where they lay, leaving tell-tale particles of shell. But a snake could easily have slipped in and engulfed them whole, leaving no trace of its visit.

Bitterly disappointed by the loss of the puff-birds' eggs on May 6, I did not revisit their nest until May 30, when other business took me into that part of the forest. To my great surprise, the nest was occupied again. Despite the rather violent shaking caused by my climb up the slender supporting branch, the puff-bird that was sitting in the chamber did not dart out until I actually reached the termitary. Pushing in the electric light, I saw three eggs resting where the first three had lain. Instead of being immaculate white, as the first set had been when newly laid, these had become soiled and were covered with blackish speckles. Apparently they had been deposited a number of days earlier. Trogons' eggs laid in termitaries also become heavily soiled.

I had only two days more to remain on Barro Colorado, and in a last-minute effort to answer the question whether one or both members of the pair incubated, I watched again late on the afternoon of May 31. This time I was successful in witnessing the replacement of one by the other. One puff-bird was within when I began my vigil at 3:40 p.m. I observed no sign of activity at the termitary until 4:23, when the mate came flying through the treetops and settled on a high bough about 20 feet from the termitary. I was more than 40 feet away and heard no sound, but the puff-bird in the nest evidently did, for it came to the doorway. Here it paused a minute or two, looking out, then flew forth and alighted on a twig in front of the nest, where it delayed for several minutes, puffing out its feathers and uttering low *peep*'s. Next it went to a more distant perch and delayed longer, before at last it winged away over the treetops. The new arrival lingered where it had first come to rest, then flew to the perch in front of the nest and delayed still more, knocking the sides of its bill alternately against the branch. Finally, 23 minutes after its arrival, it entered the nest to stay—and at last I knew that the two sexes of the Black-breasted Puff-bird share the incubation of the eggs. It sat in the nest for 78 minutes (until 6:04), when it came out and lingered for 19 minutes on the perch in front, then flew away through the treetops. At 6:50 this bird or, more probably, its mate came out of the forest and after hesitating a minute or two entered the termitary, when the fading light had become so dim that I could hardly distinguish it. This was my last glimpse of a Black-breasted Puff-bird.



I had watched this nest for a total of 7 hours while incubation was going on. The 5 sessions on the eggs which I timed ranged from 7 to 162 minutes and averaged 58.2 minutes. Five periods when the eggs were unattended ranged from 17 to 46 minutes and averaged 25.2 minutes. The nest was occupied by one member of the pair or the other for only 70 per cent of the 7 hours. In their manner of incubation these puff-birds much resembled such toucans as the Blue-throated Toucanet (*Aulacorhynchus caeruleogularis*) and Frantzius' Araçari (*Pteroglossus frantzii*). The toucans, like the puff-birds, take sessions of very irregular length, now fairly long, now very short, and often go off before the mate arrives to replace them, leaving the nest unattended, so that one must watch long and patiently to assure himself that both members of a pair share the task of incubation. One of my Black-breasted Puff-birds sat once for a period much longer than I timed at nests of either of these far bigger toucans, and the sessions of the pair also averaged longer. Jacamars keep their eggs far more constantly covered.

The Black-breasted Puff-bird's habit of nesting in a termitary is not unique in the family. Cherrie (1916:321) found a nest of the Two-banded Puff-bird (*Hypnelus bicinctus*) in a termitary at Caicara on the Orinoco. An entrance tunnel about 8 centimeters in diameter led to a spherical chamber about 15 centimeters in diameter, hollowed out of the heart of the termitary. He records that one of the parents remained in the cavity, covering the single fresh white egg, while he cut and hacked at the hard, tough structure and the insects swarmed out everywhere over the nest in countless numbers. There was no lining in the chamber; the egg was deposited on the debris at the bottom of the nest-cavity. Because I did not cut into the termitary that contained the Black-breasted Puff-birds' nest, I saw practically nothing of the insects; they had sealed off the innumerable passages leading into the part of their dwelling occupied by the birds. The same thing occurs when trogons carve their nest-cavity in a termitary.

WHITE-WHISKERED. SOFT-WING

*Malacoptila panamensis* Lafresnaye

The Soft-wing is a stout bird about seven inches in length. Its soft, loose plumage is colored with many blended shades of brown, chestnut, tawny, and buff which in aggregate give the bird at a distance a bright reddish-brown hue. From close by it is seen to be profusely spotted and streaked with tawny and pale buff on the upper plumage, and, on the under parts, broadly streaked with brown and dusky. *M. p. panamensis* is more liberally streaked than the northern

race, *inornata*. At the base of the bill are mustache-like tufts of white or whitish feathers, for which Sclater (1882:119, and pl. 40) called the bird the "White-whiskered Soft-wing" (the substantive a loose translation of the generic name)—a most appropriate English appellation which has been strangely ignored by later authors. The bird's eye is large and red; its bill rather long, stout, slightly curved, and dark above; its legs and feet yellowish gray. The coloration of the female is much less bright than that of the male, but in the dim light of the woodland it is not easy to distinguish the two.

The species, as a whole, ranges from western Ecuador to southern Mexico. On the Pacific slope of southern Costa Rica I have met the bird as high as 4,700 feet above sea-level, but it is much more abundant below 3,000 feet, and in general throughout its Central American range is known only from the Tropical Zone. A species of the rain forest, northward of Costa Rica it is largely if not wholly confined to the Caribbean side. In the forest the Soft-wings are usually seen within 15 or 20 feet of the ground; but I suspect that they spend a good part of their time at considerably greater heights, although because of their habitual immobility they are not often discovered among the taller trees until one becomes familiar with their voice. Not infrequently they wander from the primary forest into neighboring areas of older second growth, and occasionally I see them in the shady pasture in front of my house, hard by the forest. Like other forest birds, they seem often to come to the edge of an adjacent clearing in the twilight, apparently to enjoy a slightly longer period of daylight and to hunt food at a time when the illumination beneath the tall trees is too dim for this activity. Usually I have found Soft-wings singly, but not infrequently one individual will attach itself to a mixed flock of small birds of other species.

My notebooks contain no better word-picture of the Soft-wing's behavior than that which I wrote many years ago after my first meeting with the species. On the afternoon of September 4, 1930, John T. Emlen and I were following a trail through tall second-growth woods, in the Lancetilla Valley near the Caribbean coast of Honduras, when we met a Northern White-whiskered Soft-wing (*inornata*) resting upon a small bough 10 feet above the path. It permitted a close approach and sat motionless, very upright, while we examined the details of its plumage through our field-glasses (although most were clearly visible to the naked eye) and described them minutely to each other in voices perfectly audible to it. It was quite silent during the quarter of an hour or more that we had it in view, and while perching was motionless except that several times it rapidly about-faced on the branch, thus alternately exposing its front and back to our close scrutiny. While it appeared dull and stupid, it was by no means asleep, for its

eyes were ever watchful for creatures crawling over the surrounding foliage. When it espied its prey, usually below the level of its perch and at a distance of 10 or 15 feet, it darted out rapidly, and we distinctly heard the loud *clack* of its heavy bill as it closed upon the booty. Then it returned to a perch, usually the same, to sit quietly until some other suitable morsel presented itself. Once it shot straight toward us and picked up some insect in the grass beside the trail, not 10 feet from where we stood. In its habit of sitting motionless, scanning the foliage for insects, its rapid darts upon the prey and return to the same perch, and its habitual silence, it greatly resembled the Turquoise-browed Motmot (*Eumomota superciliosa*) of the same region, but permitted an even closer approach than the latter. After we had proceeded on our way and crossed the river we saw another Soft-wing, or perhaps the same again, perched low above the trail; and in the dim light of evening, I almost bumped into it before it took flight.

Because of its habitual fearlessness of man, and its habit of remaining motionless like a heron or kingfisher while keeping a sharp lookout for its prey, this puff-bird and many others of its family are frequently called "stupid," especially by collectors.

*Voice.* The Soft-wing is no more gifted in voice than the other puff-birds I know. The only notes that I have ever heard from it are thin, weak whistles or *peep*'s, but these vary considerably in length and intonation. While I sat in a blind amidst the forest on Barro Colorado Island in the Panamá Canal Zone, watching a nest of an antwren, a Soft-wing perched motionless for more than a quarter of an hour on the low twig of a sapling about 20 feet away, and repeated low, peeping notes which even at this distance were scarcely audible. At other times I have heard the bird utter a high, thin, sibilant whistle. One afternoon in May, in the forest in the basin of El General, Costa Rica, I watched a Soft-wing as it perched on a lower bough of a tall tree and delivered repeatedly a long-drawn, thin, sharp, high-pitched *tzeeee tzeeee*. As he voiced these notes, he twitched his tail far to one side, then far to the other, holding it motionless for a few moments at the extremity of each beat. I have often heard notes of this character floating down from somewhere above me in the heavy forest, but usually without being able to pick out their author with my eyes.

*Nesting.* On June 8, 1943, I found in the forest close by my house in El General the only nest of the White-whiskered Soft-wing that I have ever seen. It was in a burrow on a hillside which, although steep, was by no means precipitous—a horse could have climbed straight up. The forest was high, with a lofty closed canopy, and the undergrowth of bushes and saplings open and easy to walk through.

The ground, carpeted with fallen leaves and other litter, bore only a sparse, scattered cover of low ferns and saplings. The burrow descended obliquely at an angle of about 30 degrees with the horizontal. It was about  $2\frac{1}{4}$  inches in diameter, perfectly straight, with a roomy chamber at its lower end. The total length from the entrance to the back of the burrow was  $20\frac{1}{2}$  inches. The chamber was lined on bottom and sides with large pieces of dead leaves, upon which rested two pure white eggs. The mouth of the tunnel was surrounded by a low pile of decaying twigs, some thorny, and dead leaves. On top of these were three big whole leaves, the largest 12 inches long by 4 inches wide. The edges of these leaves just touched the mouth of the tunnel. Although I thought the burrow had been dug by the birds, there was no fresh earth visible below it. Possibly when excavating, the Soft-wings carried the loose earth away in their bills, as chickadees and barbets remove the chips when carving their nest-cavity in wood; but if they actually did this, the excavation of the burrow must have been a long and laborious task. The nest was so well hidden, its mouth closely surrounded by dead leaves in the midst of the long, leaf-strewn slope, that I might have passed over it without becoming aware of its existence if a bird had not flown out as I walked by.

The two immaculate white eggs formed the complete set, for on subsequent days the number did not increase. I wanted to study the pattern of incubation at this nest, but because of the steepness of the slope and the positions of the neighboring trunks, the only point which offered accommodation for a blind was close in front of the burrow. I feared that alterations in the surroundings so near the nest might reduce its chances of escaping predatory animals.

On my subsequent visits to the nest, I almost always found a puff-bird in charge. As I came near, it would emerge, fly to a bough above my head and repeat over and over its high, thin, long-drawn whistle. Then it would rise into the crowns of the trees and vanish. Or sometimes it would, upon leaving the burrow, fly without stopping into the upper levels of the forest, whence the whistles floated down from the unseen bird. But if I approached very softly and cautiously, I might throw in the beam of my electric torch and surprise the Soft-wing in the nest. It would always be facing outward as it sat on the eggs, and the large, deep red eyes shone brightly in the beam of light. As soon as I extinguished the light and stood to one side of the doorway, it would emerge and fly swiftly out of sight. Sometimes, upon looking into the tunnel after the bird's departure, I would see a number of dark-colored flies, as big as house flies, resting upon the white eggs.

When I approached the nest at 10 o'clock on the morning of June 17, both parents repeated their thin whistles almost continuously, but they were well up among the trees where I could not see them. Looking into the burrow with the electric torch, I saw that the eggs had

hatched. The nestlings were pink-skinned, completely naked, and had tightly closed eyes. Their short, sharp bills curved downward at the tip; the lower mandible did not exceed the upper in length, as with newly hatched woodpeckers, kingfishers, and jacamars. I could not see the nestlings' feet and did not wish to open the burrow and remove the birds for a closer examination, knowing that such interference would diminish their slender chances of living to fly from the nest. The young Soft-wings moved around rather actively upon their leafy bed, apparently trying to escape the light.

Two days later the nestlings had vanished, although the burrow and its surroundings were unaltered. I believe that only a snake could have entered to swallow the nestlings. I heard the parents whistling in the vicinity but could not see them; and if later they made another nest in that part of the forest, it escaped my search.

I have not seen any published description of the nest of the White-whiskered Soft-wing (*Malacoptila panamensis*), but Arbib and Loetscher (1935:327) report having found it breeding in the Panama Canal Zone during July and August. Todd and Carriker (1922:227) describe briefly a nest of the closely related Mustached Soft-wing (*M. mystacalis*) discovered in the Santa Marta region of Colombia: "The nest is placed at the extremity of a hole in a bank of earth, excavated by the birds to a depth of nearly two feet (in the case of the one examined). The tunnel proper is from two to three inches in diameter, while the nest-chamber at the end is enlarged to be about six inches across and four inches high. The nest is very slight—merely a few twigs and dead leaves. The one examined was in a bank by the roadside, where people and animals were passing daily; it contained one young bird, nearly fully fledged."

#### BLACK-FRONTED NUN-BIRD

*Monasa nigrifrons* (Spix)

The most memorable event of my visit on October 6, 1940, to the Río Yavarí, a southern tributary of the Amazon which forms part of the boundary between Perú and Brasil, was a meeting with a flock of Nun-birds. While we examined a rubber tree in a riverside plantation, a small flock of these birds perched in the boughs close above us. They were very tame and allowed us to see them well. They were dark on all the upper parts, wings, and tail, and their under plumage was dark gray. Their only bright color was on the strongly tapering bill, which was brilliant orange. Cherrie (1916:322) states that in Venezuela a related species (*M. niger*) has a poppy-red bill and is called *pico de lacre* (sealingwax-bill), a name which would equally well fit the Peruvian bird. Their eyes were large and dark, their feet blackish. While perching quietly above us they voiced soft musical murmurs, the while twitching their black tails from side to side.

The Nun-birds appear to be more sociable than the majority of the puff-birds, and a careful study of their habits might reveal some interesting relationships. But we are fortunate in having a description of a nest of the Black Nun-bird (*Monasa niger*) found by Cherrie (1916:322) in the Orinoco region of Venezuela on May 27, 1907. This was in a burrow situated in a belt of heavy timber bordering the San Feliz River. The tunnel was about 7.6 centimeters in diameter and 1.5 meters in length, and went down into the level ground at an angle of about 45 degrees with the surface. Covering the entrance was a pile of coarse and rotten dead twigs, as large as a half-bushel measure, and "unquestionably of recent construction." The mouth of the burrow itself was reached through a rounded tunnel which ran along the ground beneath the pile of sticks. So cleverly concealed a nest would not have been discovered had not the cries of the well-grown young, issuing from beneath the brush pile, drawn Cherrie's attention. In the presence of a pile of dead vegetation over the entranceway, the burrow of the Nun-bird resembles that of the Soft-wing, but in the Nun-bird this feature was far more strongly developed; the Nun-bird likewise left no loose earth about the entrance.

#### SWALLOW-WING

#### *Chelidoptera tenebrosa* (Pallas)

While voyaging with a rubber survey party over the waterways of eastern Perú in the gun-boat *Amazonas*, I saw much of the Swallow-wings along the shores of the Amazon, the Marañon, and their great tributaries, the Huallaga, Ucayali, and Napo. Swallow-wings are about the size of a large swallow, but stouter of body and with a bigger head. In plumage they are chiefly black, but with the rump pure white, the abdomen rufous, and the under tail coverts dull white. The pointed tips of the long wings, when folded, reach almost to the end of the short tail. The bill, fairly stout at the base but tapering to a sharp tip, is black and markedly curved. The feet are blackish and the eyes dark.

These birds rested, generally in pairs, on the topmost leafless twigs of tall, dead or dying trees along the shores, whence they made long aerial sallies in pursuit of insects, returning usually to the same high lookout to devour their victims and await another capture. It did not occur to me that these "flycatchers" might be puff-birds until months afterward, when I found them depicted among other members of this family in Goeldi's "Album de Aves Amazonicas." But when one gives thought to the matter, it is clear that the Swallow-wing has only developed to a higher degree the insect-catching arts of its relatives *Notharchus* and *Malacoptila*; it pursues the insects above the trees rather than among them, with a corresponding increase in

radius of action and ease of flight. The only note I heard from these Peruvian Swallow-wings was a weak whistle. From the Amazonian plain I traced them upward into the Andean foothills; the highest seen was near San Ramón Chanchamayo, at about 2,700 feet above sea-level.

Like the Soft-wings and Nun-birds, the Swallow-wings nest in burrows in the ground. According to Cherrie (1916:323), who found the species not uncommon along the Orinoco, frequenting open glades in forested regions or the light woodland bordering savannas, they may dig their tunnels either in the bank of a stream, like a Bank Swallow, or in level ground. The straight shaft slants downward at an angle of about 30 degrees with the horizontal and varies from about one to two meters in length. At the nether end is a slight enlargement where the eggs, pure white and generally two in a set, rest upon the bare ground or on a few bits of dead grass. The birds apparently carry off in their bills all the earth they excavate, for no loose dirt was found about the mouth of the tunnel. No mention is made by Cherrie of a pile of leaves or sticks over or around the orifice of the burrow, as with those of *Monasa* and *Malacoptila*. The young Swallow-wings are hatched perfectly naked, like the nestling Soft-wings, but their skin is slate black instead of pink. When they are about half grown and their pin feathers begin to appear they are said to creep out to the entrance of the burrow, where they sprawl in the sun while awaiting the visits of their parents with food. If suddenly alarmed, they scuttle backward into their burrow, never pausing even long enough to turn around. The bottom of nests containing older young swarm with maggots that thrive in the excrement and cast-off parts of the insect food—chiefly small beetles—with which the young are nourished. Cherrie records that he found four nests between March 2 and May 8.

#### SUMMARY

The Black-breasted Puff-bird (*Notharchus pectoralis*) lives among the crowns of the trees in the lowland forests of eastern Panamá and northern Colombia. It perches motionless much of the time, breaking its long periods of immobility by sudden darts to snatch insects from the vegetation or from the air.

The only notes heard were a low, weak *peep* and a nasal sound uttered when the birds were disturbed at their nest.

On Barro Colorado Island a pair were discovered carving a nest-chamber into a big, black, arboreal termitary on March 28, 1935. The sexes alternated at this task, and they worked hard through much of the day over a period of two weeks before the nest was completed.

During the 10 days which elapsed between the apparent completion of the chamber and the laying of the first egg, one or the other member of the pair guarded the nest much of the time. It rested quietly in front or at times sat within.

Three pure white eggs were laid at two-day intervals.

Male and female took turns at incubation, but usually one flew away before the other arrived to replace it. Their periods of sitting were most variable, those timed ranging from 7 to 162 minutes. During 7 hours of observation the eggs were covered only 70 per cent of the time.

The eggs vanished before hatching, apparently taken by a snake. The parents made repeated inspections of the nest after their disappearance.

After a few weeks a second set of three eggs was found in the same cavity.

The White-whiskered Soft-wing (*Malacoptila panamensis*) dwells chiefly in lowland forest, but at times is seen in adjoining areas of older second growth and even in shady pastures. In its manner of catching insects it greatly resembles the Black-breasted Puff-bird.

Its notes are weak *peep*'s or high, thin whistles.

A nest was found, on June 8, 1943, in a short burrow going obliquely down into a steep hillside covered by tall forest. The chamber at the lower end was lined with dead leaves, and a little heap of twigs and dead leaves surrounded and concealed the entrance. Although the burrow was apparently dug by the puff-birds, no excavated earth was found near it.

Two white eggs formed the full set.

The nestlings hatched quite naked. They vanished, apparently taken by a snake, when two days old.

The Nun-birds (*Monasa*) appear to be more gregarious than other puff-birds. Their nests in burrows (as described by Cherrie) have points in common with those of the Soft-wing.

The Swallow-wings (*Chelidoptera tenebrosa*) rest in pairs on the exposed tops of tall trees, whence they dart out or up in spectacular fashion to catch flying insects. Their notes are soft whistles. They nest in burrows in the ground, and the young are born naked.

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FINCA 'LOS CUSINGOS,' SAN ISIDRO DEL GENERAL, COSTA RICA

## A SINGING FEMALE WOOD THRUSH

BY HERVEY BRACKBILL

THE female Wood Thrush (*Hylocichla mustelina*) of a color banded pair whose two nestings I studied in Baltimore in 1943 sang frequently during the laying and incubating stages of both nestings. Her utterances differed in form from the songs of males and were weaker and less musical, but their sustained and vibrant quality marked them definitely as songs. (This female did not return in 1944.)

I have mentioned (1943:82) another female Wood Thrush that, during a defense of territory, voiced at intervals a short, explosive cry that had a musical quality and suggested rudimentary song; other observers have reported song by females of two other hylocichlids, Bicknell's Thrush (*H. minima bicknelli*) and the Veery (*H. fuscescens*). Wallace (1939:314) states that practically every sitting Bicknell's Thrush that he watched sang occasionally during incubation, hatching, and brooding. The dates given by Halle (1943a:103, 1943b:46-47) for the singing of a Veery that seemed to be a female suggest a song cycle extending from courtship three-fourths of the way through incubation. •

*The songs.* The songs of the female Wood Thrush were of two distinct forms. The one I heard oftenest I recorded as *huh-huh-huh-cheee*. The *huh* notes were much like the common soft call of the Wood Thrush, but "heavier" or "solider"; although usually three or four in number, they varied from one to six. *Cheee*, the accented note of the phrase, was a somewhat prolonged, definitely vibrant note, resembling the final note of a male Wood Thrush's rising song phrase but hoarse and much below a male's in volume.

The second song form was *huh-huh-huh huh-o-wee*, the introductory *huh's* as in the first song, but the *huh-o-wee* a slurred, flat-toned whistle, with the accent on *wee*.

There were some variants of both main forms, and also occasional songs that combined the characteristic sections of both, as: *hoo-yuh-wee cheee* (the first phrase a flat-toned whistle, accented on the *hoo*), and *huh-huh-huh-huh hoo-wee cheee* (accent on the *wee*).

*Song cycles.* The mate of the singing female, a color-banded bird from 1942, returned to his nesting territory on May 8, 1943; the female was present by May 9; nest building occurred May 10 to 13, laying May 14 to 17, hatching May 28 to 30, and the young left the nest (prematurely) June 7. Building of the second nest began June 11, laying occurred June 16 to 18, hatching June 28 to 30, and the young left the nest between July 10 and 12.

The female's song was cyclical. Each cycle began, as far as I observed, early on the morning of the second laying day. The first cycle was at least 16 days, May 15 through May 30, song last being heard

some hours after the hatching of the fourth and last egg. The second cycle was at least 5 days, June 17 through June 21, song last being heard on the third day following completion of the clutch of three eggs. (On five occasions on four later days during incubation and hatching, I watched this nest for one to four hours at a stretch without hearing the female sing.) This decline in the female's singing from brood to brood resembles the decline in attentiveness that in a previous study (1943:86) I recorded for both members of a pair of Wood Thrushes. Nice (1943:127) found that female Song Sparrows (*Melospiza melodia*) sang only before the first nesting.

*Place of song.* On the first day of each song cycle the female sang both from the nest rim and from perches out in the territory. On the second day of the first cycle I once saw her sing in the home tree a few yards from the nest. With these exceptions, I saw her sing only when she was sitting on the nest (however, once steady incubation had begun I never followed her on her foraging trips between sittings).

The greatest distance from the nest at which I observed singing was 43 yards, on May 15. Other song perches that day were 30, 27, and 23 yards from the nest. On June 17 some singing was done 21 yards and 4 yards from the second nest.

Except for one that was only 3 feet up, the perches used were 10 to 18 feet above the ground. The first nest was 17 feet and the second nest 11 feet above the ground.

Wallace (1939:314-315) actually observed female Bicknell's Thrushes singing only from the nest. I infer from Halle's accounts (1943a:103, 1943b:46) that the female (?) Veery sang when away from the nest.

*Hours of song.* The female Wood Thrush sang at all hours of the day. The distribution of my records parallels to some degree my opportunities for observation; most records during both nestings fell between 5:00 and 7:00 a. m.; during the first nesting there were a number between 5:45 and 6:45 p.m. and a scattering between 10:00 and 11:30 a.m.; during the second nesting there was one at 2:45 p.m.

Wallace (1939) mentions that one female Bicknell's Thrush sang "at various intervals during the day" (p. 341) and that two sang in the late evening (p. 338).

*Rate.* The highest rates of song observed were: May 15, 5 songs given in 30 seconds; May 19, 7 given in each of 2 (non-consecutive) minutes, 4 in one minute; June 19, 3 in each of 2 (non-consecutive) minutes.

For periods of continuous singing the highest rates were: May 15, 23 songs in 9 minutes (from the nest rim), 19 songs in 8 minutes (away from the nest); May 19, 59 songs in 27 minutes (on the nest); June 19, 29 songs in 45 minutes (on the nest).

*Volume.* The songs varied considerably in volume. At their weakest they almost justified "whisper" designation; at their loudest they were still far below male song. I did not determine their carrying power exactly, but on May 19 I heard song from a distance of 16 yards and on June 21 from 23 yards; these songs would have been easily audible at considerably greater distances—possibly 35 yards. The songs were loudest at the start of each cycle.

*Attitude when singing.* I never saw the female Wood Thrush adopt an unusual attitude when singing; she perched or sat in her customary ways; sometimes there was not even a perceptible bill or throat movement.

*Song stimulus.* During the two nestings I observed the female's starting to sing 26 times. The apparent stimuli were: the male's song, 14 times (12 times in first nesting); the male's calls, once (second nesting); the singing male's nearer approach, once (first nesting); the male's silent approach to a distance of about 25 yards, once (second nesting); a neighboring male's song 80 yards or more away, once (first nesting); the cries of a full-grown young Robin (*Turdus migratorius*) being banded 23 yards away, once (second nesting); no observed stimulus, 7 times (4 times in first nesting).

On the occasion when the singing male's nearer approach appeared to be the stimulus, the nearer perch from which he sang was one of his most-used ones. Every time during the first nesting that his song seemed to stimulate the sitting female to sing, he sang from about that same place (he was not always visible to me). I do not believe he was ever visible there to the female, but I cannot be sure.

The interval between the male Wood Thrush's starting to sing and the female's response (when she did respond) varied from "at once" to 7 minutes. The female's reaction was quickest at the height of her song cycles. Thus, of 8 song bursts evoked by the male's singing May 15-19, 4 came "at once" and the others after 30, 60, and 75 seconds, and 4 minutes of singing by the male. Of 4 such bursts May 25-30, only one came "at once" and the others after 30 seconds, 6 and 7 minutes. Of 3 such bursts June 17-19, the intervals were 15, 60, and 75 seconds.

*"Responsive" singing.* Paired birds of a number of species sing "responsively." Such song is of three types: (1) the singing of the male inspires the female to sing—apparently the reverse of this order is uncommon—but the songs of the two birds are entirely uncoordinated; (2) the two birds sing song for song in alternation; (3) the female's notes begin as the male's end and the phrases of the pair, thus added together without a perceptible break, comprise the species song.

As has been indicated, the song of the female Wood Thrush was, for the most part, responsive to the male's in the first sense. So also was the song of female Bicknell's Thrushes (Wallace, 1939:338). Only once did I observe responsiveness of the second type by the Wood Thrushes: on May 15, while singing away from the nest, the female for a very short time "answered" the male's song phrase for phrase; this appeared to be a chance occurrence.

On one occasion (May 23) the male Wood Thrush sang in response to the female; after she had given two songs from the nest he broke more than 25 minutes of silence by singing half a dozen low phrases from a favorite perch, then flew within a foot of the nest for a few seconds (his whereabouts during his silent period were not known).

Only one other time did the song of the female Wood Thrush appear to influence the male's behavior in any way. On May 15, immediately after she had sung her second song within 45 seconds, the male flew from a perch about 50 feet away to one within 2 feet of her; then after a minute's idleness both birds flew to the ground and foraged.

Shaver (in Laskey, 1944:27) states that in response to song by the female Cardinal (*Richmondena cardinalis*) the male may appear and feed her or copulate with her.

*Masculinity in the female.* Saunders (1929:17) was "inclined to think that in most cases singing females . . . possess some trace of masculine characteristics." Nice (1943:127) found that to be true of singing female Song Sparrows insofar as their song was "always given from an elevation . . . in contrast to the female's usual behavior of staying close to the ground," and (p. 128) insofar as two out of four outstanding singers were (at least on occasion) "both unusually aggressive in defending their territories"; however, she noted that one of those two females had a normal nesting history, while the other for three straight years was the earliest layer of all her birds.

As already noted, the female Wood Thrush always sang from elevated places. Which bird of the pair occupied the higher or more commanding spot at the times the female sang could seldom be determined with certainty. However, twice the female was higher than the male, and twice I think she was lower, when his song moved her to sing (there was no correlation between her relative position and the promptness of her response); she once was higher than he, and once on about the same level, when she sang with no observed stimulus. Wallace relates (1939:338) that female Bicknell's Thrushes when they sang were sometimes above and sometimes below their mates.

This singing female Wood Thrush was no more active in defense of territory than the female of a pair that I studied intensively in the preceding year (1943:82); once I imperfectly saw an apparent defense against another Wood Thrush, and once the female helped her mate drive off a Blue Jay (*Cyanocitta cristata*).

## SUMMARY

A female Wood Thrush, studied in Baltimore in 1943, frequently sang during the laying and incubating stages of her two nestings. Her songs differed in form from those of males, and were weaker and less musical. She sang less during her second nesting than during her first. She sang both from the nest and from perches out in the territory, chiefly in the early morning and the evening. The male's singing was the commonest stimulus observed. Except on one (apparently chance) occasion there was no coordinated responsiveness in the singing of the two birds. Only twice was the male observed to react to his mate's singing: both times he flew to her, once first responding with a few songs. This female showed no other signs of masculinity.

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## NOTES ON TEXAS SEASIDE SPARROWS

BY LUDLOW GRISCOM

IN 1944 I published a "Second Revision" of the Seaside Sparrows, *Ammospiza maritima*, which was primarily a study of Gulf Coast variations based on superb material assembled by George H. Lowery, Jr., at Baton Rouge. I was in no position at that time to make a critical study of the birds of the Texas coast then assumed to be *sennetti* Allen, and my few notes were prefaced with the remark that our knowledge of *sennetti* "really lags behind that of any other subspecies at the moment."

In January 1946 Dr. Max M. Peet offered me the opportunity to examine his series of *Ammospiza maritima* from the Texas coast, collected by H. H. Kimball. No less than 68 of this series come from localities other than the type locality (Corpus Christi, Nueces Bay), and the degree of individual variation in 65 specimens, all presumably from Matagorda (on the north arm of Matagorda Bay near the mouth of the Colorado River), is as great as that shown by *fisheri* on the coast of Louisiana (Griscom, 1944). Additional specimens from the Museum of Comparative Zoology and a kind loan, through the courtesy of Dr. John T. Zimmer, of 32 specimens from the American Museum of Natural History result in a grand total of 180 specimens from the coast of Texas from Galveston Bay southward, including every locality of record. They prove that the present systematic concept of *sennetti*, as well as the present definitions of the ranges of *sennetti* and *fisheri*, requires substantial revision.

Historically, systematically, and nomenclaturally, the characters of *sennetti* are those shown by a large series from the vicinity of Corpus Christi, the type locality; a total of 80 before me were collected from 1891 (F. M. Chapman) to 1935, between early October and early June (all birds collected after early April are more or less badly worn). It appears that all published diagnoses of this subspecies are correctly based on the characters displayed by the great majority of this series. The series shows a minor variation already described (Griscom, 1944: 323): two thirds have a grayer tone above; one third are more olivaceous. But it is the extreme variations in the series which are of particular interest:

1. Slightly darker above, that is, *browner*; dusky crown stripes more distinct; dusky and white streaking on back more distinct; chest band deeper in color and more distinct.
  - 1a. One extreme specimen (M.C.Z., Thayer Collection No. 14747).
  - 1b. Nine other specimens, not so extreme.
2. Normal (average), either grayish or olivaceous above—61 specimens.

3. Extremely pale and gray above—7 specimens.
4. Extremely olive and yellow above—2 specimens (La. State Univ. Mus. Zool. See Griscom, 1944:323).

The darker extreme of Variation 1 could be interpreted as the predicted "dark phase" of *sennetti* (Griscom, 1944:323), although the degree of difference between the dark and light phases would be very much less than in any other subspecies of *maritima* in which two definite phases have been described.

Actually my prediction of a dark phase in *sennetti* proves correct and raises a point of some historical interest. In 1891 F. M. Chapman went to Corpus Christi and was guided by J. M. Priour to the head

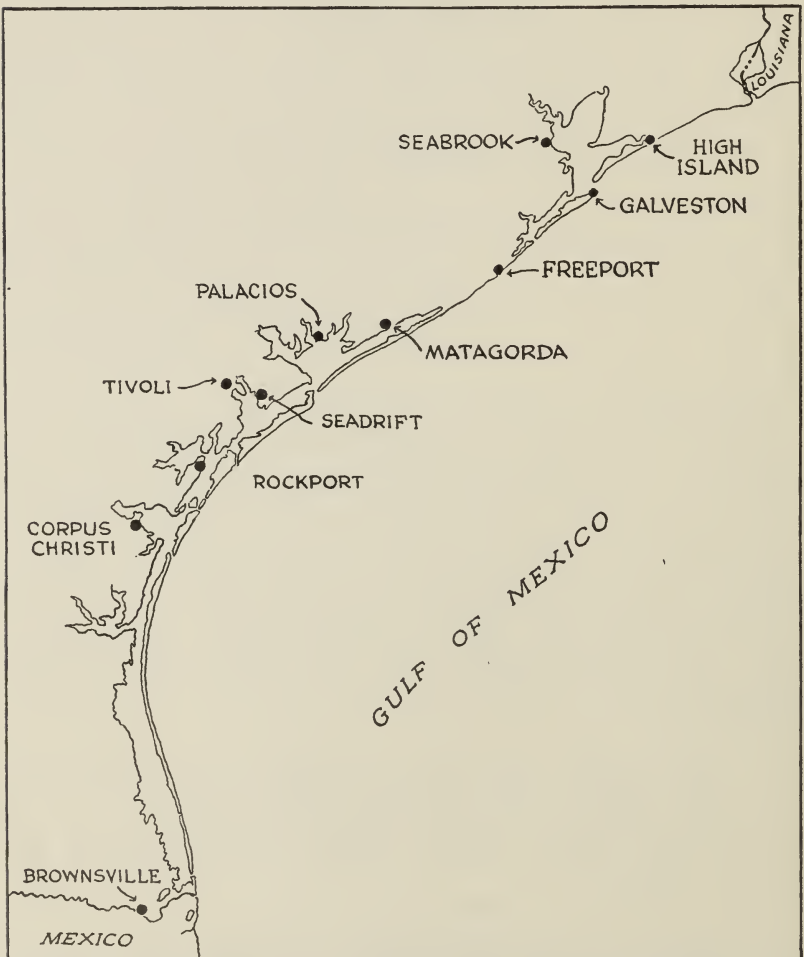


Figure 1. Sketch map of the Texas coast.



of Nueces Bay. Here, in a marsh near the mainland end of the "Aranzas Railway trestle," he collected two dark birds and saw three others, noting especially that no typical *sennetti* were present in that particular locality, although he found them common in other marshes of Nueces Bay. He recorded the dark birds (1891:324) as "*peninsulae?*", but actually they are indistinguishable from light phase *fisheri*, a race not described until 1899. Chapman was inclined to suppose that the dark birds were migrants, but Priour insisted that such dark birds were resident throughout the year, and later, when Chapman described *fisheri*, he gave *sennetti* full specific rank. Griscom and Nichols (1920:24) recorded these dark specimens as *fisheri* and assumed that they were migrants.

Rhoads (1892:98-99) made a trip to Corpus Christi in late May 1891 and was guided by Priour to the same localities where Chapman had collected. Rhoads explicitly states (p. 112) that they made every effort to find some dark Seaside Sparrows but without success. The fact is that for the next 45 years, Seaside Sparrows were collected in Nueces Bay in fall, winter, and spring without other dark birds turning up, with one supposed exception: a specimen (U.S.N.M.) collected by F. B. Armstrong on March 19, 1899.

As I see it, only two inferences are possible from this meager evidence. If Priour was wrong, we have to explain why *fisheri* used to migrate to Nueces Bay, Texas, and now no longer does so. If Priour was right, a dark phase of *sennetti* formerly existed there and has now died out. Evidence to be presented from other coastal localities north of Nueces Bay will give preponderance to the second inference. Moreover, we must recall in this connection that *fisheri* is now proved to be a permanent resident at all localities of record in Louisiana and Texas.

The Texas series of specimens is best described by working north and east up the coast, commenting on the characters possessed by specimens from each locality of record. Crossing Nueces Bay (1) and proceeding northward we come to the Rockport peninsula, bounding Copano Bay on the east.

2. Rockport. Two specimens—typical *sennetti*. (The patches of marsh are scarce and scant, and the majority have been destroyed by civilization in the past 25 years. The Seaside Sparrow is nearly extinct locally.)

3a. Seadrift, head of San Antonio Bay on the east side. Two specimens—minutely browner than typical *sennetti*.

3b. Tivoli, head of western arm of San Antonio Bay. Six specimens (A.M.N.H.), collected in *mid summer*, are of vital importance. Two are juveniles of no use systematically. But of the four adults, three are clearly normal (light phase) *fisheri*, and one is *sennetti* but

minutely browner than typical *sennetti*. All are obviously worn, breeding adults; it is impossible to claim that the specimens of *fisheri* were migrants. Both types of coloration were taken at the *same place* on the *same day*, hence we have here the same type of evidence as that furnished by George H. Lowery, Jr., for Louisiana, which proved the existence of two color phases in *fisheri*.

4. Palacios, middle of Matagorda Bay. One specimen—obviously browner than typical *sennetti*.

5. Matagorda, on the north arm of the Bay at the mouth of the Colorado River. A great series in Dr. Peet's collection (although the data on some are questionable) breaks up as follows:

- a. 14 are the normal dark phase of *fisheri*.
- b. 32 are the intermediate phase of *fisheri*.
- c. 12 are the normal pale phase of *fisheri*.
- d. 5 are the extreme pale phase of *fisheri*.
- e. 2 resemble *sennetti* but are obviously browner.

I hasten to add that I do not wish to be held to the exact numbers in the first four categories. On four occasions in the last year, after a good interval, I sorted the birds into these four categories, never reaching the same results twice. Actually the series is sufficiently large, so that one extreme passes into the other extreme by a perfect gradation.

6. Freeport, Brazoria County, at the mouth of the Brazos River. Three specimens—*fisheri* in the intermediate phase.

7. Seabrook, on the west side of Galveston Bay. Two specimens—*fisheri*, intermediate and pale phase respectively.

8. High Island, on the east side of Galveston Bay. A fine series (A.M.N.H., Dwight Collection) is *fisheri* in the light phase. These birds have always been called *fisheri*, and for many years this locality has marked the southernmost, or westernmost, limit of this subspecies.

The evidence submitted above can be summed up in the following generalizations:

1. Typical *sennetti* is unknown north of Rockport, Copano Bay.
2. An overwhelming majority of Seaside Sparrows from San Antonio Bay (Seadrift) northward are indistinguishable from *fisheri*.
3. The existence of a dark and light phase of *sennetti* is proved.
4. The light phase is apparently very rare northward of Rockport, Copano Bay; the dark phase is very rare or extinct southward.

5. Actually, "typical" *sennetti* of current textbooks and descriptions is an extreme development of the light phase.
6. The few birds of the *sennetti* type from San Antonio Bay (Seadrift) northward are surprisingly alike, being darker (*browner*) than typical *sennetti*. Actually, however, they are inseparable from certain extremes of toprotypical *sennetti* described above as Variation 1, and also inseparable from certain extremes of the light phase of *fisheri*, notably reference specimen La. State Univ. Mus. Zool. No. 6162 (see Griscom, 1944:319), thus establishing an interesting type of intergradation by individual variation.

The question now arises, how are these facts to be expressed systematically and taxonomically? An interesting letter received from Dr. Peet suggests that since the very great majority of specimens from the Texas coast south to Seadrift, San Antonio Bay, are indistinguishable from *fisheri*, they must be named *fisheri*. With this reasoning I heartily agree. Since the few specimens of the "*sennetti* type" from north of Seadrift are inseparable from extremes of *fisheri* from Louisiana, no violence is done in naming them *fisheri* also. I therefore formally propose that:

1. The range of *fisheri* be extended south to San Antonio Bay (Seadrift), Texas.
2. The range of *sennetti* be defined as "Restricted to Nueces and Copano Bays, coast of Texas."

The only taxonomic difficulty that arises is how to name the few dark birds in existence from Nueces Bay which are indistinguishable from *fisheri*. The problem can be finally settled only by competent field work in the breeding season at Nueces Bay. In the meantime, protagonists of the migration or storm waif theories, who would call dark birds from Nueces Bay *fisheri*, and light birds from farther north *sennetti*, can reflect on the fact that both types breed at Tivoli, the exact halfway spot.

It should be noted that Brownsville is dropped from the range of *sennetti*. I was originally responsible for this extension of range (1926. *Auk*, 43:24). It was based on four specimens collected in November 1909 by J. M. Priour at "Brownsville," purchased by Dr. L. B. Bishop from F. B. Armstrong. Actually, the original labels had been removed, Priour never collected at Brownsville, and Armstrong bought the balance of Priour's collection after his death. Armstrong is well known to have labeled "Brownsville" everything from Corpus Christi to Tamulipas, and both Priour and he made out series of tags ahead of time. Thirty years of field work and search have failed to discover a breeding colony of Seaside Sparrows south of Nueces Bay. If any form of

the species has ever occurred near the Mexican border, it must have been a straggler on migration. I am much obliged to Mr. A. J. Duval, of the Fish and Wildlife Service, and to Drs. Herbert Friedmann and Peet for assistance in tracing the history of these specimens.

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MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE 38, MASSACHUSETTS

## NOTES ON BIRDS OF THE GOMEZ FARIAS REGION OF TAMAULIPAS<sup>1</sup>

BY STEPHEN W. EATON AND ERNEST P. EDWARDS

ON June 20 and 21, and again from August 4 to 7 in 1946, we collected and made observations on birds in the Gomez Farias region of southwestern Tamaulipas, Mexico. The information in the following paper is presented as a supplement to the thorough report by George Miksch Sutton and Olin Sewall Pettingill, Jr. (1942),<sup>2</sup> which was based largely on the work in this area of the Cornell University-Carleton College Expedition from March 12 to May 4, 1941.

We recorded four species not listed in that report, *Columbigallina talpacoti*, *Sittasomus griseicapillus*, *Habia* sp. and *Basileuterus rufifrons*. In addition, we obtained further data on the extent of the breeding season and noted the presence of several migrants from the north (in the first week of August).

The State of Tamaulipas, bounded on the east by the Gulf of Mexico and on the north by Texas, includes part of the great mountain range known as the Sierra Madre Oriental, which runs through the southern and central portions of the State near the western border. Streams draining the eastern slopes of this mountain range in the vicinity of Gomez Farias join to form the Rio Guayalejo, which flows generally southward to the Rio Tamesi. Near the coast, the Tamesi forms part of the Tamaulipas-Veracruz border, emptying into the Gulf of Mexico at Tampico. It was close to the easternmost ridges of the Sierra Madre, along one of the tributaries of the Rio Guayalejo, that we camped in 1946. (See Map 1.)

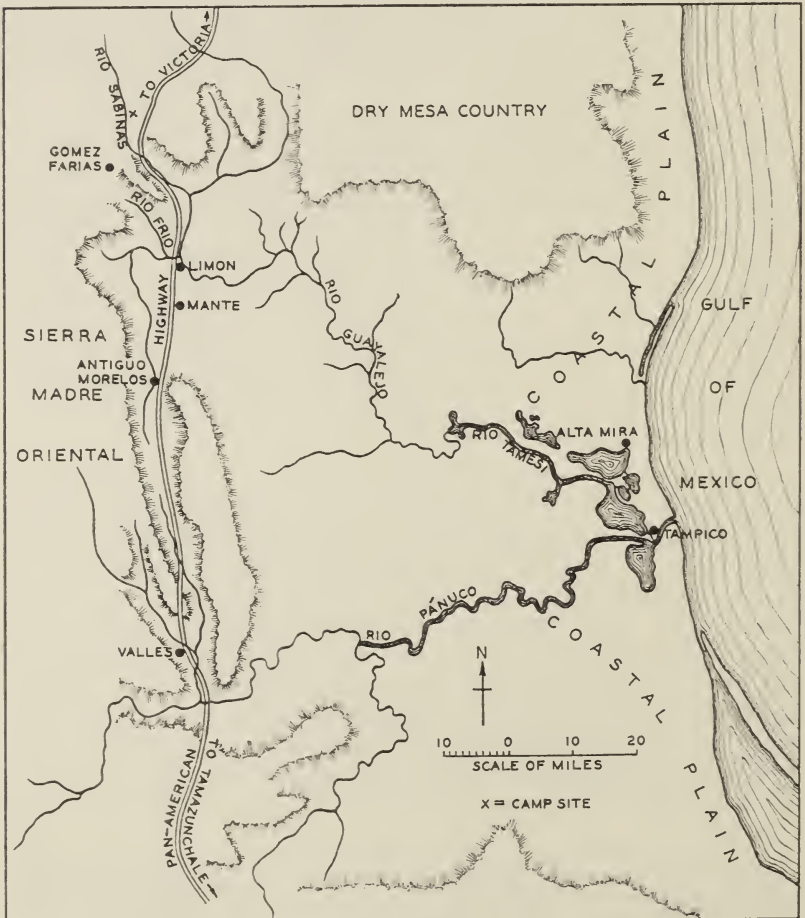
Our camp site, about 30 feet above the water on the east bank of the Rio Sabinas, was on the E. W. Storms ranch, called "Pano Ayuctle," the Aztec name for "pumpkin ford." Pano Ayuctle is about 88 kilometers south of Victoria, Tamaulipas, and three kilometers west of the Pan-American Highway opposite kilometer-mark 618 (north from Mexico, D.F.). Mesquite and wild pineapple thickets border much of the branch road to Pano Ayuctle. In the numerous small clearings near the river, corn and sugar cane are the principal crops. We frequently encountered plantings of mangoes and citrus trees, chiefly lime, lemon, and orange, in the vicinity of the dwellings, and at Pano Ayuctle these were supplemented by a few coffee trees and ornamentals, such as the royal palms lining the entrance road, flamboyants (*Delonix*), and

<sup>1</sup>To Dr. George M. Sutton, of the University of Michigan, we are grateful for numerous suggestions helpful in the preparation of this report. The specimens mentioned are now in his collection. Dr. Robert T. Clausen, of Cornell University, kindly helped with the identification of some of the plants. The U.S. National Museum and the U.S. Fish and Wildlife Service generously allowed access to their bird collections.

<sup>2</sup>"Birds of the Gomez Farias Region, Southwestern Tamaulipas," *Auk*, 59:1-34.

Spanish cedars (probably *Cedrela mexicana*). Along the river are many cypress trees, frequently with the epiphytic strangling fig wound about their trunks. Under these trees are thickets of dense tropical vegetation covering the few feet between the river and the edge of the cultivated area. At our camp site, the river was about 50 feet wide, and 8 feet deep at the deepest point, while upstream and downstream it was constricted and shallowed into riffles at frequent intervals.

On four occasions, one of us made a trip to the small range of hills west of the Rio Sabinas; this area will be referred to as "the mountain." To reach the mountain it was necessary to ford the river and walk west along trails which traversed the valley floor. Along these trails



Map 1.

were thick second growth tangles with, here and there, a few clearings planted in corn. Unbroken forests of tall trees covered the mountain, and beneath the trees were small patches of wild pineapple and bamboo. Large rocks littered the ground and often formed crevices which extended 20 or more feet straight down from ground level. It was in this mountain forest that many species of birds concentrated in flocks early in August to feed on the ripening fruits of the trees. Intensive field work along the eastern slopes of this range in August and September should yield important data on bird distribution.

A striking feature of the upper Rio Sabinas is a huge circular spring called in Spanish the *nacimiento*—literally, *birth* [of the river]. This spring is approximately 75 feet in diameter and furnishes most of the water for the river—at least to the Pan-American Highway crossing, approximately 25 kilometers downstream. The spring is bordered on the west by ledges of stratified rock, while on the northeast side a small drainage stream from the valley above empties into it. Seepage water trickles down over the rock ledges but adds no appreciable amount to the great flow of water rising from the depths of the pool. The stream flowing into the *nacimiento* contributes probably no more than a twentieth of the volume of the river except during the rainy season.

The reason for the occurrence of many peculiarly neotropical birds along the Rio Sabinas and adjacent foothills of the Sierra Madre Oriental (Gomez Farias region) is evident upon examination of the physiography of the region. (See Map 1.) The three factors which we think have a direct effect in making this region the northern limit of distribution for certain birds are:

a. The humid forest which is more or less continuous along the eastern slopes of the foothills of the Sierra Madre Oriental from Veracruz northward to a point approximately 50 miles south of Victoria, Tamaulipas. The humidity of this strip is maintained by the easterly winds coming off the Gulf of Mexico, rising on reaching the mountains, and precipitating rain along the eastern slopes. The cloud-banner mentioned by Sutton and Pettingill (1942)<sup>2</sup> is probably the result of these climatic conditions.

b. Large rivers, such as the Tamesi and Guayalejo, up which birds make their way from the coast.

c. The dry mesa country north and east of the Rio Sabinas, which extends from the Sierra Madre Oriental nearly to the Gulf of Mexico and acts as a barrier to further northward extension of such humid-forest birds as *Sittasomus griseicapillus* and *Cyclarhis gujanensis*.

It is interesting that in early August, while some northern migrants were already moving southward through the Gomez Farias region along the Sierra Madre Oriental, several of the local species of birds were still nesting or feeding young-on-the-wing.

## SPECIES NOT PREVIOUSLY RECORDED FROM THE REGION

*Columbigallina talpacoti*. Ruddy Ground Dove. On August 7 Eaton saw four of these birds on the mountain at about 1,000 feet elevation. They were flushed from the forest floor, where they had apparently been feeding on fruits which had ripened and dropped to the ground.

*Sittasomus griseicapillus sylvioides*. Mexican Sittasomus. On August 6, on the mountain at about 800 feet elevation, Eaton collected a male specimen with small testes. Two Canyon Wrens (*Catherpes mexicanus*) were moving about and singing when the little Sittasomus flew to a nearby tree. It acted much like a Brown Creeper (*Certhia familiaris*), creeping up one tree and then flying to the bottom of another and starting up again. It made no sound of any sort. On collecting it, we noted that the iris was dark brown and the tarsi gray. The molt was apparently complete except that the three outermost primaries were still more or less sheathed at the base. The outermost primary of the right wing was missing. That of the left wing measured 20 mm.; the next, about 37 mm.; the third (from the outside), 61 mm. In a comparable non-molting specimen the same feathers measure, respectively, 46, 60, and 66 mm.

On August 7, Eaton saw another Sittasomus farther up the mountain—at about 1,000 feet.

Our Gomez Farias specimen is larger (wing 83, tail 83 mm.) than the specimens of *sylvioides* from Veracruz in the United States National Museum and is slightly duller on the rump and upper tail coverts. However, considering the extreme freshness of the plumage (which affords maximum wing and tail measurements), we place the bird with this race for the present. So far as we have been able to ascertain, the species has never before been recorded from Tamaulipas.

*Basileuterus rufifrons*. Rufous-capped Warbler. Eaton saw one of this species August 6 at the foot of the mountain at the edge of a clearing.

*Habia* sp. Ant tanager. Eaton saw four or five ant tanagers on the mountain in dense bamboo thickets under tall forest trees on August 7. The birds were travelling in a noisy little group and were quite difficult to approach.

## NOTES ON NIDIFICATION

*Columba flavirostris*. Red-billed Pigeon. On March 18, 1941, Lea (Sutton and Pettingill, 1942)<sup>2</sup> noted a Red-billed Pigeon with a twig in its bill. On June 20, we saw one carrying nesting material into a monkey's-ear tree (*Pithecolobium*).



*Scardafella inca*. Inca Dove. Pettingill (Sutton and Pettingill, 1942) <sup>2</sup> found a nest of this species with two heavily incubated eggs on March 30, 1941. In 1946, we learned from a local ranch owner that a pair of Inca Doves had just successfully raised young in a tree in his yard during the latter half of June. On August 5, Eaton flushed an Inca Dove that was incubating two eggs. These facts indicate that the species nests through at least six months of the year in this region.

*Crotophaga sulcirostris*. Groove-billed Ani. On June 20, Edwards saw an adult make several trips with food to a small tree near our camp and presumed it was feeding young. On August 7 we noticed almost full-grown young Anis moving about in little groups.

*Tyrannus melancholicus*. Olive-backed Kingbird. Edwards saw this species feeding nearly full-grown young on August 6 near the foot of the mountain.

*Myiozetetes similis*. Social Flycatcher. On June 20 Edwards discovered a nest in a small clump of Spanish moss (*Tillandsia* sp.) which hung from a vine attached to a tree branch high above the river. Its owner was apparently feeding young.

*Parula pitiayumi*. Pitiayumi Warbler. On August 5, Edwards saw an adult feeding a young bird just out of the nest.

*Tanagra lauta*. Bonaparte's Euphonia. In the afternoon of June 20, Eaton saw a young bird hunting food near an adult female. When the adult caught an insect, the young stopped its ineffectual bug hunt and begged—chipping, and vibrating its wings. The young was like the female but with lighter yellow on the breast and lighter olive on the back. On August 7, Edwards saw a male and female building a nest near the river in a small mass of Spanish moss at the end of a pendant branch. They made several trips to the nest carrying small pieces of what appeared to be thin bark, entering the clump of moss through a poorly defined opening in the side.

#### FALL MIGRANTS

*Actitis macularia*. Spotted Sandpiper. On August 5, Edwards saw this species at the *nacimiento*. Later in the day, at two points along the river between the *nacimiento* and Pano Ayuctle, we saw the species again (single individuals).

*Mniotilta varia*. Black and White Warbler. On August 7, Eaton saw one of these warblers in the forest on the mountain, at about 900 feet elevation.

*Seiurus motacilla*. Louisiana Water-Thrush. On August 5, we saw single birds at three localities along the Rio Sabinas between the *nacimiento* and Pano Ayuctle. We heard one give a whisper-like song.

*Icterus spurius*. Orchard Oriole. On August 6, Edwards saw an adult male, which we presume was a migrant, in a large tree near the edge of a cornfield west of the Rio Sabinas near Pano Ayuctle.

#### MISCELLANEOUS NOTES

*Ictinia plumbea*. Plumbeous Kite. We saw single Kites on June 20 and 21, and on August 5 saw two perched in the top of a large cypress tree two miles upstream from Pano Ayuctle. One of these was immature with a streaked breast and short tail; the other was adult.

*Claravis pretiosa*. Blue Ground Dove. We saw this dove for the first time on August 5 about a mile from Pano Ayuctle. August 6 and 7, Eaton saw three on the flat land near the base of the mountain. Sutton and Pettingill (1942)<sup>2</sup> included the species in their list on the basis of one sight record.

*Cyclarhis gujanensis flaviventris*. Mexican Pepper Shrike. On August 7, Eaton shot a molting female on the mountain at about 800 feet elevation. When first seen, it was hanging almost upside down on a swaying branch. Its actions reminded Eaton of the behavior of a parrot. Pettingill (Sutton and Pettingill, 1942)<sup>2</sup> took the only specimen heretofore recorded in Tamaulipas.

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GENERAL NOTES

**The American Bittern in Puerto Rico.**—On November 14, 1947, a female specimen of the American Bittern (*Botaurus lentiginosus*) was brought to me by Mr. Luis Santos, who had killed the bird near a small ciénaga northwest of the town of Añasco, Puerto Rico, densely covered with *Typha* associations and other thick clumps of plants typical of swampy areas. According to Mr. Santos, the bittern was feeding on the mudflats south of the swamp. The specimen (No. 918) is on deposit at the Institute of Tropical Agriculture, Mayaguez, Puerto Rico.

As far as I am aware, this constitutes the only recent record of the occurrence of the American Bittern in Puerto Rico. The last record known was that of Danforth (1925, "Birds of the Cartagena Lagoon," *Jour. Dept. Agric. Porto Rico*, 10:46), who flushed one bird in Cartagena Lagoon on the southwestern corner of the island, on November 30, 1923.

Bond (1945, "Check-list of Birds of the West Indies," p. 10) records the species as wintering southward to Panama, and: "Not uncommon winter resident in Cuba. Also recorded from Puerto Rico, Grand Cayman, Swan Island and from the Bahamas (New Providence). Should also be found in Hispaniola and Jamaica, though records of its occurrence on these islands are unsatisfactory."

Wetmore (1927, "The Birds of Porto Rico and the Virgin Islands," *N.Y. Acad. Sci., Sci. Surv. of Porto Rico and the Virgin Islands*, 9:303) states that the American Bittern is a migrant straggler in Puerto Rico and cites three definite records (1873, 1921, and "a skin in the collection of Blanco"), as well as the 1923 record of Danforth.—VENTURA BARNES, JR., *Division of Fisheries and Wildlife, Department of Agriculture and Commerce, Mayaguez, Puerto Rico.*

**Anting by some Costa Rican birds.**—Within recent years, the curious phenomenon of "anting" has received considerable attention from ornithologists, and numerous observations have been published, especially in the *Wilson Bulletin* and the *Auk*. In view of this widespread interest, it seems desirable to put on record a few instances of anting that have come to my attention in Costa Rica during the last dozen years. My first observation was made at a time when most of us had never heard about anting, and I shall give it as I recorded it in my journal on October 28, 1936: "Today at noon the pair of Buff-throated Saltators, *Saltator maximus* [a big, thick-billed, olive-green member of the finch family], that frequently come into my yard, flew into the lemon tree in front of the cabin, and one of them behaved most unusually. It perched on a slender ascending branch supporting a grayish nest inhabited by fat brown ants of medium size and began to pick off the ants with its bill. It held its right wing extended in such a fashion that the primary feathers shielded the side of its breast and belly, and every time that it picked up an ant, it rubbed its bill rapidly against these feathers. Then it seemed to eat the ant, but of this I could not make sure, for the creatures were too small for me to distinguish them in the bill. Once it climbed up very close to the nest to pick the ants from its surface, and here a leaf interfered with its reaching its wing, which was held forward as before. As a result, the bird rubbed its bill against the leaf instead of against its flight feathers. Was this rubbing against wing or leaf for the purpose of killing the ant?"

My next observation was made more than nine years later, and the actor in this instance was a little, sharp-billed flycatcher, *Pipromorpha oleaginea*. On November 7, 1945, while walking along the creek in front of my house, I found a lone male (I could tell the sex by the yellow corners of the mouth) in a little tree growing on the bank. He plucked a small, dark object from the foliage; then holding it in the tip of his bill, he rubbed it along the inner surface of the remiges. As he did this, his wing was slightly opened and his tail bent forward

under the perch. The object in his bill then disappeared, but he found another, and rubbed it beneath his wing. He did this several times over. I could not actually distinguish what the bird held in his bill, but after he flew off I found in the tree a small silken ants' nest; a number of the blackish ants were crawling over the boughs and foliage. Without much doubt the flycatcher had been anting.

Early in the morning of April 8, 1947, I met a lone Barred Woodhewer (*Dendrocolaptes certhia*) just within the edge of the tall second-growth woods beside a pasture. It picked from the bark of a tree a big, dark-colored insect (which might have been an ant), held it in the tips of the mandibles, rubbed it beneath a wing, then swallowed it. Next it clung to the side of a large silken ants' nest that it found near by, apparently plucked off an ant, and extending its wing forward, rubbed the ant beneath the partially spread primaries. Again it clung to the ants' nest and again passed its bill beneath a wing. It did this several times more. While passing its bill beneath its wing it perched or rather clung to slender branches or vines near the ants' nest, in a posture I had never before seen a woodhewer take, but somewhat in the manner of a perching bird. That this was not a natural or secure position for the big tree-climbing bird was attested by the fact that several times it lost its balance and seemed on the point of falling off. Except in the first instance, I could not see whether it swallowed the ants which, apparently, it rubbed beneath its wings.

My fourth and last example concerns the tiny Variable Seedeater (*Sporophila aurita*). It is less convincing than my other three instances of anting, because I could find no ants in the bush where I saw the bird perform; but her actions were certainly those of a bird anting, and no other explanation of her odd conduct occurs to me. Early on the morning of May 27, 1947, a female Seedeater flew into the cestrum bush in front of the house. She searched diligently over the slender branches until she seemed to find some tiny object. Then, standing high and bringing her wings forward, she rubbed her bill (and doubtless what she held in it) beneath her remiges. She did this repeatedly, each time after picking from a branch some small object which she had difficulty in finding. Once she rubbed her bill beneath a wing while clinging upside down to a twig. When she flew off I looked for ants in the bush but saw none—strangely enough, for ants are usually on everything in this region. The bird herself needed to hunt hard for them—if this is indeed what she sought—and must have used practically all of the available supply.

In the north temperate zone, birds have nearly always been observed anting on the ground, but here in the tropics I have seen birds anting only in trees and bushes. I believe that in Central America far more species of ants live in trees, either in nests of their own construction or in cavities and crannies of various sorts, than in the ground. The only terrestrial ant-hills at all abundant in this region are those of the leaf-cutting or parasol ants (*Atta*) and of the fire-ants (*Solenopsis*). The stingless attas are hard, spiny morsels which would hardly seem to lend themselves to anting, and the birds seem to leave the well-named fire-ants strictly alone. The first three birds that I saw anting performed close beside the silken nests that are woven about the foliage of trees and bushes by *Camponotus senex textor* (specimens identified by Dr. M. R. Smith of the U. S. Bureau of Entomology). This is a blackish, stingless ant of medium size that is exceedingly abundant in the clearings and in the light vegetation in El General, although not found in the big forest unless it be high up in the sun-bathed tops of the trees where it might escape detection. The adult ants themselves are no more capable of secreting silken thread than adult butterflies and moths, but their larvae do; holding the white grubs in their mandibles and moving them back and forth, the workers cause the larvae to spin thread where it is needed for building or repairing the grayish irregularly formed nest.—ALEXANDER F. SKUTCH, *San Isidro del General, Costa Rica*.

**The Wood Duck in New Mexico.**—On October 19, 1947, Hugh B. Woodward, H. H. Drum, and Walter Bellman brought in a bag of ducks taken on a marsh one mile south of Bernardo, Socorro County, New Mexico. In this bag were two Wood Ducks (*Aix sponsa*), a male and a female, both immature and both molting heavily. I saved these as specimens; the female is now in the collection of the University of Michigan Museum of Zoology, the male in Dr. Max M. Peet's collection (also housed in the Museum). So far as I can learn, no New Mexican specimen has previously been preserved, nor have any sight records been published since 1928.

W. W. Cooke (in F. M. Bailey's "Birds of New Mexico," 1928, p. 131) quotes Thomas C. Henry on the status of the Wood Duck in New Mexico: "but two or three were ever met with, and only on the Rio Mimbres." (Henry was stationed at Fort Webster, east of Silver City, on the Rio Mimbres from December 1852 to early 1854.) Cooke also notes one sight record made by William H. Emory near Las Palomas (south of Hot Springs) on October 12, 1846.

Recent observations of the Wood Duck in New Mexico are as follows: John C. Knox, of the U. S. Fish and Wildlife Service, examined a Wood Duck taken by a hunter at San Marcial, Socorro County, during the open duck season in 1944. During the open season in 1945, Knox examined a second Wood Duck killed by a hunter at San Marcial and also saw one in flight at the same location. In 1946 Knox observed one adult male Wood Duck on a pond in Tingley Park, Albuquerque, Bernalillo County. Thomas G. Cornish killed a male Wood Duck in December 1946 on the Rio Grande 10 miles north of Albuquerque, and on December 22, 1947, he saw another one at the same location. On January 7, 1948, Roger Tory Peterson and I observed two male Wood Ducks in prime plumage on a pond in Tingley Park, Albuquerque. They were tame enough for close observation though they did not join other ducks and geese in taking food thrown to them. I observed a male Wood Duck on the same pond on February 25, 1948.

Charles T. Vorhies (1947. *Condor*, 49:245) has outlined a remarkably similar story of the Wood Duck in Arizona.—A. E. BORELL, *Soil Conservation Service, Albuquerque, New Mexico.*

**Unusual consumption of fish by three species of birds.**—On September 2, 1947, I noted a large concentration of birds of several species on the Souris River below the spillway downstream from Lake Darling, an artificial lake on the Upper Souris National Wildlife Refuge in North Dakota. The birds appeared to be feeding almost exclusively—if not entirely—upon small fish. This was particularly noticeable in the tailrace below the spillway, where the water was black with a tremendous concentration of fingerlings. The tailrace was about 15 feet by 25 feet in surface area, deep, and without shallow margins, so that all birds feeding there were swimming. Two Greater Yellow-legs (*Totanus melanoleucus*), three Blue-winged Teal (*Anas discors*), and two Franklin's Gulls (*Larus pipixcan*) were noted swimming in the water and feeding voraciously upon the fingerlings, which averaged perhaps scarcely more than an inch in length. The fish seemed to be invariably swallowed head first, and consisted mainly of small chubs, shiners, and sticklebacks.

While yellow-legs not infrequently consume small fish in shallow water as a part of a meal, they are rarely found swimming, and only occasionally do they consume fish in large numbers. They frequent shallow margins and marshes, and it is rare for them to forage for food in deep water. It is also extremely rare for teal, or any species of river duck, to consume fish in appreciable quantity. They are primarily vegetable feeders and are most at home in shallow waters and mud flats. On this occasion, because of the great concentration of these small fish

and the relative ease with which they could be obtained, various species of birds were feeding primarily upon them.

The occurrence is a clear illustration of the fact, often not fully realized, that availability is an exceedingly important factor in determining food consumption and that the normal food habits of birds or other animals are often completely changed by an unusual availability of a particular item that is otherwise rare in their diet.—CLARENCE COTTAM, *Fish and Wildlife Service, Washington, D.C.*

**Food of the Old-squaw in Lake Michigan.**—For many years commercial fishermen of the Great Lakes have periodically encountered large numbers of Old-squaws (*Clangula hyemalis*) in nets set in from 8 to more than 30 fathoms of water. The heaviest take of these deep-swimming ducks is reported to occur in nets set in from 8 to 16 fathoms. Reports on depths and numbers of birds have been recorded in detail by Schorger (1947. *Wils. Bull.*, 59:151-159). The question has often been raised whether the Old-squaws were seeking fish or pursuing their more usual food: insect larvae, small crustaceans, and mollusks.

On March 16, 1938, Durward L. Allen obtained data and stomachs of 36 Old-squaws from commercial fishermen at Saugatuck, Allegan County, Michigan. The series (21 females, 13 males, and 2 undetermined) included adults and immatures of both sexes.

The stomach contents of these 36 specimens were almost entirely composed of a small bivalve, *Pisidium* sp. (a total of 1,550 individuals, an average of 44 per duck), and a deep-water crustacean, *Pontoporeia hoyi* (a total of 1,295 individuals, an average of 36 per duck). A small number of another bivalve (*Sphaerium*), a few crayfish (*Cambarus*), snails (*Amnicola limosa* and *Gyraulus parva*), insect larvae (*Chironomus*, Orthocladinae, *Prodiamesa*, *Spaniotoma*), and a small amount of vegetable matter had also been eaten. The only persisting parts of the crayfish were gastroliths, and it is possible that these, as well as the vegetable matter, were remains from food taken before diving into deep water.

The bathymetric distribution of the two principal food organisms, *Pisidium* and *Pontoporeia*, has been reported by Eggleton (1937. *Mich. Acad. Sci. Arts and Letters*, 22:593-611) for Lake Michigan. In the years studied, both these animals reached their greatest abundance in depths less than 60 meters (33 fathoms).

We thank J. W. Leonard for identifying the insects and F. E. Eggleton for verifying our determinations of the other invertebrates.—KARL F. LAGLER and CATHERINE C. WIENERT, *Department of Zoology, University of Michigan, Ann Arbor*, and *The Institute for Fisheries Research, Michigan Department of Conservation*.

**A nest of the Spruce Grouse in east-central Saskatchewan.**—On June 6, 1947, on our way from Nipawin, east-central Saskatchewan, to Fishing Lake, 75 miles northward, Walter A. Tholen and I stopped at the fire tower about four miles from the Fishing Lake cabin. Mr. Wicker in charge showed us a nest of the Spruce Grouse (*Canachites canadensis*) that he had found two days earlier. It was located at the base of a small broken white spruce about four inches thick, and there was a broken branch hanging over it. Dense sedges and grasses, nearly all of them dead, surrounded the site, and there were a few scattered branches of Labrador tea in the vicinity. The nest was 21 cm. in internal diameter and cupped to a depth of 4 cm. It was made of dead sedges, with a few feathers and finer sedges for the lining. (Plates 3 and 4.)

The nest contained seven eggs, spotted, over a rather uniform light buff background, with dark brown. The eggs averaged 42.3 mm. (extremes: 40.9-43.0) × 31.9 mm. (extremes: 31.2-32.5); and 20.5 grams (extremes: 19.8-22.0).

On June 6, when Mr. Wicker showed us the nest in the late afternoon, the female was incubating. On June 7 she was on the nest at 10 a.m., allowed me to approach within six feet, and I photographed her. The male was sitting in a



*Spruce Grouse nest and eggs. Near Fishing Lake, east-central Saskatchewan,  
June 7, 1947.*



*Female Spruce Grouse, incubating. Near Fishing Lake, east-central Saskatchewan, June 7, 1947.*



spruce tree only a short distance away. He allowed me to approach within 50 feet, then flew. I did not see him again. On June 7 I found the female on the nest at 10:00 a.m. and at 3:30 p.m.; at 5:17 p.m. she was still on the nest, and I watched her from then until dark. It was a cold cloudy day with a moderate northeast wind. At 8:43 p.m., in the dusk, the female suddenly flew directly from the nest, disappearing into a thick spruce-tamarack swamp. At 9:06 p.m. she again landed on the little spruce stump above the nest and dropped onto the eggs after looking carefully about her. It was nearly dark then because of the heavy clouds but was not entirely dark until 10:30 p.m. On June 9 I was back at the nest at 4:00 a.m., shortly after daybreak; the female had probably left and returned earlier, for she remained on the nest during the next eight hours. During two visits in the afternoon on the same day and two mid day visits on the following day (June 10), she was on the eggs. Thus during 12 hours' observation, she incubated for 11 hours and 37 minutes and fed 23 minutes on June 8 and 9, the 23 minutes being just before dark. She always sat on the nest facing out from the stump.

Female Spruce Grouse were observed along the roadway near our cabin on June 8 at 2 p.m. and June 9 at 1:30 p.m. They were dusting in some sand in the roadway.

Other birds in close proximity to the nest were Greater Yellow-legs (*Totanus melanoleucus*), Richardson's Owl (*Aegolius funereus*), Nighthawk (*Chordeiles minor*), Canada Jay (*Perisoreus canadensis*), Ruby-crowned Kinglet (*Regulus calendula*), and Myrtle Warbler (*Dendroica coronata*). On June 9 the Canada Jays landed only two feet in front of the Spruce Grouse on her nest, but she did not move; they hopped about her for several minutes. Red squirrels ran about her on numerous occasions, and two snowshoe hares scampered up and down the roadway at times, but she showed no sign of disturbance.—LAWRENCE H. WALKINSHAW, 1703 Central National Tower, Battle Creek, Michigan.

A female Bob-white in male plumage.—On June 3, 1944, F. W. Buchanan collected a Bob-white, *Colinus virginianus*, in the valley of Elkhorn Creek, Lee Township, Carroll County, eastern Ohio. In all outward appearances, the bird was a typical male, but upon dissection, the specimen proved to have a somewhat enlarged and apparently functional ovary. The carcass was unfortunately not preserved; the skin (C.U.21567) has been deposited in the Louis Agassiz Fuerter Memorial Collection at Cornell University.

Mr. Herbert L. Stoddard informs us (*in litt.*) that in all of his experience with the Bob-white he has never collected an individual exhibiting such a condition, although on two or three occasions he has seen Bob-whites in the field whose behavior seemed to indicate a reversal of sex characters.

Two similar cases in wild birds of other species have come to our attention: one in the Spurred Towhee, *Pipilo maculatus montanus*, reported by Bergtold (1916. *Auk*, 33:439), and one in the Bay-breasted Warbler, *Dendroica castanea*, reported by Stoddard (1921. *Auk*, 38:117). In both cases, the birds, although wearing male plumage, possessed apparently normal, undiseased ovaries, with ova in various stages of development.

The plumage-determining mechanisms have been studied most thoroughly, as would be expected, in the domestic fowl. Whereas the results may not be applicable to birds in general, they are probably valid for a galliform species such as the Bob-white. Professor F. B. Hutt, of the Department of Poultry Husbandry, Cornell University, kindly directed our attention to the pertinent literature.

It is now well established that the secondary sexual characters, including plumage characters, of female birds are determined by a hormonal secretion of the ovary, which acts as an inhibitor to male secondary sexual characters. In

its absence, male secondary characters appear. There are innumerable cases on record of female-plumaged birds that have assumed male plumage and, upon dissection, have proved to have abnormal or diseased ovaries. In the extreme manifestation of this condition a female may actually become a functional male (Crew, 1923. *Proc. Royal Soc. London*, 95B:256-278).

It is somewhat more difficult, however, to explain the cases in which a male-plumaged bird acts and functions as a *normal* female. The best explanation seems to be that of Crew (1927. *Proc. Royal Soc. London*, 101B:514-518). According to Crew's theory, the ovaries of the birds in question undergo occasional periods of physiological inactivity, and the production of hormones is much reduced. If such a quiescent period coincides with the period of molt, the new feathers will be of the male type, since the inhibitory influence of the ovarian hormone is absent. After the pattern of the feathers has already been determined, the ovary resumes its normal activity in time to display the ordinary manifestations of the breeding season. Evidence for this theory of irregular production of ovarian hormones was provided by a Rhode Island Red fowl studied by Crew, which molted irregularly into male and female plumages in the following annual succession: male, female, male, male, female. In each plumage, the bird was a good and consistent layer.

In almost all large collections of bird skins there are specimens which, on plumage evidence, have been considered by workers examining them to be incorrectly sexed. It is possible that some of these were specimens like the Bob-white described above. The possibility serves to emphasize the importance of a description on specimen-labels of the condition of the gonads rather than a mere notation of the sex.—FOREST W. BUCHANAN, *Amsterdam, Ohio*, and KENNETH C. PARKES, *Laboratory of Ornithology, Cornell University, Ithaca, New York*.

**The eyesight of the Bluebird.**—At "The Frith," near Butler, Pennsylvania, we have a pair of 4,000 volt power-distribution wires, crossing several hundred yards of the laboratory grounds, 30 feet up in the air. The herbage below is grass, briars, and low bushes not more than about two feet high.

Bluebirds (*Sialia sialis*) sit on these wires, their heads bent down, apparently intent on the ground below. Suddenly one of them will dive down, sometimes to a point perhaps 10 yards to one side of the point directly under the wire, instantly capturing a caterpillar, which he immediately takes, not to the wire itself, but to the power pole or cross arm supporting the wire, a more convenient perch for battering the grub into pulp. If, after sitting on the wire and watching for a time, he does not dive, he moves 10 or 20 yards along the wire, and sits and watches again. I can see no explanation except that he actually sees the caterpillar, up to 40 or 50 feet away, and deliberately uses the vantage point of the wire to study the area below quite minutely.

One caterpillar, we could see through the binoculars, was a large cecropia or allied form, but others were much smaller.

Hawks, we know, can see mice and other small objects from a much greater height, but we have supposed it was movement on the part of mice that betrayed them. Caterpillars of the cecropia type are very quiescent creatures, remaining motionless for long periods while they digest their food, then moving up the stem of the plant an inch or two to a convenient leaf, mowing it quietly into their mouths, then backing down to the stem and relapsing into a motionless condition. Most other caterpillars are comparably quiet. Yet the Bluebird spots them, even with a brisk breeze blowing so that all the vegetation of the countryside is in motion.

Most passerine birds seem to hunt their food in a myopic way, like the titmice and warblers and vireos, by diligent searching at close quarters. Old

World flycatchers and the American tyrant flycatchers, like these Bluebirds, watch from a vantage point, but it is one thing to see a lively, flying insect in mid-air, and quite another to see a lethargic, camouflaged caterpillar in the brush.—F. W. PRESTON and J. M. McCORMICK, *Preston Laboratories, Box 149, Butler, Pennsylvania.*

Home range and duration of family ties in the Tufted Titmouse.—The Tufted Titmouse, *Parus bicolor*, formerly considered rare in Michigan (Barrows, 1912. "Michigan Bird Life," pp. 692-694), now occurs in moderate numbers throughout the southern part of the State; yet we have little more information on the species than was available in the days when it was rare.

From December 1940 to the end of 1947 (85 months), I maintained a banding station at my home in Ann Arbor, a location favorable to birds, and I did some trapping and banding in every month—usually every week. In that period I banded 26 adult and 3 young Tufted Titmice. With the exception of one, banded March 11, the 26 adults were first taken between October 25 and February 23. Half of the adults (13) were never taken (or even identified) again—even though 17 of the 26 had been color-marked before being released; 11 were retaken or seen repeatedly between late spring and early fall (on 141 occasions in all). There is but one other bander (who traps only occasionally) and few observers in the region I studied; yet 5 of my color-marked Titmice were repeatedly trapped or reliably recorded by others within a .6-mile radius from my banding station. I found two nests of banded birds—.25 and .3 miles from the station. These data seem to indicate that there is no real migration of this species in Michigan (such as several writers have postulated) but that there are two classes of birds: *A*, those that remain in restricted home ranges throughout the year (hence repeatedly recorded in a small radius); *B*, those that wander (hence not recorded after banding). It seems reasonable to suppose that the former are fully adult birds; the latter, birds in their first winter wandering widely before finally settling on a home range.

Adults commonly came to the feeding station in twos, and in several cases I found banded and color-marked pairs remaining together for considerable periods. Such cases are: Pair 1, January 1942 through March, May 1942 through August, October 1942 through January 1943; Pair 2, December 1944 through May 1945; Pair 3, January 1941 through April. During these periods the pairs were seen together frequently, sometimes daily. Gillespie (1930. *Bird-Banding*, 1:113-127) has already presented some evidence for permanent mating of this species.

In the six-year study made in California by John B. Price (1936. *Condor*, 38:23-28) of 64 banded adults and 145 banded juveniles of the nearly related Plain Titmouse, *Parus inornatus*, 45 per cent of the adults (banded after being captured on the nest) were recaptured in subsequent years within 100 yards of the original nest site whereas only 1.3 per cent of the juveniles were recaptured. Most mates remained together for at least two or three years.

A more remarkable characteristic of the Tufted Titmouse was the continued association of the young with their parents. Adults often brought their young to my feeding station, in one case on the day of fledging (July 8)—from a nest a third of a mile away. One or more young sometimes continued to come with the adult pair for many weeks. In one case, two marked young, first brought by the adults (Pair 1, above) to the feeding shelf on June 22 (1942), continued to accompany the parents until November 8; after that date, only one young came with the adults, but it continued to appear with them until January 10 (1943).

The greatest age recorded for any of these Titmice I have banded is five years—for a bird (No. 138-104183) banded December 7, 1941, when it was at least six months old, and last seen four and a half years later (May 26, 1946). Two others were at least two and a half years old when last seen.—JOSSELYN VAN TYNE, *University of Michigan Museum of Zoology, Ann Arbor.*

**A Western Lark Sparrow from Florida.**—While examining a series of Lark Sparrows (*Chondestes grammacus*) in the Louis Agassiz Fuertes Memorial Bird Collection at Cornell University, I came upon a specimen taken by Fuertes at Flamingo, Monroe County, Florida, on April 5, 1908. After comparing it with large series of both the western (*C. g. strigatus*) and the eastern (*C. g. grammacus*) subspecies at Cornell and at the University of Michigan Museum of Zoology, I have identified it as *strigatus*. McAtee, Burleigh, Lowery, and Stoddard (1944. *Wils. Bull.*, 56:152–160) have pointed out the tendency of many western birds to migrate in an easterly or southeasterly direction. They list (Table 1, p. 156) the Western Lark Sparrow from Louisiana and Mississippi, but I have been unable to find this subspecies recorded from Florida.—ROBERT M. MENGEL, *University of Michigan, Ann Arbor*.

**Golden Eagles in Hidalgo, Mexico.**—About mid morning on July 10, 1942, we saw one immature and two adult Golden Eagles (*Aquila chrysaetos*) 10 miles north of Zimapan, Hidalgo. They sailed on set wings down the steep slopes of a mountain, crossed the Pan-American Highway a short distance ahead of our car, and continued over the valley until lost to sight. Although the Golden Eagle has been recorded from several localities in central Mexico, we have found no records from as far south as Hidalgo.—ROBERT M. MENGEL, *University of Michigan, Ann Arbor*, and DWAIN W. WARNER, *Minnesota Museum of Natural History, University of Minnesota, Minneapolis*.

## EDITORIAL

The Thirtieth Annual Meeting of the Wilson Ornithological Club will be held jointly with the Ninth Annual Meeting of the Wisconsin Society for Ornithology in Madison, Wisconsin, April 21 to 24, 1949. Previous meetings have been held in the fall, but, following numerous requests from Members, the Council decided by mail ballot to hold the meeting in the spring. Technical sessions, demonstration sessions, popular sessions, and field trips are being planned by the combined Local Committees on Arrangements.

## OBITUARY

ALDO LEOPOLD, forester, ornithologist, and conservationist, died April 21, 1948, near Fairfield, Wisconsin. He was born at Burlington, Iowa, January 11, 1887. After graduating from Yale he served in the Forest Service until 1924, when he was appointed Associate Director of the Forest Products Laboratory at Madison, Wisconsin. In 1933, he became Professor of Wildlife Management in the University of Wisconsin. He wrote extensively on game birds and mammals and was the author of the first book on "Game Management."

LEON J. COLE, geneticist and ornithologist, died February 17, 1948, at Madison, Wisconsin, aged seventy. Born at Allegany, New York, he attended Michigan State College and the University of Michigan and earned the Ph.D. in zoology at Harvard. He had carried on field work in Alaska, Bermuda, Yucatan, Tortugas, and Europe. Ornithologists will always remember that it was he who (in 1901) first publicly proposed in America that birds should be banded and, during the following ten years, led the movement for organized bird banding.

## ORNITHOLOGICAL NEWS

Herbert Deignan, of the National Museum, is in Australia as ornithologist with a joint expedition under the auspices of the National Geographic Society and the Australian Government. Plans for the expedition included a survey of Arnhemland, northern Australia.

Seth H. Low has been transferred from his position as Manager of the Salt Plains National Wildlife Refuge to take charge of the bird-banding program of the Division of Wildlife Research, U. S. Fish and Wildlife Service.

Emerson Stringham (P.O. Box 986, Kerrville, Texas) is preparing a monograph on Alexander Wilson and is interested in procuring all books and papers by or about Wilson. He will be glad to hear from Members who wish to dispose of such books or papers or who know where they may be procured.

Frederick V. Hebard (1500 Walnut Street Building, Philadelphia 2, Pennsylvania) is making a study of "injury feigning" in all species of North American birds. He would like to receive detailed reports from Members on their own observations of such displays.

## THE LOUIS AGASSIZ FUERTES RESEARCH GRANT FOR 1948

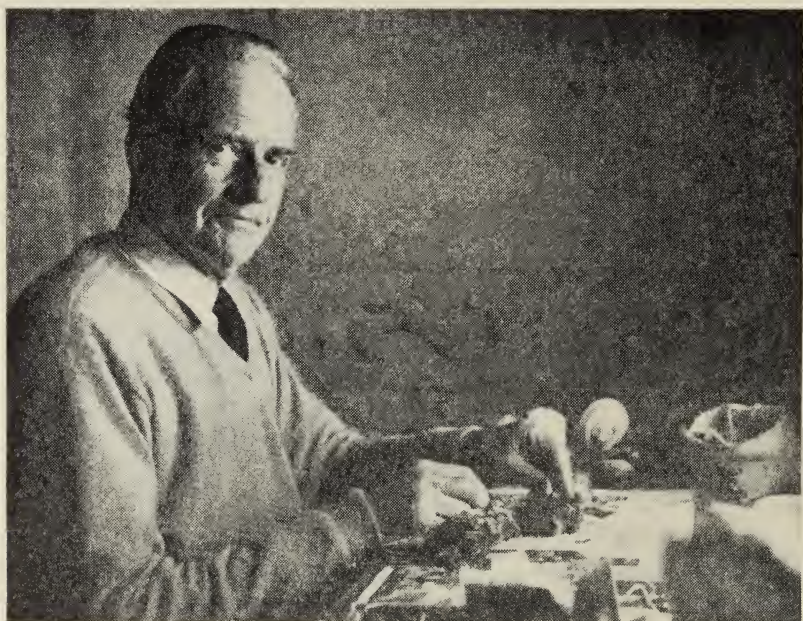
The Louis Agassiz Fuertes Research Fund was established to encourage ornithological research. The grant is designed to help students and amateur ornithologists in defraying the expenses of their research programs, particularly such items as travel, materials, and equipment.

One hundred dollars is given each year to the applicant selected by the Research Committee of the Wilson Ornithological Club 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 and all members of its Affiliated Societies are eligible for the grant.

Applications should be sent before October 1 to Dr. John T. Emlen, Jr., Chairman of the Research Committee (Zoological Department, University of Wisconsin, Madison 6, Wisconsin). Dr. Emlen will supply application forms on request, or the applicant may supply the following information in a letter: Name, address, and age; ornithological training and experience (but note that no formal training is required as a basis for eligibility); subject of investigation (title, objectives, 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.

### NEW LIFE MEMBER



WILLIAM H. PHELPS, the leader in Venezuelan ornithology and Research Associate on the staff of the American Museum of Natural History, was born in New York City in 1875. While at Harvard he was active in the Nuttall Ornithological Club and spent the summer of his junior year in Venezuela collecting birds. The results of this expedition, written in collaboration with Frank M. Chapman, were published in the *Auk* in 1897. After graduation Mr. Phelps established himself in business in Venezuela. Forty years later, in 1937, he retired from business, built a museum in the garden of his house in Caracas, and devoted himself to the study of Venezuelan birds. The Museum has a staff of four: a Curator, his assistant, and two collectors. William H. Phelps, Jr., works with his father on the collection and for several years has led the more difficult expeditions. The Phelps Collection now comprises 43,000 specimens, and more than a hundred new birds have been described from it. Mr. Phelps' many papers on Venezuelan birds constitute a major contribution to South American ornithology.

## ORNITHOLOGICAL LITERATURE

FIELD GUIDE TO BIRDS OF THE WEST INDIES. By James Bond. Illustrated by Earl Poole. Macmillan Company, New York, 1947:  $4\frac{7}{8} \times 7\frac{3}{8}$  in., ix + 257 pp., col. frontispiece, 211 drawings. \$3.75.

Bond's latest work on West Indian birds is based on his well-known "Birds of the West Indies" (Acad. Nat. Sci. Phila., 1936), but the text has been completely rewritten and abridged, and the new volume is definitely not a second edition. The detailed descriptions in the predecessor volume are reduced to a few lines of general description with particular emphasis on field marks; the ranges are stated in less detail. On the other hand, the accounts of the haunts, notes, and habits have been expanded, and a general statement of each bird's status is appended—helpful features not to be found in the earlier volume. Poole's line drawings which illustrated the 1936 work are again used, with numerous new ones as well, bringing the total number of species figured to over 210.

The use of Bond's field guide, which has no keys of any kind, naturally assumes that the student is able to place in their proper families the birds seen and then run down the specific identification by comparison with the drawings and a perusal of the appropriate text. North American migrants and wide-ranging water birds known to occur in the West Indies are included, as well as the endemic species, and Bond himself suggests in the introduction that one of the recent standard North American bird guides can be employed as a useful adjunct by visitors to the Caribbean. A short statement preceding each family, of the type used by Mayr in his recent "Birds of the Southwest Pacific," would facilitate placing of birds in their proper families by the less experienced observers, but this suggestion is not intended to be a criticism of what promises to be a most useful and convenient popular bird guide.—J. L. Peters.

THE BIRDS OF BREWERY CREEK. By Malcolm MacDonald. Oxford University Press, Toronto, Canada, 1947:  $9 \times 6\frac{1}{8}$  in., x + 334 pp., 23 photographs (7 in color). \$5.00.

However busy he may have been as High Commissioner for the United Kingdom in Canada, The Right Honourable Malcolm MacDonald put his early morning hours to good use. This book, of engaging and disarming charm, contains no little factual material. Clever interweaving of first-hand observations and recounted incidents has made a highly readable narrative of bird life. Certainly it is one that can be read with pleasure and much profit by laymen and with pleasure and probably some profit by most ornithologists.

Launching the account with a description of the area and a chapter devoted to "A Bird's Year," Mr. MacDonald continues with a report of his observations, arranged chronologically, by months. From a birdless first day in the field to a final accounting of 160 species, he writes of many varied incidents—and with great freshness of viewpoint.

The outstanding feature of the book is the easy cadences, which permit whimsical analogy to follow straight reporting. Without assuming the "sloppy sentimentality" of which Mr. MacDonald warns, it still is fun to picture his Red-wing as an Admiral complete with epaulets, or his Robin as a General in ceremonial dress. Too, one cannot help cheering him in the role of Matchmaker MacDonald during his encounter with the amorous Buffle-heads.

His life-history reports show remarkably fine powers of observation. Accounts of the Flicker, Catbird, Oriole, and particularly of the Spotted Sandpiper are exceedingly well handled. He proposes a very logical theory regarding the "decoy"

antics, or distraction display, of the Spotted Sandpiper as being related to the courtship display but later presents new evidence, thus leaving the matter open to more observation.

The book includes 23 photographs (some in color) by Arthur A. Allen and W. V. Crich. These are related only in that the birds portrayed are named in a quoted line of the text. Excellent photographs all, those in color being reproduced about as successfully as the present use of this process will allow, but the black and white ones suffer from a toning which robs them of a good deal of character.

The book is carefully indexed, so that one may follow all the material relating to a particular species. Some typographical errors do not appreciably detract from an otherwise finely produced book.—Rosario Mazzeo.

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REPORT OF THE SECRETARY FOR 1947

As of the date of this report, the Wilson Ornithological Club has 1,562 Members, the highest number the Club has ever attained. During 1947 we gained 372 Members and lost, from all causes, 111—a net gain of 261 Members.

One of the 372 new Members is a Life Member; the others are divided as follows: Sustaining Members, 14; Active Members, 100; Associate Members, 257.

The total present membership, by classes, with corresponding figures for 1946 in parentheses, is:

Founders .....	2	(2)
Life Members .....	57	(44)
Sustaining Members .....	106	(72)
Active Members .....	557	(449)
Associate Members .....	840	(734)

During the year, Walter F. Scott did a splendid job as Chairman of the Membership Committee in offering to great numbers of persons the opportunity to join the Club, and he is to be congratulated on his fine work.

We now have Members resident in every State in the Union, in most of the Provinces of Canada, and in many foreign countries. Although not a complete membership tally by State and country, the following list gives the geographical distribution of the majority of our Members: California, 61; Illinois, 90; Indiana, 31; Iowa, 50; Massachusetts, 54; Michigan, 113; Minnesota, 54; Missouri, 40; New Jersey, 27; New York, 134; Ohio, 153; Pennsylvania, 71; Wisconsin, 86; Canada, 59.

Your new Secretary has enjoyed his work and was particularly impressed by the splendid cooperation given him by the other Officers and the Members.

All of the statistics of membership contained in this report were furnished by our Treasurer, Burt L. Monroe. With so large a membership, it requires a tremendous amount of labor to keep records of the Members clear and up to date, and the Treasurer's generous donation of time and effort deserves the commendation of the entire membership.

Respectfully submitted,

December 31, 1947.

James B. Young, *Secretary*.

REPORT OF THE AFFILIATED SOCIETIES COMMITTEE FOR 1947

During the past year there have been no new affiliations with the Club, and it would seem that it is time to consolidate the affiliations already existing and to seek new ways to increase their value.

The Louis Agassiz Fuertes Research Grant, for which Members of the Affiliated Societies, as well as Members of the Wilson Ornithological Club, are eligible, is one bond of union already established.

It was gratifying to have many members of our most recent affiliate, the Brooks Bird Club of West Virginia, taking an active part in the 1947 Annual Meeting. It augurs well that the next Annual Meeting is to be held in association with another of our affiliates, the Wisconsin Society for Ornithology.

We would like to see such things as active exchange of visitors, journals, program ideas, cooperation in research projects, and joint action on conservation matters develop between the affiliates and our Club. Suggestions are invited from Members of the Club and from Members of the Affiliated Societies.

Respectfully submitted,

December 31, 1947.

Gordon M. Meade, M.D., *Chairman*.



## TO OUR CONTRIBUTORS

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

**MANUSCRIPT.** Manuscripts should be typed, with double-spacing and wide margins, on one side of white paper of good quality and of standard size (8½ x 11). The title should be brief and should indicate the subject clearly. Ordinarily the scientific names of the birds treated should be given and should appear early in the article. Most articles should conclude with a brief summary.

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

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

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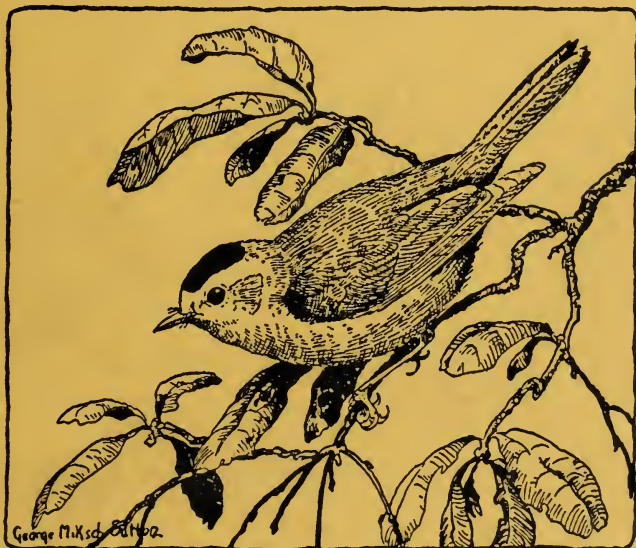
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# The Wilson Bulletin



George M. Kisch, 1948

Published by the  
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## THE WILSON BULLETIN

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### THE WILSON ORNITHOLOGICAL CLUB

Founded December 3, 1888

Named after ALEXANDER WILSON, the first American ornithologist.

President—Olin S. Pettingill, Jr., Carleton College, Northfield, Minn.

First Vice-President—Maurice Brooks, West Virginia University, Morgantown

Second Vice-President—W. J. Breckenridge, University of Minnesota, Minneapolis.

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Secretary—Harold Mayfield, 2557 Portsmouth Ave., Toledo 12, Ohio.

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Associate Editor—Margaret M. Nice.

Assistant Editor—G. Reeves Butchart.

Membership dues per calendar year are: Sustaining, \$5.00; Active, \$3.00; Associate, \$2.00. *The Wilson Bulletin* is sent to all members not in arrears for dues.

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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 two members have generously established a fund for the purchase of new books; members and friends are invited to maintain the fund by regular contributions, thus making available to all Club members the more important new books on ornithology and related subjects. The fund will be administered by the Library Committee, who will be glad of suggestions from members on the choice of new books to be added to the Library. Harold F. Mayfield (2557 Portsmouth Avenue, Toledo, Ohio) is Chairman of the Committee. The Library currently receives 65 periodicals, as gifts, and in exchange for *The Wilson Bulletin*. With the usual exception of rare books 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 Club Library, University of Michigan Museum of Zoology, Ann Arbor, Michigan." Contributions to the New Book Fund should be sent to the Treasurer, Burt L. Monroe, Ridge Road, Anchorage, Kentucky (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*.



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# THE WILSON BULLETIN

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*Holboell's Grebes (Colymbus grisegena holböllii) carrying nest material, Lake Ontario, 1944. From a painting by John A. Crosby.*

## A NESTING OF THE CAROLINA WREN

BY MARGARET M. NICE AND RUTH H. THOMAS<sup>1</sup>

THE Carolina Wren, *Thryothorus ludovicianus*, charming, conspicuous, and widely distributed as it is throughout southeastern United States, has been much neglected by life-history students. And this in spite of the fact that it often leaves its characteristic woods habitat to nest about buildings and even on porches. In 1946 we were able to watch one nesting of this species from the arrival of the female to the leaving of the young.

The male, which had been banded March 27, 1941, near North Little Rock, Arkansas, had lost a mate in late March 1946. On April 18 we noted him bringing three wisps of grass and placing them under the eaves of the sleeping porch. (Typically, in Ruth Thomas' experience, a male does not build until mated.) On April 19 we first saw his new mate, an unbanded bird.

### BUILDING THE NEST

In the afternoon of April 19, the new female came onto the porch, then flew to the base of a nearby oak; the male suddenly dropped down from his perch, hitting her and giving a loud song; she answered with the typical "screech" of the female Carolina. Later we discovered them nest-hunting in a shed to the south; we removed the grape baskets that were stored there and hung one (partially closed with a shingle) on the sleeping porch.

The next morning (April 20), at 7:55, both came to the porch; they entered the basket, gave little notes, then left. For a while both carried material into the tool-shed, some 25 yards to the east. At 8:25 the female returned to the basket and gave little notes, while her mate sang nearby. At 8:32 she brought the first load of material and gave notes in the basket; at 8:33 the male entered and left again; the female came with material, and he followed with a load. She had carried 5 loads and he 6 when, at 8:38, they were frightened away by a boy coming to the porch. They then made a number of trips with leaves, and the male tried to insert a large twig but dropped it; at 9:11 they left. We scattered dead leaves and other nesting material in front of the porch and placed lichen and cat's fur from the nest of a Carolina Chickadee, *Parus carolinensis*, on a nearby chair.

At 11:50 the male brought material, gave "nest notes" in the basket, and sang loudly. Four minutes later, both were investigating under the eaves. The male then went to the basket without a load, and his

<sup>1</sup> Although the study as a whole was cooperative and largely based on R. H. T.'s previous experience with the Carolina Wren gained through many years of intensive banding, observation, and recording, M.M.N. is responsible for the larger part of the observations recorded here (covering the period April 16-May 28, 1946) and, in the main, for the writing of the paper.

mate carried a dead leaf in and out again. He then drove off a male Bewick's Wren, *Thryomanes bewickii*, with a *scat* note and sang loudly. We saw nothing more of them that day until 3:15, when the male made two trips to the basket with empty bill. While inside, he uttered tiny squeaks; his mate did not appear. We did not know whether they had finally selected the basket for their nest.

At 6:50 a.m. on April 21 the male came to the basket without a load, entered, gave nest notes, then sang once from the edge; his mate joined him; both entered and stayed for about 3 minutes. Then he brought two loads. At 7 o'clock she carried in a large load and gave many notes inside—*fit fit fit fit*; he joined her, bringing nothing, left, and returned twice with loads. She came with dead grass, but went onto the roof. He then brought 8 loads of moss and bits of cypress bark from the lawn chair; she gathered some grass but dropped it. The male carried 3 more loads, and at 7:17 she brought more material. By 7:20 he had brought 18 loads, she 4.

Both birds continued working, and between 8 and 10 o'clock the major part of the nest was constructed. The male carried 107 loads and his mate 54—a total of 161 loads—in the first hour; he carried 98 and she 50—a total of 148—in the second hour, making an average during the 2 hours of 1.7 trips per minute for the male and 0.9 trips a minute for his mate. The dead leaves, oak catkins, dry grass, and the few twigs that made up the nest were all gathered in the immediate vicinity—on the ground or from the roof. The female often chattered when she met her mate and often twittered in the basket. Once the male was scratching around in the nest and singing inside the basket; afterward he sang loudly 3 times on the ivy-covered oak, 10 feet from the nest; his mate came out from the ivy leaves; he sang again, then brought more loads and gave 2 songs in the nest. Whenever a Blue Jay, *Cyanocitta cristata*, appeared, he stopped work and *churred*—the note he used when one of the dogs stood on the porch beneath the basket.

Building zeal began to lessen, especially in the male. From 10:38 to 11:08 he brought 23 loads, she 18; from 12:20 to 12:35 he brought 2, she 5; from 1:23 to 1:38 he carried 4, she 8; and from 2:30 to 3:30 he made 3 visits, bringing a load on only one; and she 13, bringing material all but once. Little more happened that day until between 6:00 and 6:15 p.m., when he made 2 visits, bringing nothing, and she made 6 trips with material.

Although we were watching for "courtship displays," we saw little. At 12 noon the female gave a long trilling cry on the oak branch; the male went to her, and they may have copulated; he then sang, his feathers fluffed. Twice in the afternoon we saw him displaying before her with outspread wings, uttering a kind of *chur*, but she made no response. At 6:15, as they were foraging on the ground, he gave her a caterpillar, which she accepted without any demonstration. (On March

28, 1937, Mrs. Thomas saw a male Carolina Wren offering a caterpillar to his mate; the birds at that time were either building or about to build.)

The nest was practically completed during this great burst of energy the morning of April 21; the male's nest-building urge was satisfied, but that of the female did not entirely disappear until May 6, the eighth day of incubation.

On April 22 the pair arrived at 5:30 a.m., the female going into the basket, the male going onto the top. In the next hour and a half she came 15 times, bringing hair and fine grass. He visited the nest 3 times, sang a good deal, and displayed to her once on the wood-pile, but she gave no response. During the rest of the morning they paid a few visits to the basket, he empty-billed, she with more lining material; each gave soft notes at times in the basket.

The next morning (April 23) they arrived at 5:26 and gave little notes in the nest; in an hour and a half she carried in 14 bits of lining, while he made 3 more visits. From 7:45 to 8:45 she carried 2 loads and was very vocal in the nest. At 9:05 she was nowhere to be seen, and apparently the male was seeking her. After vigorous singing from the lawn chair and nearest oak branches, he went into the basket, gave a tiny note, and came out. He repeated this twice, the last time staying in for 2 minutes; then he sang loudly from the nearest oak and from other perches. One visit from the female early in the afternoon was our only other record for the day.

On April 24, after a heavy downpour late in the night, the Wrens did not arrive until 7:09 a.m.; the male went into the basket, while his mate scolded for 2 minutes with her bill full of dry grass; later they both entered. At 8:07, she brought a tiny root, and at 8:16 a few more small roots. These were the only visits during a continuous watch of over 5 hours.

#### EGG LAYING

On April 25, 6 days after her arrival and 5 days after the start of nest-building, the female laid her first egg. The times of her early morning departures and arrivals for the 5 days of egg-laying are given in Table 1.

From April 26 to 29 the female's absences from the nest showed a striking regularity, ranging between 23 and 26 minutes. When laying, she stayed on the nest from 30 to 64 minutes at a time; the two shortest periods and also the next to the longest were terminated by her departure in response to her mate's singing nearby. She arrived at the nest to lay her first egg some 9 minutes earlier in the day than on the following days. (In Finland, at latitude 63° N., in early June, with sunrise at about 2:30 a.m., one Willow-Warbler, *Phylloscopus trochilus*, went on the nest to lay at about 3:00 a.m. and another at 4:00 a.m., both going on the nest slightly earlier from day to day—Kuusisto,

TABLE 1  
CAROLINA WREN, NORTH LITTLE ROCK, ARKANSAS  
EGG LAYING

1946 April	Sky	Sunrise	Left nest	Came to lay	Minutes off	Left again	Minutes on
25	Clear	5:26		5:43		6:24	41
26	Clear	5:25	5:33	5:56	23	6:30*	30
27	Clear	5:23	5:28*	5:54	26	6:25*	31
28	Clear	5:22	5:29	5:54	25	6:58	64
29	Cloudy	5:21	5:26	5:51	24	6:47*	56
Average		5:23	5:29	5:52	24.5	6:37	44

\* Apparently left in response to male's signal song.

1941:34.) On April 25 the Carolina Wrens came to the nest at 5:43 a.m.; the female entered the basket and gave loud chatterings inside; the male flew to the edge and looked down, whereupon his mate redoubled her notes. The night of April 25 was the first she spent in the basket.

Except for April 28, when we left for the day at 10:25, one of us was on the porch much of the time every day; on April 25 the female brought material 3 times during the morning after laying her egg and stayed from one to 28 minutes; on April 26 she did not reappear after 6:30 a.m., and on April 27 she made but one visit. The male came to the basket 2 or 3 times each morning; twice, on April 26 and April 28, he brought caterpillars; one he ate himself, since his mate was not at home. His first visit on April 28 was very early—5:18 a.m.; he looked down into the basket and gave 2 small notes, but getting no response he left; 11 minutes later his mate hopped onto the edge of the basket and flew off.

#### INCUBATION

During the 14 days of incubation we watched the nest from 2 to 14 hours a day. Unfortunately, owing to the amazingly long periods spent by the female on the nest and her quietness in leaving, as well as to our reluctance to disturb her by examining the nest basket, some data, especially for periods on the nest, are lacking from our records. Six hours, for instance, on May 10 and 11 yielded only one complete record (for a period off the nest) but did give data on the male's feeding of his mate.

At least 7 times during the first 8 days of incubation (April 29-May 6) the female brought catkins or a few hairs on her return to the nest. About half of her departures were apparently in response to her mate's singing nearby; twice she followed him after he had fed her.



Several times he brought food when she was not there; once, when he offered her a morsel a minute after her return, she did not accept it. He was most intent on feeding her early in the morning. On May 7 and 8 his zeal increased but waned in the next 3 days, only to increase again on the morning of the fourteenth (last) day of incubation, when he made 13 trips in 5 hours 30 minutes before the hatching of the first egg (about 1:43 p.m.).

Feeding of female by male during incubation was reported in the Carolina Wren by Wight (1934), but Laskey recorded none during the two nestings that she observed in July and August (1946b:62; and 1948). Laskey suggests that feeding may occur during early nestings only, as with the Cardinal, *Richmondena cardinalis* (Laskey, 1944:42). "Courtship feeding" seems never to have been reported for the Winter—or European—Wren, *Troglodytes troglodytes*, or for the House Wren, *Troglodytes aëdon*, both thoroughly studied species; nor for the marsh wrens, *Telmatodytes* and *Cistothorus* (Welter, 1935; Walkinshaw, 1935); but it does occur to some extent in the Rufous-browed Wren, *Troglodytes rufociliatus* (Skutch, 1940:308), Bewick's Wren (Miller, 1941:96; Laskey, 1946a:40), and Northern Cactus Wren, *Campylorhynchus brunneicapillus couesi* (Anders Anderson, letter).

The results of 92 hours of watching are summarized in Table 2. We obtained two all-day records as follows: May 2, the fourth day of incubation, dawned clear; the male gave his first song at 4:40 and came to the nest with food at 5:20; 8 minutes later the female left. His second offering, brought at 6:00, he ate himself, for the female had not returned. His third and last visit came at 5:13 p.m. The female's periods off and on the nest lasted the following numbers of minutes (periods off being in parentheses): (39), 45, (61), 147, (38), 119, (58), 119, (61), 85, (22). The 6 periods off the nest averaged 46.5 minutes; the 5 periods on the nest, 103 minutes. That evening, which was rainy, the male went to roost at 6:26 p.m., the female went to the nest for the night at 6:42. The morning of May 7 was cloudy. The male gave his first song at 4:52 and sang 188 times during the first hour. His first visit to the nest occurred at 5:27, and his mate left at 5:35; he brought food 8 times between 6:00 and 12:33 and once more at 6:38. The female's periods away from and on the nest were as follows: (20), 68, (30), 129, (25), 112, (17), 174, (36), 99, (20), 53, (18). The 7 periods off the nest averaged 24 minutes; the 6 on the nest 106 minutes. Thus, though the periods on the nest were as long as those of May 2, the periods off the nest averaged little more than half as long; 62 per cent of the daylight hours were spent on the nest on May 2, and 79 per cent on May 7, with mean temperatures of 75° F. and 64° F., respectively, being on May 2, 8° above normal, on May 7, 4° below. On May 7, a clear evening, the female went to the nest for the night at 6:55 p.m.

The most striking feature of the female's behavior during incubation was the very long periods spent on and off the nest. We never knew the female to spend less than half an hour on the nest; one session lasted nearly 3 hours (174 minutes), and the average for the whole fortnight was 86 minutes. Periods off the nest averaged 31 minutes in length.

A marked lengthening of the periods on the nest appeared on the fourth day (May 2); during the first 3 days, 11 periods averaged 65.6 minutes; during the last 11 days, 25 periods averaged 95.2 minutes. Two or more periods on the nest were observed on 6 of the days between May 2 and May 12; the daily average for 5 of these days ranged from 103 to 108 minutes, while on the other day 3 periods averaged 95 minutes. Shortening of the periods off the nest was evident from the fifth day (May 3): 19 periods in the first 4 days averaged 39 minutes, 27 periods in the last 10 days averaged 25 minutes. This shortening was more marked from the sixth day of incubation (May 4) and coincided with a drop in temperature, the mean temperature of the first 5 days averaging 69° F. (3° above normal), of the last 9 days, 63.6° F. (4.6° below normal); 64.5 per cent of the time was spent on the nest during 40.5 hours of observation on the warmer days, 80 per cent during 51.5 hours of observation on the cool days.

Very long periods on and off the nest were also recorded by Laskey (1946b:62; 1948:107) in her study of two Carolina Wrens in Nashville, Tennessee. She watched one nest July 10 and 11, 1946, for 6 hours and 14 minutes; the female incubated 43 per cent of the time, staying on the nest from 15 to 87 minutes and off the nest from 41 to more than 85 minutes; temperatures were high (up to 94° F.). She watched the other nest for 67 hours during incubation, from July 21 to August 2, 1946; temperatures were normal, averaging 78.6° F., and daily fluctuations were small, ranging from 3° above normal to 3° below; 63 per cent of the time was spent on the nest; 33 periods on the nest ranged from 12 to 137 minutes, averaging 57.9 minutes, and 43 periods off the nest ranged from 9 to 58.5 minutes, averaging 33.5 minutes. Thus periods off the nest averaged almost the same as those of our Carolina Wren in Arkansas, but periods on the nest averaged a third shorter; whereas on the average both birds stayed off the nest a half hour at a time, the periods on the nest averaged for the Tennessee female about an hour (57.9 minutes), for the Arkansas female, about an hour and a half (86.1 minutes). Due to the comparative uniformity of the weather during Laskey's second study, it was not possible (as it was in our Arkansas study) to trace a difference in rhythm correlated with temperature changes; also, in Laskey's study, the periods on and off the nest were about the same during the first 4 days as during the last 10.

Periods spent on and off the nest by these three Carolina Wrens are very much longer than those of most small passerines that have so

TABLE 2  
CAROLINA WREN, NORTH LITTLE ROCK, ARKANSAS  
INCUBATION

Date (1946)	Hours watched	Feedings by male	Periods on the nest		Periods off the nest		Time on nest (%)	Temperature (mean) USWB
			No.	Length (minutes)	No.	Length (minutes)		
Apr. 29	7.5	4	4	31-102 ( 63)	4	11-84 (43.5)	59.1	66°F. (0)
30	4	4	2	31-74 ( 52.5)	3	13-43 (25.3)	67.5	66° (0)
May 1	11	3	5	46-112 ( 73)	6	22-74 (37.5)	62	70° (+4°)
2	14	3	5	45-147 (103)	6	22-61 (46.5)	62.4	75° (+8°)
3	4	1	1	74	2	23-49 (36)	70.5	70° (+3°)
4	6	3	3	89-104 ( 95)	3	23-28 (25.3)	78.9	62° (-5°)
5	2	1	1	56	2	26-31 (28.5)	60°	60° (-7°)
6	4.5	3	2	75-134 (104.5)	2	26-41 (33.5)	76	71° (+3°)
7	14	10	6	53-174 (106)	7	17-36 (24)	79.4	64° (-4°)
8	3.5	12	2	86-145 (105)	3	15-19 (17)	81.9	62° (-6°)
9	6	5	1	43	3	8-35 (23.7)	64°	64° (-4°)
10	3.5	2			1	19	70°	70° (+1°)
11	2.5	5					59°	59° (-10°)
12	9.5	37*	4	43-145 (108)	4	14-32 (25.5)	81.1	60° (-9°)
Total period	92	93†	36	31-174 ( 86.1)	46	8-84 (31.2)	73.4	65.6°
First 5 days	40.5	15	17	31-147 ( 71.3)	21	11-84 (39.3)	64.5	69° (+3°)
Last 9 days	51.5	78‡	19	43-174 ( 99.6)	25	8-41 (24.4)	80.3	63.6° (-3.8°)

Mean lengths of periodson and off the nest and degrees of departure from normal temperature are given in parenthesis in the respective columns.  
Data for 2 all-day records (May 2 and 7) are given in boldface type.

\* 13 times in 5.5 hours before hatching of the first young (1:43 p.m.).

† 69 times in 86 hours before hatching of the first young.

‡ 45 times in 50 hours before hatching of the first young.

far been studied. For 21 individuals, of 8 species, listed by Nice (1943: 221, Table XXIII), average periods on the nest ranged from 12 to 49 minutes, with a median of 29.8; average periods off the nest ranged from 5.7 to 16.5 minutes, with a median of 8.5. The Northern Cactus Wren also has short periods of attentiveness and inattentiveness (Anders Anderson, letter).<sup>2</sup> The number of times the incubating female leaves the nest each day varies among 11 species from 11 to 90, with a median of 21 (Nice, 1943:220). The Carolina Wren of this study left the nest 6 and 7 times (on the 2 days of complete records). The House Wren leaves 27 to 43 times a day (Baldwin and Kendeigh, 1927:213). The Oven-bird, *Seiurus aurocapillus*, seems to be the only passerine so far studied with an incubation rhythm at all comparable with that of the Carolina Wren; 26 full-day recordings by the itograph, involving 4 incubation periods of 3 females, show that the birds left the nest from 5 to 13 times a day, the median being 8.5 times. Periods on the nest averaged from an hour to nearly 3 hours; periods off from 16 to 22 minutes. There seemed to be considerable variation in incubation rhythm, even in the same bird, from year to year (Hann, 1937; Nice, 1938).

#### RELATIONSHIP BETWEEN TEMPERATURE AND INCUBATION RHYTHM

As illustrations of relationship between incubation rhythm and temperature, let us examine a number of cases for which sufficient data have been obtained: the Carolina Wren of this study; Laskey's Carolina Wren in comparison with ours; 3 Willow-Warblers, *Phylloscopus*, whose incubations were recorded mechanically (Kuusisto, 1941); 3 Song Sparrows, *Melospiza melodia*, during 4 incubations (92 hours—Nice, 1937:123, Table IX); 5 Song Sparrows, whose incubations (representing 29 days) were recorded mechanically by Baldwin and Kendeigh (Nice, 1937:124); a Barn Swallow, *Hirundo r. rustica*, for which 5 full-day observations were recorded (De Braey, 1946:166 ff.; Nice, 1947); 3 Oven-birds in 4 incubations (covering 26 days), recorded by itograph (Hann, 1937; Nice, 1938).

For all except one of the 17 birds involved in the above studies, the percentage of time spent on the nest decreased with increasing temperature. Thus, our Carolina Wren spent 80 per cent of the daylight hours incubating when the temperature averaged 63.6° F. and 64.5 per cent when it averaged 69° F. In Laskey's study the Carolina Wren spent 63 per cent of the time on the nest at a mean temperature of 78° F., whereas the female of our study incubated 73 per cent of the whole period at a mean temperature of 66° F. The Willow-Warbler (*Phyllo-*

<sup>2</sup> Courtney Jones (1939. "Rock Wrens at Wupatki," *Southwestern Natl. Monuments, Monthly Repts.*, Suppl. for July, pp. 69-72) found that a Rock Wren [*Salpinctes obsoletus*] averaged 18 minutes on the nest, 15 minutes off. Harold Heath (1920. "The Nesting Habits of the Alaska Wren," *Condor* 22:49-55) observed four nests of the Alaska Winter Wren (*Troglodytes troglodytes alascensis*) and found that periods on the nest ranged from 18 to 21 minutes, periods off, from 2 to 5 minutes.

*scopus*), incubating during warm weather (with maxima of 80.6° and 82.4° F.) in 1937 spent less time on the nest than did the two females incubating during cool weather (with maxima of 64.4° to 68° F.) in 1938 (Kuusisto, 1941:diagrams 11, 15). One of my Song Sparrows (K7) spent 80 per cent of the time on the nest at a mean temperature of 57° F.; K3 spent 71 per cent of the time on the nest at a mean temperature of 69° F.; and K2 spent 79 per cent at a mean temperature of 55° F., 75 per cent at a mean temperature of 70° F. As temperature increased (48° to 80° F.), there was a consistent decrease (77 per cent to 72 per cent) in the percentage of time Baldwin and Kendeigh's Song Sparrows spent on the nest, with the exception of one bird that incubated 79.5 per cent during an average mean temperature of 75° F. The time spent by the Barn Swallow on the nest shows a consistently descending percentage (74 per cent to 66.5 per cent) with an increase in mean temperature (58.6° to 71° F.). Average temperatures during the Oven-birds' incubation ranged from 59° to 80° F., percentage of time on the nest from 85 and 86 per cent to 73 per cent.

In all cases the length of periods off the nest was correlated with temperature. This was true of our Wren, whose periods off the nest decreased markedly in length during the cool weather of the latter part of incubation (although then another factor may have been involved, namely, increased attachment to the eggs). In the cool weather of 1938, 92 per cent of the Willow-Warblers' absences were very short (less than 10 minutes); in the warm weather of 1937 this was true of only 69 per cent of the absences. The length of periods off the nest of my Song Sparrows averaged 6 minutes (for K7), at a temperature of 57° F., and 8 minutes (for K3), at a temperature of 69° F.; K2 stayed off 7.8 minutes, at an average temperature of 55° F., and 9 minutes, at an average temperature of 70° F. One of Baldwin and Kendeigh's Song Sparrows showed a consistent adjustment to temperature, her periods off the nest increasing regularly from 4.1 minutes, at 43° F., to 7.5 minutes, at 54° F., and all showed a regular *average* increase of periods off the nest, from 5.7 minutes, at 48° F., to 16.5 minutes, at 80° F. The Barn Swallow's periods increased consistently from 2.5 minutes, at 58.6° F., to 5.8 minutes, at 71° F. One Oven-bird (No. 15) stayed off 16 minutes at 59° F. in 1935, and 22 minutes at 63° F. in 1936; the other two averaged 20 minutes at 80° F.

The number of periods off the nest per day decreased with rising temperature, for Baldwin and Kendeigh's Song Sparrows, from 33 to 15; for the Barn Swallow, from 79 to 46; for Oven-bird No. 15, from 9.2 to 5.8. For the Willow-Warblers, periods off the nest were much fewer in 1937 than in 1938 (Kuusisto, 1941:45); Kuusisto gives actual figures for only one nest in 1938 (p. 41); the bird left 27, 27, 30, and 35 + times in one day.

Correlative with the lessening of the number of absences with increasing temperature, is the increase in the length of periods on the nest: for the northern Ohio Song Sparrows a consistent increase from 19.3 minutes to 42.4 minutes; for the Barn Swallow, from 7.2 to 11.9 minutes; for Oven-bird No. 15, from 96 to 170 minutes.

Carolina Wrens and Song Sparrows studied at Columbus, however, decreased the length of periods on the nest with increasing temperature. The Wren of our study averaged 98 minutes on the nest at 64° F. and 71 minutes at 69° F.; Laskey's Wren averaged 57.5 minutes at 78° F.; my Song Sparrows averaged 30.5 minutes at 57° F. (K7), 20 minutes at 69° F. (K3), 30 minutes at 55° F. and 27 minutes at 70° F. (K2).

To summarize: in colder weather the birds increased the percentage of time spent on the nest, shortening the periods off the nest. Ten birds of four passerine species (5 Song Sparrows in northern Ohio, Oven-bird, Barn Swallow, 3 Willow-Warblers) increased the length of periods on the nest, decreasing the number of periods (both on and off). Five birds of two species (3 Song Sparrows in central Ohio and 2 Carolina Wrens) decreased the length of periods (both on and off), increasing the number. It will be noted that in all cases periods off the nest were shorter in cold weather than in warm, while the number of periods (both on and off) differs according to whether the periods on the nest lengthen or shorten.

#### CARE OF THE YOUNG

Except for giving small notes when fed by her mate, the female Carolina had been quiet in the nest during incubation. On May 12, at 1:43 p.m., she started to chatter, much as she had done when arranging material in the nest, and 16 minutes later she again chattered. The male brought food 6 times between 1:43 and 2:50, when the female left the nest. We then found that the first young had hatched, and there was no sign of the shell. The female had left at 9:54, at which time there were still 5 eggs; she returned at 10:25; unfortunately, no one was watching the nest from 12:40 to 1:15, so we cannot be sure that she did not take a brief vacation, but she may have stayed on continuously for 4 hours and 25 minutes. The male had been feeding his mate 2.2 times an hour on this morning—in contrast to 0.7 times an hour during the previous 81.5 hours of observation, but after 1:46 p.m. he fed his mate 4 times an hour. He showed excitement by loud singing and by flipping his wings. At 5:47 p.m. his mate was absent, and he fed the nestling directly for the first time. The next day 3 more eggs had hatched by 10:00 a.m., and the last one hatched between 12:10 and 4:46.

Two full-day records were obtained: on May 15, when the young were 2 and 3 days old; and on May 22. In addition, we watched from one to 11 hours every day except May 20 while the young were in the nest. A summary of the results is given in Table 3.

TABLE 3  
CAROLINA WREN, NORTH LITTLE ROCK, ARKANSAS  
CARE OF FIVE YOUNG

Date (1946)	Hours watched	Feedings						Brooding periods (mean lengths)	Time on nest (%)	Temperature (mean) USWB		
		Per hour		Total		by ♂ & ♀	by ♂				by ♀	by ♂ & ♀
		by ♂	by ♀	by ♂ & ♀	by ♂							
May 12	4*	6.0	0	6.0	24	0	24	95.7	23.7	83.6	60°F.	
13	4*	3.5	0.5	4.0	14	2	16	54.0	27.7	69.3	62°	
14	4.5	4.2	0.2	4.4	19	1	20	57.2	19.5	85.2	70°	
15	14	3.6	0.9	4.5	51	12	63	34.9	30.5	51.4	66°	
16	4	3.0	2.3	5.3	12	9	21	17.0		4.7	72°	
17	3	5.7	2.0	7.7	17	6	23	0		0	72°	
18	3	5.7	2.7	8.4	18	8	26	0		0	70°	
19	3	5.0	4.0	9.0	15	12	27	0		0	68°	
21	3*	3.7	5.3	9.0	11	16	27	0		0	62°	
22	14.3	5.4	5.8	11.2	77	83	160	0		0	64°	
23	1	6.0	8.0	14.0	6	8	14	0		0	70°	
24	11	4.0	10.1	14.1	44	111	155	0		0	76°	
25	6	5.7	11.1	16.8	34	67	101	0		0	70°	
26	1	7.0	11.0	18.0	7	11	18	0		0	66°	
Total period	77.8	4.5	4.5	9.0	352	346	695				67.7°	
First half†	38.5	4.1	1.0	5.1	158	38	193	49.8	27.4	72.4	67.4°	
Second half	39.3	5.0	7.8	12.8	194	308	502	0		0	68°	

The first young hatched about 1:43 p.m. May 12; 3 more by 10 a.m., and the last by 4:46 p.m., May 13. Data for 2 all-day records (May 15 and 22) are given in boldface type.

\* Watched in afternoon only.

† For brooding: first four days.

For the first 3 days (May 13 to 15) the female behaved much as she had while incubating; she brooded much and fed little. The percentage of daylight hours spent on the nest during these days (72 per cent) was as much as during incubation (73 per cent), and the average length of periods off was much the same (27 minutes now, 31 minutes before). The chief difference lay in the *number of periods off*, which became twice as numerous (12 on the all-day session of May 15, in contrast to 6 and 7 on May 2 and 7), and in the *length of periods on* (50 minutes now, 86 minutes before). (The explanation of the lower percentage of brooding on the cool day of May 13, in comparison with the mild day of May 14, probably lies in the time the observations were made, in the afternoon on May 13, in the morning on May 14; 64 per cent of the morning hours were spent on the nest on May 15, 40 per cent of the afternoon hours.)

The female spent the nights on the nest up to May 18, when the young were 6 and 7 days old; we did not check on this point on May 19 and 20, but on May 21 the female did not come to the nest while we watched from 7:02 to 7:30 p.m., by which time it was very dark. On the following evening, she entered the box at 7:15 p.m., evidently for the night, since she had not left by 7:30. Laskey's female did not brood the young after they were 4 days old despite unseasonably cold weather.

The female showed an almost continuous increase in her rate of feeding, from 0.5 times an hour (on May 13) to 11 times an hour (on May 25). The male had a burst of enthusiasm upon the hatching of the first egg on May 12 and brought food to the nest 6 times an hour, but his rate dropped the next day to 3.5 times an hour, then gradually increased to 5.7 times an hour (on May 17 and 18). On May 21, for the first time, the female outdid her mate; in 18 hours during May 24 to 26 (the last 3 days of nest life) she brought more than twice as many meals as her mate. Omitting the afternoon of May 12, the rate for the *pair* increased consistently from beginning to end, from 4 to 18 times an hour, averaging 9 times an hour for the whole period. When the young were 2 and 3 days old, 63 meals, or 12.6 for each, were brought during the day; when the young were 9 and 10 days old, 160 meals, or 32 per nestling, were brought (assuming that only one bird was fed on each trip, a matter on which we could make no observations). The hourly rate of feeding during the first half of nest life was 5.1, during the last half, 12.8, or two and a half times as high—the same proportional increase as found at 7 Song Sparrow nests (Nice, 1943:231). Beginning with May 16 both parents brought some very large insects.

During the first week our Carolina Wrens showed the same rate (number of trips per hour) in feeding their 5 young as did Laskey's pair in feeding 3 young: 5.1 trips per hour, or one trip per bird for our brood, 1.7 trips per brood for hers. During the last 5 days of nest life,



Laskey's pair made 6.1 trips per hour (only 2 young were then present), whereas our pair, during the last week, averaged 12.8 trips per hour. For the whole period, Laskey's pair averaged 2.2 trips per hour per young, our pair averaged 1.8.

In keeping with the slow pace of the incubation rhythm, both these pairs of Carolina Wrens fed the young rather infrequently. The hourly rates *per brood* of 8 passerine species (Nice, 1943:235) ranged from 39.7 (Great Tits, *Parus major*) to 11.4 (Song Sparrows); 2 other species—American Robins, *Turdus migratorius*, at 6.5, and Oven-birds at 3.7—showed a lower rate than our Wrens. The rates *per nestling* for the 8 species ranged from 8.4 (Wire-tailed Swallows, *Hirundo smithii*) to 3.1 (Song Sparrows); the Robins received 1.7 and 2.1 meals per hour, the Oven-birds 0.8 to 1.2.

The first sac of excreta we saw carried away was one on May 15 (by the male). On May 22 (a full-day observation) the male carried off 12; the female, 16—a total of 28 for the day, or 18 per cent of the number of feedings. During the 11 hours' observation two days later, the male took 4 sacs and the female, 25—again 18 per cent of the number of feeding trips.

#### LEAVING THE NEST

On May 18 we had first heard notes from the young at some of the feedings. They squeaked when hammering began nearby but not when the basket was touched. The next day they responded with sounds to the shutting of the porch door and to a scratch on the basket. The female now began giving her *tinkle*, denoting mild alarm, at Blue Jays. These *tinkles* were often heard from then on, and the male *churred* more and more vigorously (at times, 70 notes a minute) at the Jays, which never paid the slightest attention. During the last few days, as the female assumed the larger share of the task of feeding the young, the male's role as policeman became more pronounced.

By May 24 the young had become very noisy at meals, and occasionally they gave the location note—*psit*. The next day they called at times in response to their father's songs. Between 5:00 and 6:00 p.m. the female fed the young 11 times, the male 3 times, but twice he came to the basket without food and merely looked in.

On May 26, when the young were 13 and 14 days old, the male's first feeding of the day came at 4:48 a.m., the female's at 5:01; both fed the young industriously during the first hour. The young were silent at first, but at 6:09 responded to each of the male's songs with location notes. At 6:43 a nestling was up on the edge of the basket, but promptly hopped back; this performance was repeated at 7:20. The male then came to the basket *without food* 4 times and peered in; once he gave a note, then flew to the west and sang loudly, while the young scrambled about inside the basket. He was apparently *trying to get the young to leave*.

By 7:38 a.m., 4 young Wrens were up on the edge. The female now arrived, scolded, and fed the one young inside; she scolded again, and all disappeared inside. The next minute 3 clambered up again; the female went to the basket without food, hopped in, and all followed her. The male joined them without food, then started to sing from the nearest oak. At 7:42, all 5 young climbed out on the edge, and 2 flew to the shelf under the eaves. The female went into the basket with food, came out, and fed one of the young on top; she then hopped into the basket, giving coaxing notes, and 3 young followed her. The male *churred* in the oak and the female *tinkled*. The male fed a young Wren in the basket and took away a fecal sac. One fledgling flew from the shelf and landed on the floor of the porch. The female went to the basket, then to the young Wren under the eaves, giving coaxing notes, returned to the basket, and fed a young Wren inside. Unlike the male's, her efforts seemed to be *directed toward getting the young back into the nest*.

The bird on the floor called *pfifit pfifit*. With some young in the basket and some fluttering about, the scene became considerably confused. Both parents fed young at 7:53 a.m., the female at 7:59, 8:03, and 8:04. Now it appeared that the female, as well as the male, was trying to lure the young from the nest and its vicinity; she went to the eaves, giving coaxing notes, while the male went into the basket, which then contained only one young Wren. At 8:13 both parents entered the basket, the female carrying an insect; the young Wren followed her out, but the mother did not feed it. All 5 young started to fly about, whereupon we decided to band them. The male scolded vigorously and fluttered to within a few feet of one of us, then left.

We banded 3 young and put them in a trap, and they began to call; the male appeared and *churred*. The fourth fledgling screamed when caught, whereupon the male flew near with slow wing movements—a mild form of "distraction display," which seems not to have been previously recorded for the Troglodytidae.

The female flew in and out of the porch, giving the "tolling" notes; she returned with an insect, went to the empty basket, then left. Seven minutes later, the male came to the feeding shelf some 15 feet from the young in the trap; the young began to call. The female arrived again with food, going to the empty basket, then hurrying past the trap, calling. The male came 3 times to the basket, looked down at the young in the trap, then left; the female came 4 times, each time hurrying past the trap, calling loudly. At 9:03 she arrived with food, went to the basket, called, alighted on top of the trap, returned to the basket, and left. We then put the trap containing the young under a large drop trap at the side of the house; the male *churred* vigorously, but the female came directly to the young to feed them; we caught and banded her. We released the young at once; they flew some 15 feet and landed well.

The Wrens moved down the hill into the woods, and we did not see the young again. The male returned occasionally, but the female was seen only once—on June 18, when she and the male were examining the nest basket. A pair, apparently juveniles, took possession of the hill. In late July, the male occasionally appeared to chase them with much excited singing, but he was not seen after July 28 although he was watched for until December 18.

#### EARLY MORNING AND EVENING ACTIVITIES

The beginning and end of activities of both male and female were closely correlated with light. Records for 19 mornings are given in Table 4. The male's awakening songs on 8 clear (one slightly misty) mornings came 27 to 42 minutes (average: 33 minutes) before sunrise; on 2 cloudy mornings, 21 and 27 minutes (average: 24 minutes); and on 2 rainy mornings, 14 and 21 minutes (average: 17.5 minutes). Civil twilight at 35° latitude occurs at 26 to 28 minutes before sunrise at this time of year (Kimball, 1916:617); thus, the first song on clear mornings averaged 6 minutes before civil twilight. The male did not sing as early as the Mockingbird (*Mimus polyglottos*), Robin, Purple Martin (*Progne subis*), Mourning Dove (*Zenaidura macroura*), Cardinal, or the Catbird (*Dumetella carolinensis*), but was always earlier than the Bewick's Wren, Chimney Swift (*Chaetura pelagica*), and Orchard Oriole (*Icterus spurius*).

Three of the male's first visits to the nest on the days the female was laying took place about an hour after his first song, although one (on April 28) must have come about 25 minutes after (see Table 4). During incubation his 4 first visits of the day occurred about half an hour after his first song, whereas 3 first visits to feed the young came at 6, 8, and 18 minutes after. Thus a progressively greater bond to the nest is evident.

The female came to the nest at about sunrise when building and when feeding young. Her very late arrival (7:09 a.m.) on April 24 may have been due to a heavy downpour that began about 2:00 a.m. and lasted well into the morning. During the period of laying, she left the nest from 5 to 8 minutes after sunrise (returning in 23 to 26 minutes to lay). On 3 mornings in the early part of incubation she left the nest 10 to 12 minutes after sunrise; on 2 mornings during the latter half she left 22 to 23 minutes after. We obtained only one record while she was brooding the young: on May 15 she left 29 minutes after sunrise. Here an increasing bond to the nest seems evident after incubation started.

Until May 2 the male roosted in a fold of awning outside a west window of the house; the heavy rain falling that night may have discouraged him from returning. We did not know where he spent his nights after that except for May 25, when we found him once more in the awning. On 5 clear evenings he went to roost from 3 minutes be-

TABLE 4  
CAROLINA WREN, NORTH LITTLE ROCK, ARKANSAS  
EARLY MORNING ACTIVITIES

Date (1946)	Sky	Sunrise	Male		Female		
			1st song	To nest	To nest	Left nest	
Building	Apr. 22	cloudy	5:29			5:30	
	22	cloudy	5:28			5:26	
	24	cloudy*	5:27			7:09	
Laying	25	clear	5:26	4:44	5:44	5:43	
	26	clear	5:25	4:50	5:58		5:33
	27	clear	5:23	4:53			5:28†
	28	clear	5:22		5:18		5:29
	29	cloudy	5:21	4:54	6:05		5:26
Incubation	30	rainy	5:20	4:59			5:42
	May 1	misty	5:19	4:50	5:24		5:31
	2	clear	5:18	4:40	5:20		5:28
	7	cloudy	5:13	4:52	5:27		5:35
	9	clear	5:12	4:45	5:18		5:35
	10	cloudy	5:11				5:23†
Care of yg.	15	cloudy	5:07		5:05		5:36
	19	rainy	5:04	4:50			
	22	clear	5:02	4:30	4:36	5:09	
	24	cloudy	5:01			5:07	
	26	clear	5:00	4:30	4:48	5:01	

Time is Central Standard. Hours of sunrise from USWB at Little Rock.

\* After heavy rain in latter part of preceding night.

† Called off the nest by male's loud song nearby.

fore sunset to 2 after; on 4 cloudy evenings, from 2 to 13 minutes before sunset; and on 2 rainy evenings, 26 and 28 minutes before. His last feedings of the young usually came around sunset on clear evenings. His last songs were less regular than his roosting or last feeding; only once did we hear him as late as 9 minutes after sunset—on May 23.

While there were eggs in the nest the female always came to the basket before sunset: 1, 2, 5, and 14 minutes before, on clear evenings; 12, 23, and 33 minutes before, on cloudy and rainy evenings. But after the young hatched she always returned after sunset: 4, 5, 7, 15, and 17 minutes after, on clear evenings; 8 and 10 after, on cloudy evenings. In fact, on 3 occasions she had difficulty in finding the basket in the

TABLE 5  
CAROLINA WREN, NORTH LITTLE ROCK, ARKANSAS  
EVENING ACTIVITIES

Date (1946)	Sky	Sunset	Male			Female	
			Last song	Last fed yg.	To roost	To nest	Last fed yg.
Building	Apr. 20	cloudy	6:45	6:43		6:43	
	24	cloudy	6:48			6:44	
	25	cloudy	6:49			6:45	6:26
	26	clear	6:50			6:52	6:49
	27	clear	6:50	6:48		6:52	6:45
	28	clear	6:51			6:53	
	29	rainy	6:52			6:26	
Incubation	May 30	cloudy	6:53	6:33		6:40	6:20
	1	clear	6:53	6:47		6:50	
	2	rainy	6:54	6:24		6:26	6:42
	5	clear	6:57	6:49			6:43
	7	clear	6:58	6:53			6:56
Care of yg.	12	clear	7:02		6:55		7:09
	13	cloudy	7:03	7:02			7:13
	14	clear	7:04				7:08
	15	cloudy	7:04		6:49		7:12
	16	clear	7:05		7:05		
	17	clear	7:06	7:08	7:07		7:23
	18	clear	7:07	7:08	7:07		7:22
	19	cloudy	7:08	7:02			
	21	clear	7:09	7:12	7:07		
	22	clear	7:10		6:43		7:15
	23	clear	7:10	7:19	7:14		6:59
	25	clear	7:12	7:14		7:15	7:14

Time is Central Standard. Hours of sunset from USWB, Little Rock.

dark, having to alight on the stepladder below the nest on May 15, "stumbling about" on May 17, and on May 13 she could not find the nest on her return at 7:13 and went away. We turned on the light in our part of the porch. She came back at 7:16, scolding vigorously, flew to the ladder, made an unsuccessful attempt to reach the nest, and with the second try succeeded.

On the 5 days for which we have records of his last feedings and her final return to the nest, his feedings averaged 8 minutes before sunset; her returns, 8 minutes after. His day started earlier and ended earlier than hers. Evening activities for 24 days are shown in Table 5.

## SUMMARY

A nesting at North Little Rock, Arkansas, of a color-banded six-year-old male Carolina Wren, *Thryothorus ludovicianus*, mated with an unbanded mate, was watched some 250 hours, from the arrival of the female on April 19, 1946, to the leaving of the 5 young on May 26.

On April 20 the pair built sporadically in a tool-shed and in a basket on the sleeping porch; on April 21 they built most of the nest in the latter place between 8:00 and 10:00 a.m., the male bringing 205 loads, his mate 104. After that, his zeal diminished; in a total of 2 hours and 30 minutes of observation during the rest of the day he brought 30 loads, she 49. He brought no more material after that, but she carried in lining for 4 more mornings and continued to bring hair or grass blades occasionally until May 6, the eighth day of incubation.

Five eggs were laid, starting April 25, the female spending the night in the basket from that date. She left the nest 5 to 8 minutes after sunrise, returning in 23 to 26 minutes, and stayed on to lay from 30 to 64 minutes.

Incubation lasted 14 days and was performed entirely by the female. During 92 hours of observation she incubated 73 per cent of the time, staying on the nest from 31 to 174 minutes, averaging 86 minutes, and staying off the nest from 8 to 84 minutes, averaging 31. Two all-day observations gave the following results: fourth day, 5 periods on—averaging 103 minutes, 6 periods off—averaging 46.5 minutes; ninth day, 6 periods on—averaging 106 minutes, 7 periods off—averaging 24 minutes. The mean temperature of the first day was 8° F. above normal; on the second, 4° below normal. During the first 5 days, 64.5 per cent of the time was spent on the nest, with a mean temperature of 69° F.; periods on the nest averaged 71 minutes and periods off, 39 minutes. During the last 9 days, 80 per cent of the time was spent on the nest, with a mean temperature of 63.6° F.; periods on the nest averaged 99.6 minutes, periods off, 24.4 minutes.

Periods on and off the nest (as also with 2 Carolina Wrens observed by Laskey) were very much longer than those of most passerines so far studied. Females of 11 species left the nest 11 to 90 times a day—in contrast to the 6 and 7 times of the Carolina Wren of this study; the Oven-bird is the only passerine known to have an at all comparable rhythm.

In 7 studies of incubation in passerines it was found that the colder the weather, the more time spent on the nest and the shorter the absences of the parent. In some cases the absences were also more frequent, the periods on the nest shorter than in warm weather; in other instances periods on the nest were longer.

The male Carolina Wren fed his mate to some extent during nest building, egg laying, and incubation—93 times in the 92 hours of the incubation period.

The young hatched on May 12.

The nest was watched 77.8 hours during the nestling period, including 2 all-day sessions; when the young were 2 and 3 days old, the male made 51 trips, the female 12—together making 12.6 trips per young; when the young were 9 and 10 days old, the male made 77 trips, the female 83—32 trips per young. During the first week the parents together averaged 5.1 trips per hour; during the last, 12.8. The male increased his rate from 3.5 an hour to 7, the female from 0.5 to 11; the average of each for the whole period was 4.5. Excreta were carried off after 18 per cent of the feedings on May 22 and 24 (14 and 11 hours observation).

The young left at 13 and 14 days. After vigorous feeding during the first hour of May 26, the male began to lure the young out of the nest by visits without food and by loud singing nearby; the female, on the contrary, 3 times got the young back into the nest basket after they had left it. By 8:00 a.m. the female started luring the young out with coaxing notes and by refusing to deliver the food she carried.

When we caught a fledgling and it screamed, the male showed a mild form of distraction display; this is apparently the first record of this behavior in the Troglodytidae.

Activities of both male and female were closely correlated with light. The male's awakening song on clear mornings averaged 6 minutes before civil twilight. The female came to the nest about sunrise when nest building and feeding young; she left the nest, when laying, 7 to 8 minutes after sunrise. The male's day ended at about sunset except on 2 rainy evenings when he came to roost 26 and 28 minutes before sunset. The female behaved in much the same way while there were eggs in the nest, but after the young hatched her return to the nest was later, once 17 minutes after sunset; on 3 occasions she had difficulty in finding the nest in the dark.

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## NOTES ON THE YELLOW-BREASTED SUNBIRD

BY NATHAN S. POTTER, III

**B**ETWEEN February 15 and November 5, 1945, while stationed on Calicoan (a small, sparsely populated coral island at the southern tip of Samar in the Philippines), I made a few observations on the Yellow-breasted Sunbird, *Nectarinia jugularis jugularis*. Since very little has been recorded on the life history and behavior of this species, my data, although fragmentary, may be of value.

One of the most common birds of the island, whose avifauna I am describing in another paper, the Yellow-breasted Sunbird seemed to prefer palm groves that had little or no undergrowth other than scattered bushes or banana plants, but I often saw the sunbirds also at the edge of the forest and sometimes in the dense woods. During the first few months of my stay on the island, before the camp area was cleared for the construction of warehouses, and while our quarters consisted of tents, from 5 to 12 Yellow-breasted Sunbirds could be seen at any time in the very midst of the camp. They were apparently undisturbed by the presence of man and often permitted observation from a distance of only five or six feet. As the work of clearing the vegetation progressed in their preferred habitats, the birds became increasingly scarce until only one or two were seen in a week. Between November 1 and November 5, I saw them in large numbers in the palm areas that had not been cleared around the naval station at Guiuan on the southern tip of Samar about 10 miles from the center of Calicoan.

This sunbird is scarcely four and a half inches in length, short-tailed, and rather drab above (olive-green back and grayish-brown wings). Yet it is conspicuous and easily observed because of the brilliant chrome yellow of the underparts, which extends in the female over the chest, throat, and chin, though in the male these areas are glossy black, iridescent with bluish-green and dark purple. The bill is long, sharply pointed, and decurved; the legs set far back on the body. The flight is rapid and darting, with a quick wing beat.

*Voice.* The call note of the Yellow-breasted Sunbird was an undistinguished *tweet tweet*; in flight the sunbirds twittered like swallows; song, heard only from males, was a sharp clear *cheew-wee tweet tweet tweet tweet tweet*. I heard males singing during the full period that I was on the island.

*Feeding habits.* These sunbirds were particularly active in the center of the foliage of palm trees. An inspection of the yellowish flowering part of felled palms showed the presence of large numbers of diptera and hymenoptera. Small lizards were also much attracted to that

part of the trees. During the morning the sunbirds often fed quite close to the ground in leaves, vines, and low bushes; in the afternoon they were usually in the tops of palms.

*Relations between males.* On February 20, I saw two male sunbirds chattering and chasing each other in rapid darting flight; they then alighted about a foot apart, facing each other, on a low branch near a nest site. Both birds stretched their necks and pointed their bills straight upward, displaying their beautiful iridescent throats. In this position they slowly and stiffly turned their heads from side to side. During this activity, there was a female Yellow-breasted Sunbird quite near, and although the males seemed more interested in each other, they twice interrupted the display to give chase to the female. These activities lasted about 10 minutes, after which the two males flew off, leaving the female to herself. None of these three birds paid any attention to another pair of Yellow-breasted Sunbirds that were not more than 15 feet away during the whole time, nor did that pair pay any attention to them.

On one occasion a pair was in the top of a palm about 60 feet from a nest which had just been destroyed. Whenever a second male attempted to alight in the tree, he was immediately and viciously driven off by the first male.

*Courtship.* I first saw a male chasing a female on February 18. Lighting upon the ground 10 to 20 feet from where I was standing, the female lowered and spread her wings, quivering them and twittering, as juveniles do when begging for food, while the male probed her under tail coverts with his bill. An erratic darting flight followed, after which the birds returned to the same place, the female quivering her wings as the birds clasped bills and "wrestled" with each other. Then the male again began probing her under tail coverts with his bill. No attempt to copulate was apparent. The female flew off, with the male in pursuit. During this flight, which was fast, erratic in direction, and at a low height, the male appeared to be trying to grasp the female by, or under, the tail with his bill. Finally, at a height of about 40 feet, the male appeared to secure a good hold and both birds began tumbling downward, recovering about 3 feet from the ground and about 10 feet from where I was standing. They resumed flight without the male losing his grip and flew about for 6 to 8 seconds before the male let go and both birds dropped to the ground. After more bill-clasping and tail-probing, or biting, by the male, both birds flew off. All of these activities, lasting some 15 minutes, and accompanied by much twittering, took place within an area of approximately 4,000 square feet. The courting pair was apparently unnoticed by another pair which was building a nest 12 feet from where I was standing.

I again observed a sexual chase on March 4. After an exciting rapid chase around and about in a small area, the male flying from 3 to 18 inches directly behind the female, the birds perched quietly in a palm tree paying no attention to each other. Some sort of contact, possibly copulation, between a pair was observed after a similar flight on March 11, following which the male flew off singing.

*Nesting.* I discovered three nests while they were being constructed. Two were about three feet from the ground among the exposed roots of uprooted palm trees about 65 yards from the ocean in a partially cleared area, and the third was about three feet below the level of the ground, where a pit some 15 feet in depth and diameter had been dug in the sand, exposing the roots of a palm tree. This site was 15 feet from the other two nests.

I discovered the first nest about 8:00 a.m. on February 18 while the female was building. During a half hour of observation, the female made four trips to the nest, carrying palm fibers and grasses, as well as what looked like spiderweb strands. Before adding material to the nest she appeared to roll the substance in her bill as though putting saliva on it. At this time the general appearance of the nest was that of a few wind-blown grasses or fibers that had caught in the tangled roots of the tree. The bird approached the nest site from various directions but always lit on the branches of a bush or among the roots some three feet away before going to the nest. During this time the male followed the female very closely, but I did not see him carry any nesting material. After the female had added material to the nest, the male once or twice seemed to inspect the work closely before following her. No construction was in progress when I visited the site during the noon hour, but when I returned at about 4.00 p.m. the female was again at work, making about four trips with material during a half hour's observation. All this time the male was still in attendance. By February 24 the nest still appeared no more than a small clump of wind-blown grasses. On February 25 the nest had begun to take form, and an entrance hole was evident near the center of the side away from the sea. Work was still continuing on February 27, and by March 3 the nest was well-formed and quite similar in construction to that of the Baltimore Oriole (*Icterus galbula*) but was about three times as long and much wispiest near the base, so that in general appearance it was still very like a clump of wind-blown grasses caught in the tree roots. The main structure of the nest was about 6 inches in diameter and about a foot in length. During this time neither bird had a favorite perch; both spent much time in the palms, bushes, tree roots, and on the ground, the male singing intermittently. There were usually other pairs of these sunbirds in the immediate vicinity, paying little attention to each other except when a single male would alight in a tree near a pair, and then the intruder would be driven off by the male of the pair.

On March 3 the nest was dislodged by a bulldozer pushing stumps into a pile around the nest site. I found the nest little damaged on the ground. I hung it in the same place it was before, but although it hung there for several days and a pair of sunbirds frequented the immediate vicinity, I never saw one visit the nest again, and no further work on the nest was ever evident. On March 11 I saw a female carrying nesting material in the vicinity, and on March 18 I discovered the new nest among the roots of the pile of stumps about 12 feet from the location of the former nest. It was nearly complete, with the entrance hole on the opposite side from that of the first nest. This nest was later abandoned, probably because it was adjacent to a truck-parking area, and throughout the day and night trucks were being parked within two feet of the nest.

On February 24 I discovered a nest in the sandy pit. It was nearly completed, and both birds were behaving as those described above. The pair in the pit and the pair found February 18 that built a nest in the stumps were working on their respective nests at the same time. I collected the female of the pair building in the pit about 7:30 a.m. on February 24 while she was working on the nest. Sticky strands of what appeared to be spiderweb about an inch and a half long hung from her bill. (The specimen is in the University of Michigan Museum of Zoology Collection. Eyes, bill, and feet black; ovary much enlarged.) At 12:30 p.m. on February 24 a pair was working on the nest in the pit, the female carrying nesting material to the nest and working on it. At the same time I saw the other pair at the nest in the stumps, so that the new female could not have been the one of that pair. A pair continued to work on the nest in the pit until it was destroyed by filling in the pit on March 3, after which, due to clearing activities, few birds were seen, and none carrying nest material.

Ogilvie Grant and Whitehead (1898. "On the Nests and Eggs of some rare Philippine Birds," *Ibis*, 1898:243) describe the nest of this species as a "neatly-woven pocket-shaped structure, with a roofed entrance at the side. It is composed of fibre, dead grasses, and other forest débris, bound together with spiders' webs, and lined with cotton and fine grass."

*Perches and roosting behavior.* Palm leaves and dead branches of trees or bushes varying from 5 to 40 feet in height from the ground were used as singing perches. Roosting perches were under the leaves of trees or bushes some 15 feet above the ground. As many as 12 or 15 Yellow-breasted Sunbirds would roost in an area of roughly 10,000 square feet. At the approach of evening there was a constant calling and twittering before the birds began to settle down. When it began to get dark, single birds and pairs would drop out of the general activity and alight on a branch within a foot or two of their perch, which they finally reached in two or three hops. After leaving the others to go

to their roost, the birds at first seemed tense and nervous, each spending a full minute or more before finally settling at their chosen spot for the night. The protecting leaves under which they hid motionless were three to five inches above the roosting branch, forming a horizontal roof. The birds usually roosted singly, but a pair was once seen roosting within a foot of each other. Members of a pair would occasionally roost about three feet apart; the male and female of one pair selected different trees, their perches about six feet apart and eight feet from the ground. On March 11 three or four pairs were roosting together, as pairs, in a dense growth of trees or bushes, perching 6 to 15 feet above the ground.

Although on March 16 and 17 I saw flocks of males and females roosting (the individuals fairly close to each other), almost all sunbirds roosting in the same area on March 24 were males. On this later date one male viciously attacked and drove away any bird that came within 20 feet of its perch, and attacked dragonflies and flying bugs that came within 3 to 5 feet. He did not molest a female sunbird only 6 feet away; when it was almost completely dark, the male quickly perched on a twig directly above and only 6 or 8 inches from the female: both birds being directly under leaves, as usual, and perched at a height of 18 to 20 feet from the ground in one of the larger trees in the area and just a few feet above the tops of most of the bushes. On March 26, a pair, presumably the same birds, were roosting on the same perches, with two other male birds roosting alone within 10 feet of them.

The same perches seemed to be used night after night: I saw male or female birds perched in the same place time after time, never a bird of one sex on a perch where I had previously seen a bird of the opposite sex. When the birds had once settled on their roosting perch, they became more reluctant to leave it as darkness increased. I could shoot at them three or four times with gravel in a sling-shot before they would leave; and they would return shortly afterward, dropping very quickly to their former perch or flying directly to it when it was very dark.

2002 GEDDES AVENUE, ANN ARBOR, MICHIGAN

## SOME KANSAS BIRD RECORDS

BY M. DALE ARVEY AND HENRY W. SETZER

DESPITE the extensive ornithological collections that have been made in the vicinity of Lawrence, Douglas County, Kansas, kinds of birds unusual for the county, as well as for the State, continue to be found in the county from time to time. The following records of birds are mainly from a collection of mounted birds kindly lent by Ralph L. Montell, of Lawrence, Kansas, whose intelligent curiosity led him to save unusual specimens of wildfowl. We are grateful also to George H. Lowery, Jr., who checked the identification of the specimens suspected of being Mottled Ducks.

*Colymbus auritus*. Horned Grebe. The only occurrences of the Horned Grebe previously ascribed to Kansas are: one specimen "taken at Manhattan on September 30, 1878," and a specimen "in winter plumage in the Matthews collection at Wichita University . . . probably taken near Wichita, but . . . no data attached" (Long, 1935, MS).

According to the A.O.U. Check-list (1931:4), the interior winter records are "mainly from the region of the Great Lakes." A male, No. 54, Montell collection, was obtained 2.5 miles north of Lawrence, Douglas County, Kansas, on the mill pond of the Kansas River, on 16 November 1945, by Montell. This is the second Horned Grebe definitely known to have been taken in Kansas, and the first from Douglas County.

*Aechmophorus occidentalis*. Western Grebe. There are only three previously known occurrences of the Western Grebe in Kansas, the latest a bird (K.U. [University of Kansas Museum of Natural History] No. 6854) taken on 8 November 1901, "in Shawnee County," Kansas. Long (1935, MS) states that another mounted bird in the collections of the University of Kansas (No. 8653) was apparently taken in Douglas County. A second record from Douglas County (the fourth from the State) is provided by a male, No. 89, shot 2 miles north of Lawrence on the Kansas River, Douglas County, on 11 November 1947.

*Anas fulvigula maculosa*. Mottled Duck. In 1886, Goss (1886:6) recorded a female specimen of *Anas fulvigula* taken by him at Neosho Falls, Woodson County, Kansas, on 11 March 1876. He tells also of seeing three other ducks of this species, one of which he shot but apparently did not save. This identification was later amended by Goss (1891:58) to *Anas fulvigula maculosa*. The first edition of the A.O.U. Check-list (1886:115) and all subsequent editions, cited the

species as of casual occurrence in Kansas. Long (1940:437) stated that there were four specimens known from the State. These, apparently, were the following: K.U. No. 3503, ♀, taken in Douglas County on 6 October 1894, by an unknown collector; K.U. No. 4503, ♀, taken 31 March 1895, and without further data; Kansas State Teacher's College, uncatalogued, ♀, taken at Emporia on 12 March 1890, by A. L. Bennett; and finally the specimen, taken by Goss, referred to above and now in the Museum of the Kansas State Historical Society in Topeka. Re-examination of these specimens reveals that the two in the University of Kansas Museum of Natural History are typical examples of the Mallard, *Anas p. platyrhynchos*, and that the specimen at Emporia is a Gadwall, *Anas strepera*. The specimen taken by Goss was correctly identified. Because of the difficulties in identification of subspecies of this group in the field, the only acceptable record of occurrence of the Mottled Duck in Kansas is provided by Goss' specimen, and the subspecies must be regarded as an accidental straggler to the State.

*Clangula hyemalis*. Old-squaw. There are four previous records for this duck in Kansas, none of them from Douglas County (Long, 1935, MS). Two specimens, Nos. 40, ♂, and 54, ♀, Montell collection, were taken by Montell in Douglas County: No. 40 on Oxbow Lake, 3 miles northeast of Lawrence, on 7 December 1944, and No. 54 at a point 2.5 miles north of Lawrence, on the Kansas River, on 10 November 1945. These constitute the first records for Douglas County, and the fifth and sixth for Kansas. The A.O.U. Check-list (1931:54) does not mention the occurrence of this species in Kansas.

*Somateria spectabilis*. King Eider. This species, previously unrecorded from Kansas, can now be added to the list of Kansas birds as an accidental straggler on the basis of specimen No. 88, ♂, taken by Ralph L. Montell a mile east of Lawrence on the Kansas River on 24 November 1946. Bent (1925:119) states that a bird of this species has been taken at Keokuk, Iowa, in winter. Other casual occurrences are recorded from the Great Lakes. The identification of this specimen was kindly confirmed by Dr. Herbert Friedmann of the United States National Museum.

*Gallinula chloropus cachinnans*. Florida Gallinule. This bird, recorded by Long (1940:441), on the basis of one nest found in Coffey County, as resident in Kansas, has been discovered breeding in Douglas County. R. L. Montell found a nest of this bird and obtained the female (No. 80 in his collection) at Oxbow Lake, 3 miles northeast of Lawrence, on 22 May 1946. Two chicks from the nest were hatched artificially but were not preserved.

*Caprimulgus carolinensis*. Chuck-will's-widow. This bird is recorded as common in southeastern Kansas by Long (1940:445). Long (1935, MS) lists several birds seen and one specimen taken as far north as Douglas County. The A.O.U. Check-list (1931:173) lists the bird only from the southern part of Kansas. A male was taken by Arvey on 1 July 1948, one mile south of Clinton, Douglas County (K.U. No. 25026). One other bird was seen in the same locality, and several were heard. The bird had enlarged testes, and it would appear, from this and the number of birds present, that a breeding population existed here. This is the second specimen from Douglas County, the first having been taken by Long "7½ miles southwest of Lawrence on May 4, 1935."

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THE EDWARD HARRIS COLLECTION OF BIRDS

BY PHILLIPS B. STREET

RELATIVELY little has been written on the life of Edward Harris (1799-1863) in comparison with most other ornithologists of a hundred years ago. Until recently, the only intimate account that I was able to find was one in *Cassinia* for 1902 by George Morris, of Philadelphia, a great-nephew of Harris' friend, Dr. John Spencer. Many of Harris' letters and diaries were available to Morris, who mentions how important a part Harris played in the life of Audubon and in the ultimate success of his great undertaking of portraying the birds of America:

“. . . were the whole truth told of the life and deeds of Edward Harris, the ornithological world at least would learn that it owed him a deep debt of gratitude. . . .

“It is true that in the fields of actual discovery his name is hardly known. It was as a friend and patron of scientific men that he made his influence felt—an influence exerted so quietly and modestly that its full force might easily be overlooked, especially at this late day. Of those who shared the friendships and reaped the bounty of Edward Harris, it is probable that no one was more deeply indebted to him than Audubon.”

The most detailed account of Harris' life yet published has recently appeared (1947) in a paper of the Newcomen Society entitled “Edward Harris, Friend of Audubon,” by Peter A. Brannon, of the Alabama State Department of Archives and History. William Ustick Harris, of Jackson, Alabama, a grandson of Edward Harris, has presented to the State of Alabama a collection of his grandfather's papers, journals, and relics, and it is from this material that Brannon prepared his interesting Harris biography.

My interest in Harris also stems from a collection—his bird collection—and a report of its discovery and contents is a necessary addition to the Harris story.

In October 1937, a Philadelphia contractor, Henry Makin, visited the office of my father, the late J. Fletcher Street, and, knowing my father's interest in birds, remarked that his parents had in their Moorestown, New Jersey, barn, stored in old boxes and trunks, a collection of birds which had once belonged to an Edward Harris. He said that Harris had given them to his father, together with several items of furniture, guns, and a mineral collection, in lieu of cash in settlement of a plumbing bill. The donor proved to be Edward Harris, 3rd, a son of the ornithologist.

My father journeyed to Moorestown and brought away twelve bushel baskets of birds, the skins varying in condition from good to exceedingly poor. The condition of many of the specimens was ex-

plained by the Makins. The birds were originally delivered in a large case of drawers; in due course Mrs. Makin decided the case would make a fine linen chest and demanded the removal of the skins. They were then placed in large packing boxes and an old trunk and removed to the loft of the barn. The capacities of the containers could not have been very generous, for Mr. Makin, Sr., advised my father that he had to press the birds down with his feet in order to close the lids. Then Henry Makin, growing up to young manhood and becoming interested in the collection of guns, decided to try them out, using the stuffed birdskins as targets . . . . Some 400 identifiable skins remain, representing 228 species, including many headless birds, separate heads, wings, and feet. It is regrettable that so many labels are missing and so many skins partially or wholly destroyed that a complete account of the collection is impossible.

Harris apparently collected relatively few of the specimens himself. Except for those traceable to the Audubon Missouri River Expedition, of which Harris was a member, all but a few of those skins which bear labels can be attributed to Spencer Baird, to John K. Townsend's Pacific Coast Expedition, or to Auguste Lefevre, a French naturalist. There is not a single skin whose label indicates that it was taken in the vicinity of Harris' New Jersey home.

Upon his return from Europe in 1836, Audubon wrote to Harris from New York and asked Harris to aid him in procuring permission to portray the birds which Townsend and Nuttall had collected in the Rockies and along the Pacific Coast. As Audubon stated, the collection had been entrusted to the Academy of Natural Sciences of Philadelphia; it contained "about forty new species of birds, and its value cannot be described." Townsend was still in the far west, and hence the Academy would not allow Audubon to make off with and describe the new birds. Audubon's efforts to gain permission being unsuccessful, Harris made an offer of five hundred dollars for the purchase of the entire collection, but this too was rejected. At length Audubon went to Boston and consulted Thomas Nuttall. Then, through the influence of Nuttall, who understood Audubon's desire to include the new birds in his great work, it was arranged that a committee should publish the descriptions in the Academy's "Journal" under Townsend's name and that Audubon be allowed to purchase the duplicates to paint and publish in his Giant Folio. Finally Audubon purchased some ninety-odd skins (F. H. Herrick, 1917. "Audubon the Naturalist," vol. 2, p. 154). I have found three skins from the Columbia River with Townsend's original labels; others, unlabelled, may be properly attributed to the same journey, among them five drepanids from the Hawaiian Islands, including the rare *Hemignathus lucidus hanaepepe*.

Two of the Townsend skins are Snowy Egrets, *Leucophoyx thula*, taken at Walla Walla, Columbia River, on July 3 and August 13, 1836.

Townsend, in his journal of this trip ("Narrative of a journey across the Rocky Mountains to the Columbia River," 1839), includes in the appendix a "Catalogue of Birds Found in the Territory of the Oregon" and fails to list the Snowy Egret. Gabrielson and Jewett (1940. "Birds of Oregon," p. 109) list the Snowy Egret as a "rare straggler." These two specimens, therefore, are important early Oregon records.

There is also an unlabelled male Hermit Warbler, *Dendroica occidentalis*, which I am prepared to claim as one of the two cotypes of the species. This to me is the prize find of the entire collection. I realize the hazard of attempting to prove an unlabelled skin to be a type, yet I feel that the facts warrant the assertion. The points which I submit in evidence are these:

1. Townsend collected but a single pair of Hermit Warblers. They were taken "in a pine forest on the Columbia River on the 28th of May, 1835" (*Jour. Acad. Nat. Sci. Phila.*, 7, 1837:190).

2. There is no evidence that any of the specimens in the Harris collection from the Pacific Northwest are from any source other than the Townsend and Audubon Expeditions, and no *D. occidentalis* was taken on the latter.

3. The pair of Hermit Warblers shot by Townsend were among the birds given to Audubon to be figured in his Giant Folio and described in his Ornithological Biography (1839, vol. 5, p. 55), and the measurements given by Audubon in his description of that male compare with the measurements of mine, as follows:

	Harris Collection	Audubon's	Harris Collection	Audubon's
Wing	70.0 mm. or 2 9/12 in.	2 8/12 in.	Culmen 8.75 mm. or 4/12 in.	4/12 in.
Tail	45.5 mm. or 1 9/12 in.	1 9/12 in.	Tarsus 17.25 mm. or 8/12 in.	8/12 in.

4. Neither cotype is in the U. S. National Museum, though so reported by Ridgway (1902. *U.S.Natl.Mus.Bull.* 50, pt. 2:569). H. G. Deignan states (*in litt.*, Nov. 6, 1947) that it is doubtful whether either cotype has ever been in that collection and suggests that my "male *Dendroica occidentalis* might be one of the original specimens."

In 1837 Audubon planned to explore the west coast of Florida in company with his son and Harris and to proceed as far as possible westward along the Gulf Coast into Texas. The Florida part of the expedition failed to materialize, due principally to the Seminole War, but the party did journey from Charleston through Georgia and Alabama to New Orleans, collecting for three weeks in that vicinity, and then proceeding to Galveston, Texas. There is a brief Harris journal of this trip in the papers now in Alabama, which includes a list of the birds shot and seen. Since the Audubon journal of this expedition was lost and never published, the Harris list fills a gap in the early Ameri-

can literature and is included here (Table 1). There is not a single specimen in the Harris collection bearing a label that indicates it was taken on this trip. Included among the birds, however, are the following (unlabelled): Swallow-tailed Kite (*Elanoides forficatus forficatus*), Mississippi Kite (*Ictinia mississippiensis*), Audubon's Caracara (*Polyborus cheriway auduboni*), Roseate Spoonbill (*Ajaia ajaja*), and Texas Kingfisher (*Chloroceryle americana septentrionalis*).

In December 1838, Audubon writes to Harris from London, "I feel a great pleasure in preparing a box of bird skins for you according to your desire." Whether or not any of the skins I hold are of that shipment I have no means of determining, but sixty skins, mainly shore and water birds, bear the French labels of "Aug<sup>e</sup> Lefevre, Naturaliste, 24 rue Dauphine à Paris."

Audubon set out on his Missouri River Expedition in the spring of 1843. Accompanying him were his friend Harris (who, no doubt, more than paid his own way), John G. Bell, as taxidermist, Isaac Sprague, as artist, and Lewis Squires, as general assistant and secretary. During this journey, which lasted some eight months, Audubon kept a voluminous journal which was published in 1898 by his granddaughter, Maria Audubon, as a part of the work entitled "Audubon and His Journals"; and Harris (*Smiths. Inst. Fifth Ann. Rept.*, 1851:136-138) published a "List of Birds and Mammalia Found on the Missouri River from Fort Leavenworth to Fort Union . . ." It was not until recently, however, that it became generally known that Harris also kept a diary (which compares favorably with Audubon's in every respect), and this is one of the Harris papers donated to the State of Alabama Department of Archives and History. A copy has been made from the original and sent to the Academy of Natural Sciences, and I have had the pleasure of studying it and comparing it with Audubon's. It has been of material assistance in the appraisal of this collection.

The party left Philadelphia on March 13 and arrived in St. Louis March 28. On April 4, all except Audubon left St. Louis for a few days' collecting in southern Illinois. They returned to St. Louis on April 13. In the Harris collection is a Meadowlark, *Sturnella magna*, which was taken on this side trip. The expedition proper got under way April 25, sailing on the *Omega*. Under date of May 2, Harris writes:

"Arrived at Independence this morning and took on 144 lbs of Tow which we had written for. We paid 25 cts. per lb. for it!!! Saw abundance of Parroquets today. Bell shot two at the first stopping place."

May 3: "Stopped at Fort Leavenworth to take on some cargo. Saw abundance of Parroquets but did not procure any."

Under date of May 4, Audubon in his journal mentions the taking of seventeen Parroquets. There are five Louisiana Parroquets in the Harris collection, one taken May 3, two on May 4, and two undated but taken in the same locality.

There is much in the journal to indicate how careful an observer Harris was. Under May 4, for example, he writes:

"Missouri R. below black-snake Hills shot a Finch supposed to be new, it has a black head and throat, with a large patch of ash color on the cheeks and lore space running back to its neck. Shot a number of Parroquets today."

May 6: "Shot another Finch of the same species as that of Thursday in better plumage. Both Males. It corresponds in measurements with Townsend's Finch *F. Townsendii* which was described from a female bird and does not correspond—possibly this may be the male of that bird. We hope to find the female soon."

May 8: "Shot another of the rare Finchs."

Although there must have been considerable discussion over the new finch (for Harris certainly indicates his doubt), Audubon on May 17 writes in his journal: "I am truly proud to name it *Fringilla Harrisii*, in honor of one of the best friends I have in this world." The finch proved to be *Fringilla* [*Zonotrichia*] *querula* of Nuttall, but the vernacular name, "Harris' Sparrow" remains as a fitting memorial to the subject of this paper.

The journey from St. Louis to Fort Union, at the mouth of the Yellowstone River, took, according to Harris' entry for June 12, "some 17 hours less than 7 weeks and [we] arrived here earlier in the season by one day than has ever been done before and made a quicker passage than any other boat by about 15 days." In spite of the record speed made upriver, there was much time spent in collecting, observing the Indians, and buffalo hunting. None of my skins bear labels that positively indicate their being taken on the journey up to Fort Union, but by listing the birds mentioned in the Audubon and Harris journals as having been shot en route and comparing them with my skins, it is evident that many are the same.

One Western Meadowlark, *Sturnella neglecta*, bears the label "Missouri River 1843." It is interesting to note that both Harris and Audubon recognized this to be a new species even before a specimen had been secured. It was described by Audubon the following year. Harris remarks—

May 22: "We have seen a Meadowlark to-day which must prove a new one, its note is so entirely different from ours."

May 24: "We killed Red-shafted Woodpecker, Say's Flycatcher, Arkansas F., Lark Finch and several of the new Meadow Larks, for new I will insist it is notwithstanding that we cannot from the books establish any specific difference, yet it is totally different. But as we cannot set down these notes on paper, and the world will not take our words for it if we do, we must be content to refrain from publishing this good species unless we can on our return find a something about the bird

TABLE 1  
FROM HARRIS' JOURNAL OF THE GULF COAST EXPEDITION

List of Birds procured and seen on Mr. Audubon's expedition from the S.W. Pass of the Mississippi to Galveston Bay in Texas between the 1st of April 1837 and 18th of May 1837.

Names of Birds	Dates last seen at respective places					
	S. W. Pass	Grand Terre	Cayo	Dernier Isle	Achafalaya Bay	Galveston Bay
Green Heron	From Apr. 1 to 2	From Apr. 3 to 9	Seen	Seen	Seen	Seen
Spoon-Bill Duck	Seen	Shot	Seen	Seen	Seen	Seen
Gadwall Duck	Shot	Abundant	Seen	Seen	Seen	Seen
Blue Winged Teal	Do	Shot, Abundant	Seen	Seen	Seen	Seen
Green Winged Teal	Do	Abundant	Seen	Seen	Seen	Seen
Black Duck. <i>A. obscura fusca</i>	Do	Abundant	Seen	Seen	Seen	Seen
Mallard	Seen [cancelled?]	Seen	Seen	Seen	Seen	Seen
Wood Duck		Shot	X [?]	X	X	X
Widgeon		X				
Pintail						
Canvass Back	Seen					
Harlequin Duck	Seen	X	X	X	X	X
Sanderling	X					
Stilts		X	X	X	X	X
Oystercatcher		Shot	X	X	X	X
Plover, Piping		Shot	X	X	X	X
Wilson's P.		Shot, Abundant	X	X	X	X
Ring P.						
Black-bellied P.		Saw some flocks	X	X	X	X
Golden P.		X	X	X	X	X
Turnstone		X	X	X	X	X
Great Blue Heron		X	X	X	X	X
Great White H.		X	X	X	X	X
White Egret		X	X	X	X	X
Louisiana Heron		X	X	X	X	X
Night H.		X	X	X	X	X



TABLE 1—Continued  
FROM HARRIS' JOURNAL OF THE GULF COAST EXPEDITION

List of Birds procured and seen on Mr. Audubon's expedition from the S.W. Pass of the Mississippi to Galveston Bay in Texas between the 1st of April 1837 and 18th of May 1837.

Names of Birds	Dates last seen at respective places					
	S. W. Pass	Grand Terre	Cayo	Dernier Isle	Achafalaya Bay	Galveston Bay
Least Tern	From Apr. 1 to 2	From Apr. 3 to 9	X [cancelled?] X [cancelled?]	X [cancelled?] X [cancelled?]	X [cancelled?] X [cancelled?]	X X X X X X X
Black Tern						X X X X X X X
Sooty Tern						X X X X X X X
Black-headed Gull	Shot X	Shot X	X X X	X X	X X	X X X X X X X
Common Gull						X X X X X X X
Herring Gull ( <i>argentatus</i> )						X X X X X X X
Snow Goose						X X X X X X X
Goosander						X X X X X X X
Red-breasted Merganser						X X X X X X X
White Pelican	X	Seen. Shot Abundant	X X X X X X X	X X X X X X X	X X X X X X X	X X X X X X X
Brown Pelican						X X X X X X X
Florida Cormorant						X X X X X X X
Frigate Pelican						X X X X X X X
Snake-bird						X X X X X X X
Loon						X X X X X X X
Black-throated Diver						X X X X X X X
LAND BIRDS						X X X X X X X
Turkey Buzzard	X	X	X	X	X	X X X X X X X
Carrion Crow	X	X	X	X	X	X X X X X X X
Peregrine Falcon	X	X	X	X	X	X X X X X X X
Sparrow Hawk						X X X X X X X
Pigeon Hawk						X X X X X X X
Fish Hawk						X X X X X X X
Mississippi Kite						X X X X X X X
Swallow-tailed Hawk						X X X X X X X
Red-Shouldered Hawk	At New Orleans	X	X	X	X	X X X X X X X
Marsh Hawk	Seen	Seen	X	X	X	X X X X X X X





TABLE 1—Continued  
FROM HARRIS' JOURNAL OF THE GULF COAST EXPEDITION

List of Birds procured and seen on Mr. Audubon's expedition from the S.W. Pass of the Mississippi to Galveston Bay in Texas between the 1st of April 1837 and 18th of May 1837.

Names of Birds	Dates last seen at respective places					
	S. W. Pass	Grand Terre	Cayo	Dernier Isle	Achafalaya Bay	Galveston Bay
Golden-crowned Do.	From Apr. 1 to 2	From Apr. 3 to 9	X	X	X	X
Summer Yellowbird		X	X	X	X	X
Hooded Warbler		X		X	X	X
Yellow-throated Warbler				X	X	X
Blackburnian W.				X	X	X
Chestnut Sided W.				X	X	X
Bay-breasted W.			X	X	X	X
Black & White Creeper				X	X	X
Pine Warbler				X	X	X
Blue-yellowbacked W.			X	X	X	X
Maryland Yellow-throat		Seen	X	X	X	X
Kentucky Warbler				X	X	X
Cerulean Warbler			X	X	X	X
Worm-eating Warbler				X		
Prothonotary W.				X		
Blue-winged Yellow W.				X		
Golden-winged W.				X	X	X
Tennessee W.				X		
Nashville W.				X		
Roscoe's W.				X		
Carolina Wren				X		
Short-billed Marsh Wren	Abundant	X	X	X	X	X
Marsh Wren		X	X	X	X	X
Blue bird		X	X	X	X	X
Brown Lark		X	X	X	X	X
Shore Lark		Seen here	X	X	X	X
Black-throated Bunting					X	



more than we can now discover to establish a specific difference: *Mais nous verrons.*"

June 20: "Sprague pointed out to me to-day a passage in Lewis & Clark's Journal with which we were unacquainted before but which goes far to confirm us in the opinion of the whole of our party that the Meadow Lark of this country is a new one, although we are not prepared without thorough examination and comparison to vouch for any of the differences mentioned by them with the exception of the notes of the bird about which there can be no question. It surprises me that Mr. Nuttall could have passed through this country without noticing this bird as he is so remarkably accurate in describing the notes of birds, indeed, he is almost the only man who has written the language of birds."

June 21: "I neglected last night to give the extract from Lewis and Clark's Journal about the Meadow Lark and will insert it here. It was on the 22nd of June while they were making the portage around the Great Falls of Missouri. They say 'There is also a species of Lark, much resembling the bird called the Old-Field Lark, with a yellow breast and a black spot on the croup, though it differs from the latter in having its tail formed of feathers of an equal length and pointed; the beak too is somewhat longer and more curved, and the note differs considerably.'"

I have seven skins bearing labels from Fort Union (western North Dakota), where the expedition maintained headquarters for two months.

The hybrid flicker ("*Picus ayresii*" of Audubon) and Sprague's Pipit (*Anthus spraguei*) were discovered on June 19. Harris writes: "This morning proved cold and rainy, and we did not go out, but it cleared off partially in the afternoon and Bell and I went out. Bell shot a Yellow-winged Woodpecker with a red stripe on the cheek (instead of a black one as in the common species). This is no doubt a new species to our Fauna, but I am inclined to think that I have somewhere seen a specimen of this bird and that it will not prove entirely new. As we returned home Bell and I fired together and shot a small bird which proves to be an entirely new *Anthus* or Titlark."

Audubon writes: "Harris and Bell have returned, and, to my delight and utter astonishment, have brought two new birds: one a Lark, small and beautiful; the other like our common Golden-winged Woodpecker, but with a red mark instead of a black one along the lower mandible running backward."

I have a Sprague's Pipit labelled "Fort Union, June 24/43." Cotypes are in the Academy of Natural Sciences and the United States National Museum. My specimen, taken the same day as the Academy's, is another cotype. Under date of June 24, Harris remarks: "In the afternoon Bell and Mr. Audubon rode down to the Fort again and on

their way killed more of the new Larks. Sprague was out and killed another, and what is of more consequence discovered its nest with 5 eggs, it is built of grass and placed in a hole in the ground so that the top of the nest is even with the surface, the eggs are thickly spotted of a chocolate color. Mr. Audubon remarked that it had very rarely happened to him to discover a new bird and to ascertain all its habits and to procure its nest and eggs in the course of a few days as has been the case with this bird."

The "new flickers" were the subject of much discussion in both journals, and Harris in particular has much to say about them under dates of July 1 and 2. "I would give a great deal to have Dr. Bachman here with a dozen specimens of Golden-wings from our side of the mountains," he remarks, "wouldn't we make a night of it?"

June 26: "Bell and I walked out with our guns and procured 3 Lazuli Finches." I have one taken on this date.

Much of the latter part of the stay at Fort Union was devoted to buffalo hunting, and the pages of Harris' journal include lengthy descriptions of these experiences. The Harris entry for July 16 tells the story of the most thrilling of these experiences:

"At this stage of the proceedings Owen discovered another Bull making his way slowly across the Prairie directly towards us. I was the only one of the party that had balls for his gun and I would have gladly claimed the privilege of running him but fearing that I might make out badly on my first trial run with my large gun which is altogether too large to run with (weighing eleven pounds) and supposing the meat could be carried to the Fort where it was wanted. I handed my gun and balls to Owen and Bell and I placed ourselves on eminence to view the chase. Owen approached the Bull who had continued to advance and was now about a quarter of a mile distant. The Bull either did not see him or did not heed him and they advanced directly toward each other until they were about 70 or 80 yards when the Buffalo started at a good run, and Owen's mare, which had already had two hard runs this morning had great difficulty in preserving her distance. Owen soon perceived this and applied the whip pretty freely he was soon within shooting distance and fired a shot which sensibly checked the progress of the animal and enabled him quickly to be alongside of him when he discharged the second barrel into his lungs, passing through the shoulder blade, which brought him to stand precisely in the position represented in Catlin's work of the wounded bull . . . . But to return to the Bull—Bell and I started now at top of our speed and as soon as we were within speaking distance called to Owen not to shoot again. The Bull did not appear to be much exhausted, but he was so stiffened by the shot in the shoulder that he could not turn quickly, taking advantage of which we approached him, as we came near he would work himself slowly around to face us and then make a

pitch at us. We then stepped to one side and commenced discharging our six-barrelled pistols at him with little more effect than increasing his fury at every shot. His appearance was now one to inspire terror, had we not felt satisfied of our ability to avoid him. I came however very near being overtaken by him through imprudence. I placed myself directly in front of him and as he advanced I fired at his head and then ran directly ahead of him, not supposing he was able to overtake me, but casting my head over my shoulder I saw Mr. Bull within three feet of me, prepared to give me a taste of his horns. The next moment I was off the track and the poor beast was unable to turn quick enough to avenge the insult. Bell now took the gun from Owen and shot him directly behind the shoulder blade, he stood tottering for a few moments with an increased gush of blood from the mouth and nostrils, fell easily on his knees and rolled over on his side and was soon dead."

A curious fact is revealed by a comparison of this entry with that of Audubon in his journal of the same date. The same thrilling story appears, printed almost sentence for sentence (with some change in wording) as told by Harris, as though the experience were Audubon's. Is it possible that faulty copying of the Audubon manuscript in preparation for its publication was responsible for the omission of credit to Harris?

July 29: "I should have mentioned that on Thursday morning at our encampment at the Trois Mamelles Bell shot a Titmouse very similar in its markings to the common Northern Chickadee, but which measures  $\frac{7}{8}$  of an inch more in length, than the measurements in Mr. Audubon's Syn., appears to us to have a larger tail and more white on the secondaries, and its note although very similar appears softer and less hurried in utterance."

Audubon failed to recognize it as anything new, and wrote as follows on July 27: "Bell went to skinning the birds shot yesterday, among which was a large Titmouse of the Eastern States." It did prove, however, to be the bird now known as the Long-tailed Chickadee, *Parus atricapillus septentrionalis*, and was described by Harris as *Parus septentrionalis* (*Proc. Acad. Nat. Sci. Phila.*, 11, 1845:300), the only bird ever described by him.

At the same time, Bell and Harris shot several sparrows which appeared to belong to a new species. Audubon described them and named them *Emberiza* [= *Ammodramus*] *bairdii*, Baird's Bunting, in honor of his young friend, Spencer Fullerton Baird, who had been invited upon the expedition and had had to decline. This was the last bird named, described, and figured by Audubon, the plate being the final one reproduced in the octavo edition of the *Birds of America* (1844).

The party left Fort Union on August 16 and arrived at St. Louis on October 19. Here the skins were divided up, and a supplemental Harris pocket diary for 1843 includes the following list as his share:

LIST OF BIRD SKINS PACKED BY SPRAGUE AND BELL FOR SHARE OF E. HARRIS  
AT ST. LOUIS

1 Wild Turkey	2 Western Shore Larks
1 White-fronted Goose	1 Baltimore Oriole
1 Blue Heron	8 Sprague's Lark
1 Sandhill Crane	4 Lincoln Finches
2 Sharp-tailed Grouse	1 Muscicapa?
10 Parrots	1 Finch?
1 Magpie	1 Smith's Lark Finch
8 M. Lark	1 Chestnut-collared Bunting
5 Yellow-headed Troupials	4 Arctic Bluebirds
2 Rusty Grackles	1 Golden-winged Warbler
6 Black-headed Grosbeaks	1 Worm-eating Warbler
12 Arkansas Flycatchers	8 Shattuck's Bunting*
9 Arctic Pipilos	6 Rocky Mt. Wren
13 Lark Finches	4 Lazuli Finches
3 Rose-breasted Grosbeaks	4 White-crowned Sparrows
1 Purple Martin	1 Hutchin's Goose
2 Cow Buntings	1 White Pelican
1 Rice Bird	11 Pinnated Grouse
1 Cardinal Bird	2 Bell's Vireo
3 Say's Flycatchers	1 New Black-capped Titmouse
2 Cliff Swallows	1 Young Snow Goose
	2 Tennessee Warbler

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\* Clay-colored Sparrow.

## OUT OF THE LIST SENT TO BELL IN EXCHANGE

3 Pinnated Grouse	2 Black-headed Grosbeak
3 Arkansas Flycatcher	2 Arctic Pipilos
3 Lark Finch	1 Young-Rocky Mt. Wren

There are forty-two skins in the Harris collection which were contributed by Spencer Baird; twenty of these bear descriptive labels, and the remainder simply have labels in Baird's hand, noting the species but omitting dates and localities. Herbert Friedmann advises me that the twenty labelled skins were entered in the catalogues of the Smithsonian Institution and must therefore have been in Baird's possession after his coming to the Smithsonian in 1850. He also reports a statement in an old memorandum (listing specimens sent to various persons by Baird prior to his connection with the Institution) that in 1844 Baird sent seventy specimens to a Mr. Edward Harris. Of the Baird skins which do bear data, all but two were taken at Carlisle, Pennsylvania, his boyhood home, between 1842 and 1845, the exceptions being a Bachman's Sparrow (*Aimophila aestivalis bachmanii*), taken in 1845 at Savannah, Georgia, and a Western Bluebird (*Sialia mexicana occidentalis*), from California, undated, which was probably a Townsend skin. Baird, in a letter to his brother, William, in January 1844, mentions getting "a number of California duplicates from Cassin in the Academy" (W. H. Dall, 1915. "Spencer Fullerton Baird: A Biography," p. 108).

The most interesting Baird specimens are a Passenger Pigeon, *Ectopistes migratorius*, taken at Carlisle on October 19, 1844 (another Passenger Pigeon is unlabelled) and three *Empidonax* flycatchers, including two of Baird's own discoveries, the Yellow-bellied, *E. flaviventris*, and the Least, *E. minimus*. Both species were described by Spencer and William Baird in September 1843 (*Proc. Acad. Nat. Sci. Phila.*, 1:283-284), and my skins bear May labels of that year.

It would serve little useful purpose to list the entire 400 specimens which comprised the Harris collection as found, including the unlabelled birds and the French trade-skins. Those of particular interest, however, are as follows:

FROM JOHN K. TOWNSEND

1. *Leucophoyx thula brewsteri* (Snowy Egret), ♂, Walla Walla, Columbia River, July 3, 1836.
2. *Leucophoyx thula brewsteri* (Snowy Egret), Walla Walla, Columbia River, August 13, 1836.
3. *Perisoreus obscurus obscurus* (Oregon Jay), ♂, Columbia River, October 11, 1836 (on this date, Townsend was at Ft. Vancouver).

UNLABELLED SKINS, MOST OF WHICH MAY BE ATTRIBUTABLE TO THE  
TOWNSEND EXPEDITION

1. *Recurvirostra americana* (Avocet)
2. *Haematopus bachmani* (Black Oyster-catcher)
3. *Sphyrapicus varius ruber* (Red-breasted Sapsucker)
4. *Cinclus mexicanus unicolor* (Dipper)
5. *Ixoreus naevius* (Varied Thrush)
6. *Moho nobilis apicalis* (Double-plumed Moho)
7. *Hemignathus lucidus hanapepe* (Nukupu)
8. *Himatione sanguinea* (White-vented Honey-eater)
9. *Vestiaria coccinea* (Red Sickle-bill)
10. *Vestiaria coccinea* (Red Sickle-bill)

FROM THE MISSOURI RIVER TRIP

1. *Pedioecetes phasianellus* (Sharp-tailed Grouse), Ad., Fort Union, June 26, 1843
2. *Conuropsis carolinensis ludovicianus* (Louisiana Paroquet), Kickapou Country, Missouri River, May 3, 1843.
3. *Conuropsis carolinensis ludovicianus* (Louisiana Paroquet), Kickapou Country, Missouri River, May 4, 1843.
4. *Conuropsis carolinensis ludovicianus* (Louisiana Paroquet), Kickapou Country, Missouri River, May, 1843.
5. *Conuropsis carolinensis ludovicianus* (Louisiana Paroquet), Above Ft. Leavenworth, Missouri R., May 4, 1843.
6. *Conuropsis carolinensis ludovicianus* (Louisiana Paroquet), Unlabelled.
7. *Tyrannus verticalis* (Arkansas Kingbird), Ad. ♀, Fort Union, June 26, 1843.
8. *Anthus spraguei* (Sprague's Pipit), Ad. ♀, Fort Union, June 24, 1843.
9. *Sturnella magna* (Meadowlark), Illinois, April, 1843.
10. *Sturnella neglecta* (Western Meadowlark), Missouri River, 1843.
11. *Molothrus ater* subsp. (Cowbird), Ad. ♂, Fort Union, June 22, 1843.
12. *Pheucticus m. melanocephalus* (Rocky Mountain Grosbeak), Fort Union, June 22, 1843.
13. *Passerina amoena* (Lazuli Bunting), Ad. ♂, Fort Union, June 26, 1843.
14. *Spizella pallida* (Clay-colored Sparrow), Ad. ♀, Fort Union, June, 1843.



UNLABELLED SKINS, MOST OF WHICH APPEAR, THROUGH COMPARISON WITH LIST  
IN THE HARRIS 1843 DIARY, TO HAVE BEEN PROCURED ON  
THE MISSOURI RIVER TRIP

1. *Anser albifrons* (White-fronted Goose)
2. *Tympanuchus cupido pinnatus* (Greater Prairie Chicken)
3. *Meleagris gallopavo silvestris* (Eastern Wild Turkey)
4. *Pelecanus erythrorhynchos* (White Pelican)
5. *Tyrannus verticalis* (Arkansas Kingbird)
6. *Sayornis s. saya* (Say's Phoebe)
7. *Petrochelidon pyrrhonota albifrons* (Northern Cliff Swallow)
- 8-11. *Salpinctes o. obsoletus* (Rock Wren)
12. *Anthus spraguei* (Sprague's Pipit)
13. *Helmitheros vermivorus* (Worm-eating Warbler)
14. *Vermivora chrysoptera* (Golden-winged Warbler)
15. *Vermivora peregrina* (Tennessee Warbler)
- 16-19. *Xanthocephalus xanthocephalus* (Yellow-headed Blackbird)
- 20-22. *Pheucticus m. melanocephalus* (Rocky Mountain Grosbeak)
23. *Guiraca caerulea interfusa* (Western Blue Grosbeak)
- 24-27. *Pipilo maculatus arcticus* (Arctic Towhee)
- 28-34. *Chondestes grammacus* subsp. (Lark Sparrow)
35. *Spizella pallida* (Clay-colored Sparrow)
- 36-37. *Zonotrichia l. leucophrys* (White-crowned Sparrow)
38. *Melospiza l. lincolni* (Lincoln's Sparrow)

SKINS WITH SPENCER F. BAIRD'S LABELS

1. *Ixobrychus e. exilis* (Least Bittern), No. 1522, ♀, Carlisle, Pa., May 20, 1844.
2. *Tringa flavipes* (Lesser Yellow-legs), No. 1505, ♂, Carlisle, Pa., May 10, 1844.
3. *Capella gallinago delicata* (Wilson's Snipe), No. 2119, ♀, Carlisle, Pa., April 16, 1845.
4. *Ectopistes migratorius* (Passenger Pigeon), No. 1726, Carlisle, Pa., Oct. 19, 1844.
5. *Zenaidura macroura carolinensis* (Eastern Mourning Dove), No. 2072, ♂, Carlisle, Pa., April 11, 1845.
6. *Coccyzus a. americanus* (Yellow-billed Cuckoo), No. 1537, Carlisle, Pa., May 17, 1844.
7. *Centurus carolinus* (Red-bellied Woodpecker), No. 794, Carlisle, Pa., Oct. 12, 1842.
8. *Empidonax flaviventris* (Yellow-bellied Flycatcher), No. 1004, ♂, Carlisle, Pa., May 20, 1843.
9. *Empidonax t. traillii* (Alder Flycatcher), No. 1013, Carlisle, Pa., May 24, 1843.
10. *Empidonax minimus* (Least Flycatcher), No. 999, Carlisle, Pa., May 20, 1843.
11. *Sitta canadensis* (Red-breasted Nuthatch), No. 857, ♂, Carlisle, Pa., Nov. 15, 1842.
12. *Turdus m. migratorius* (Eastern Robin), No. 2052, ♀, Carlisle, Pa., April 1, 1845.
13. *Sialia mexicana occidentalis* (Western Bluebird), No. 1244, California.
14. *Wilsonia citrina* (Hooded Warbler), No. 2246, ♀, Carlisle, Pa., May 7, 1845.
15. *Dolichonyx oryzivorus* (Bobolink), No. 1516, ♀, Carlisle, Pa., May 15, 1844.
16. *Dolichonyx oryzivorus* (Bobolink), No. 2297, ♂, Carlisle, Pa., May 21, 1845.
17. *Spinus t. tristis* (Eastern Goldfinch), No. 2203, ♂, Carlisle, Pa., May 20, 1845.
18. *Aimophila aestivalis bachmanii* (Bachman's Sparrow), No. 2402, Savannah, Ga., 1845.
19. *Spizella arborea* (Tree Sparrow), No. 1771, Carlisle, Pa., Jan., 1845.
20. *Passerella i. iliaca* (Eastern Fox Sparrow), No. 1288, ♀, Carlisle, Pa., March 11, 1844.

An additional twenty-two skins, all eastern birds, have Baird labels without descriptive data. These probably comprise a part of the early shipment which Baird mentions in a notebook.

Nine of the Harris birds are now in the collection of the Academy of Natural Sciences, having been donated by my father. These are the five Paroquets, a Passenger Pigeon, and three of Townsend's Hawaiian drepanids. Twenty-nine skins, mainly from the Lefevre group but including the *Hemignathus lucidus hanapepe*, are now in the Museum of Zoology, Princeton University. The Newark Museum has eighteen skins given them by my father in 1941 and has discarded twenty-three others "with Mr. Street's permission, evidently because of their condition."

The remainder of the Townsend, Missouri River, and Baird specimens listed herein will go to the Academy of Natural Sciences of Philadelphia with which Harris was so intimately associated. Harris gave many of his specimens to the Academy during his lifetime. The *Proceedings* for 1848 mention a gift of 119 skins. Among entries in the catalogues showing Harris donations are an American Magpie and a Bullock's Oriole from the Townsend Columbia River trip, a further indication that Harris may have had a considerable portion of the Townsend duplicates at one time.

I am indebted to Herbert Friedmann of the U. S. National Museum for information concerning the Baird specimens, to Herbert G. Deignan of that institution for his comments on the Hermit Warbler, to Rodolphe Meyer de Schauensee and James Bond of the Academy of Natural Sciences of Philadelphia for their assistance in the identification of several of the skins, and to Mr. Bond in particular for his many helpful suggestions on the preparation of this paper. Peter A. Brannon of the State of Alabama Department of Archives and History has kindly furnished me with much Harris information, including the hitherto unpublished list from the Gulf Coast Expedition.

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## THE GOLDEN-FRONTED WOODPECKERS OF TEXAS AND NORTHERN MEXICO

BY ALEXANDER WETMORE

THE long series of Golden-fronted Woodpeckers (*Centurus aurifrons*) in the U.S. National Museum shows a definite cline between the birds from north-central Texas, which are lighter in color above and below, and those from Jalisco, Michoacán, and Hidalgo in south-central Mexico, which are blacker on the dorsal surface and somewhat grayer underneath. These differences are most evident in fresh plumage, for with wear during spring and early summer the breast shows a darker gray and the upper surface decidedly more black. Among breeding specimens in worn condition, those from central and southern Mexico are definitely blacker than those from north-central Texas.

The extremes are easily separable, but in southern and southwestern Texas and in northeastern Mexico the two kinds of coloration merge so gradually that over a broad area the whole population is intermediate, making decision as to any sharply drawn dividing line difficult and in part arbitrary. Texas specimens from San Antonio and Seguin south to Corpus Christi and the Brownsville region, while somewhat intermediate, agree best with the southern group, as do those to the west as far as Eagle Pass on the Rio Grande. Beyond this point to the westward in Texas the lighter colored plumage prevails, and it presumably ranges also into northern Coahuila, since this is the coloration found along the Rio Grande River on the American side at Del Rio and Langtry. A good series from Fort Clark, collected by E. A. Mearns, also belongs in the lighter colored group. One male in worn plumage from Monclova, Coahuila, taken May 15, belongs with the darker, southern, form.

An increase of black markings in the white rump feathers is evident in skins of the southern group from San Luis Potosí (Jesús María, Ahualulco, Soledad, Hacienda Angostura) and Jalisco (Tupátaro). This tendency is almost absent from two specimens from Michoacán (Ocotlán) and is present in only part of the material at hand from Nuevo León.

The oldest name available for the birds under discussion, *Picus aurifrons* Wagler, 1829, based on a specimen from Ismiquilpam, Hidalgo, refers to the southern group, which will therefore be known as *Centurus aurifrons aurifrons* (Wagler). Two skins in the U.S. National Museum, from Tula, Hidalgo, are available for comparison. *Picus ornatus* Lesson (*Rev. Zool.* for April 1839, p. 102: from "Mexico," Abeillé Collection) is a synonym of *Centurus aurifrons*.

The northern race will take the name *Centurus aurifrons incanescens* Todd, originally restricted to the "Big Bend" area but now found to apply to the entire population of western and central Texas. Mr. Todd has kindly forwarded for examination the series of 10 skins (5 males and 5 females) on which he based his original description of this race. These differ from the more southern group in the characters outlined above. Other distinctions—variation in the depth of the yellow on the forehead and underparts and in the orange on the nape—mentioned as characters by Todd prove in the larger series now available to be individual variations.

Following is a résumé of the characters and ranges of the two groups:

*Centurus aurifrons incanescens* Todd. Northern Golden-fronted Woodpecker.

*Centurus aurifrons incanescens* Todd, Ann. Carnegie Mus., 30 (Dec. 16, 1946):298 (12 miles south of Marathon, Brewster County, Texas).

*Subspecific characters.*—Averaging lighter above, the dark cross-bars narrower and the white ones correspondingly wider; the white of the rump and upper tail coverts nearly or completely immaculate; under surface slightly paler.

*Range.*—Western and central Texas from Eastland County south to the "Big Bend" area (near Marathon), Langtry, Comstock, Del Rio, and Fort Clark south probably to northeastern Chihuahua and northern Coahuila.

*Centurus aurifrons aurifrons* (Wagler). Wagler's Golden-fronted Woodpecker.

*Picus aurifrons* Wagler, Isis von Oken, 22, pt. 5 (May 1829): col. 512 (Ismiquilpam, Hidalgo).

*Subspecific characters.*—Averaging darker above, the dark cross-bars wider and the white ones correspondingly narrower; the white of the rump and upper tail coverts usually more or less mixed with black; under surface slightly darker gray.

*Range.*—North-central Coahuila (Monclova) and southern Texas (Eagle Pass, San Antonio, Seguin) south to Jalisco (Ocotlán, Lagos), Michoacán (Pátzcuaro, Queréndaro), Hidalgo (Tula), and central Tamaulipas (Camargo, Forlón, Victoria, Soto la Marina).

SMITHSONIAN INSTITUTION, WASHINGTON 25, D.C.

GENERAL NOTES

A feeding habit of the Snowy Egret.—On April 25, 1947, I watched a Snowy Egret (*Leucophoyx thula*) feeding at the edge of a small pool along the road at Republiek, Surinam. The bird was in shallow water, standing on one foot, and with the other making rapid trembling movements in the water—the leg stretched forward, the toes and lower part of the tarsus submerged. It would stop suddenly, dabble rapidly in the water it had set in motion, and swallow something which I could not see. Then once more it would stretch one of its legs forward under the water and resume the vibrating movements. I could not make out whether the foot that was stretched forward rested on the mud or whether it was held in the water above it.

Portielje (1928. *Ardea*, 17:115) described foot trembling in captive Snowy Egrets in the Amsterdam Zoo, but from his account it appears that his birds trampled with both feet, as gulls do when feeding. The vibrating movement with one leg stretched forward is a regular feeding custom in small plovers and other waders, but I have not seen it recorded in herons.—FR. HAVERSCHMIDT, *Paramaribo, Surinam, Dutch Guiana*.

Swainson's Hawk nesting in north-central Oklahoma.—On June 29, 1948, I found a nest of Swainson's Hawk (*Buteo swainsoni*) two miles west of Stillwater in Payne County, Oklahoma. The nest, located about 25 feet above the ground in a hackberry tree, contained two eggs, one of which was pipped. The chick was alive and struggling to emerge. The following morning the parent birds did not put in an appearance when I revisited the area; the chick in the process of hatching was dead, and the other egg cold. Later, both adults appeared but did not fly near the nest nor dive down at me as they had on the previous afternoon. The pipped egg was crawling with ants, which may have caused the parents to desert. This is the first record of Swainson's Hawk nesting in Payne County and appears to extend the nesting range approximately 100 miles north and east of the known breeding range in Oklahoma.—F. M. BAUMGARTNER, *Department of Zoology, Oklahoma Agricultural and Mechanical College, Stillwater*.

Sandhill Crane observed in southwestern Ohio.—On the afternoon of May 9, 1948, as Karl Maslowski, Gordon Acomb, and I were driving across the bottomlands of the Ohio River, 18 miles east of Cincinnati, Clermont County, Ohio, we observed a Sandhill Crane (*Grus canadensis*). The bird walked slowly across a dirt road about a hundred yards in front of us, giving ample time to observe its great size, dusty gray plumage, and (with 10-power binoculars) the bill and bald red forehead.

The Crane was foraging through corn and alfalfa fields bordering a slough formed by a recent flood of the Ohio River. We observed the Crane for over an hour, hearing its low rumbling croaks and seeing it make several short flights, its neck outstretched and legs trailing. During one of these flights Maslowski was able to take a recognizable photograph from a distance of 80 yards. As we followed the great bird across the fields, we discovered many of its tracks in the soft mud, some of which plainly indicated that the Crane had been in the area for several days.

Sandhill Cranes are rare migrants in Ohio; the last previous record, as far as I can determine, was made by Milton B. Trautman in Fairfield County on October 9, 1926 (1940. "The Birds of Buckeye Lake," p. 228). Louis W. Campbell (1940. "Birds of Lucas County," p. 66) listed the last known Ohio breeding record, for Hurón County, Ohio, 1926. Frank Langdon (1879. *Jour.Cinn.Soc.Nat.Hist.*, 1:184) listed two Sandhill Crane specimens "reported to have been taken" in the vicinity of Cincinnati.—HAVEN H. SPENCER, *Turpin Lane, Newtown, Ohio*.

Incubation of the Upland Plover.—On April 29, 1948, at about 11:00 a.m., we found two nests of the Upland Plover (*Bartramia longicauda*) at the Game Farm of the Ohio Division of Conservation and Natural Resources, six miles north of Urbana, Champaign County, Ohio.

The nests were approximately 200 yards apart in a strip of timothy and sweet clover. Each contained two eggs. At the time of discovery a plover flushed from the first nest; the second was unattended. We checked the nests again at about 4:00 p.m. the same day. The first still contained two eggs; the second contained three. A fourth egg was later deposited in the second nest, probably on April 30. (A set of four was also later completed in the first nest.)

Two eggs in the second nest were pipped by 6:00 p.m. on May 24. The caps of all four eggs appeared ready to be pried open when we last examined them, at 6:00 p.m. on May 26. Four dry chicks were in the nest the next morning. If our assumption of a date (April 30) for the laying of the fourth egg is correct and the bird started incubating May 1, then 26 days were required for incubation. Similarly, two eggs in the first nest were pipped May 25. We last examined them the morning of May 27 and we are confident (judging from their condition then) that they hatched that day. Incubation periods of 17 to 24 days have been recorded for the Upland Plover. Most observations indicate that the period is 21 days (see Buss and Hawkins, 1939. *Wils. Bull.*, 51:202-220).

No mention is made in any literature we have read about both sexes incubating. We witnessed an exchange at 3:30 p.m. on May 25; the incubating bird arose at the approach of its mate and departed as the mate settled on the eggs. On May 26 one bird came to the nest as though to relieve the sitting bird, but the incubating plover pecked at it a few times, and it walked away.—WOODROW GOODPASTER and KARL MASLOWSKI, *Museum of Natural History, Cincinnati, Ohio.*

<sup>a</sup> The Mourning Dove in Alaska.—Though the Mourning Dove (*Zenaidura macroura*) has been recorded in Alaska, its occurrence that far north is decidedly rare. The A.O.U. Check-list (1931) states: "Breeds in western and interior North America from Minnesota, western Arkansas, and Oklahoma to the Pacific coast, north to Manitoba, Saskatchewan, and British Columbia, and south throughout Mexico. Winters south to western Panama. Casual at Fort Yukon, Alaska." As would be expected, most of the Alaskan records are for the extreme southern coastal strip. A few stragglers, however, have been noted inland and far to the north.

The nine published records (north to south) are as follows:

*Fort Yukon* (northeastern interior, just north of the Arctic Circle): male collected by Thomas E. Winecoff on October 9, 1916 (Friedmann, 1931. *Auk*, 48:265).

*Juneau* (southeastern coast): one seen near the city by Allen Hasselborg in November 1911 (Swarth, 1922. *Univ. Calif. Publ. Zool.*, 24:210).

*Sitka* (Baranof Island, southeastern coast): male collected near city by Merrill on September 14, 1912 (Willett, 1914. *Condor*, 16:81); one Mourning Dove observed for several hours on September 9, 1940 (Webster, 1941. *Condor*, 43:121).

*Sergief Island* (southeastern coast): an adult female (tentatively identified as *carolinensis*) collected on September 3, 1919 (Swarth, 1922. *Univ. Calif. Publ. Zool.*, 24:209).

*Stikine Flats* (near Wrangell, southeastern coast): two observed at a ranch for three weeks of September 1920 (Willett, 1921. *Condor*, 23:158).

*Wrangell* (southeastern coast): one Mourning Dove seen near a house for most of the summer of 1902 (Willett, 1921. *Condor*, 23:158); Fred H. Gray, who had observed and collected birds for many years, saw Mourning Doves in and about the city "on several occasions" (Swarth, 1922. *Univ. Calif. Publ. Zool.*, 24:210).

*Hydaburg* (Prince of Wales Island, southeastern coast): one Mourning Dove seen on September 1, 1916 (Willett, 1917. *Condor*, 19:22).

The files of the U.S. Fish and Wildlife Service contain eight records of Mourning Doves in Alaska which apparently have not been published previously. Among these is one from the cold interior. They are (from north to south) as follows:

*Clear* (interior, southwest of Fairbanks, about two degrees south of the Arctic Circle): William J. Tirre reports (memorandum, October 17, 1947) that a dove, captured by Mr. and Mrs. Paul Waugh at their home in Clear during a severe snowstorm on September 30, 1947, and later transported to the Woodland Park Zoo at Seattle, Washington, has been identified as a Western Mourning Dove (*marginella*).

*Juneau*: Frank Dufresne records (field notes) one Mourning Dove on a highway nine miles from the city in August 1942.

*Taku Lodge* (southeastern coast): Frank Dufresne reports (field notes) one dove seen from July to September 1940.

*Twin Glacier Camp on Taku River* (southeastern coast): Frank Dufresne reports (letter, October 3, 1929) a single Mourning Dove—"Carolina Dove (*Zenaidura macroura*)"—on October 2, 1929.

*Sitka*: Ernest P. Walker states (letter, August 21, 1926) that E. M. Goddard, writing on July 20, reported a Mourning Dove that appeared near the city about the end of May 1926 and remained about a month; Frank Dufresne reports (field notes) a single dove seen at Sitka in July 1938.

*Kake* (Kupreanof Island, southeastern coast): Frank Dufresne reports (field notes) that two doves were seen during July and August 1942.

*Goddard Hot Springs* (Baranof Island, southeastern coast): Frank Dufresne writes (letter, October 3, 1929) that E. M. Goddard observed a Mourning Dove ("a bird of the same type") at the Springs.

It will be noted that only one of these doves was observed as early as May, whereas five were recorded during July and August. That the majority of the birds were fall wanderers may be seen from the fact that seven were observed in September, one in October, and one in November. All but two of the records were made in the humid southern coastal strip, where temperatures are rarely low.—CLARENCE COTTAM, *U.S. Fish and Wildlife Service, Washington 25, D.C.*

**Breeding of Richmond's Swift in Venezuela.**—In a recent paper (*Univ. Mich. Mus. Zool. Occ. Papers No. 505*, Jan. 14, 1948) William H. Phelps and I reported the occurrence of Richmond's Swift, *Chaetura vauxi richmondi*, in Venezuela. The "seasonal range" of the 26 specimens we discussed indicated that the species was non-migratory, and "the fact that all 10 specimens taken at Curupao in July had much enlarged gonads and virtually no tail spines" led us to suppose that it bred there. Mr. Phelps recently has obtained full confirmation of this supposition. In a letter dated February 21, 1948, he wrote that his grandson, who has a home at the Country Club in Caracas (1,000 meters), captured an adult male (Phelps Collection No. 40979) and a young of undetermined sex (No. 40980) in the living room of his house. They had come in through the fireplace and chimney, where they presumably had a nest.

The young bird was only partly grown. The blood-sheaths at the base of the rectrices were about 11 mm. long, and those at the base of the remiges about 14 mm. long. The wing of the adult measured 113 mm., the tail 33 (the spines were completely worn off). The wing of the young bird measured 81, the tail 29 (the spines, apparently unworn, were about 3 mm. long).

W. E. Clyde Todd informs me that within recent years he has handled and identified nine Venezuelan specimens of Richmond's Swift, of which eight are now at the Carnegie Museum and one at the U. S. National Museum. These nine

specimens were from the Sierra de Carabobo, Colonia Tovar, and Petare. They were collected on April 8, 1929 (two); April 30, 1929 (two); July 2, 1914 (one); July 22, 1929 (one); July 26, 1929 (two); and July 28, 1929 (one)—dates which certainly suggest breeding.

I wish to thank both Mr. Phelps and Mr. Todd for the information on which the above note is based.—GEORGE MIKSCHE SUTTON, *University of Michigan Museum of Zoology, Ann Arbor.*

**Wheatear at Peekskill, New York.**—On November 15, 1947, I had the good fortune to observe a Wheatear (*Oenanthe oenanthe*) on a railroad embankment at Peekskill, New York, and carefully studied it at close range. Since I was familiar with Wheatears in life, this bird's diagnostic color and shape, perky, bobbing mannerisms, conspicuous white rump, and jerky black-bordered tail made me immediately certain of what I had found.

This species is only of accidental occurrence in the United States, and I know of but five other records for the New York City region: Griscom (1923. "Birds of the New York City Region") listed three specimens collected on Long Island, the last near Jamaica, in 1885; one Wheatear was seen with a flock of Snow Buntings at Montauk, Long Island, on December 27, 1936, by L. Breslau (*Proc. Linn. Soc. N.Y.* No. 50-51, 1940:48); another was carefully studied at Moriches Inlet, Long Island, on June 3, 1941, by LeRoy Wilcox.—ALLAN D. CRUICKSHANK, *Rye, New York.*

**Cardinals bathing.**—Here in Bluefield, West Virginia, the Cardinal (*Richmondia cardinalis*) lives very close to us, and I was much interested by Mrs. Laskey's article (1944. *Wils. Bull.*, 56:27-44), especially by the statement that Cardinals are not bathers. Since then I have kept a record of our bathing Cardinals, which is continuous (April 1944-May 1948) except for six months in 1946.

The Cardinals bathe mostly from January through June. I also have single records of males for July through October, but none at all for November. Judging from my records, twice as many males bathe as females. In 1947-48, I recorded males bathing five times in February and May, six times in April; females bathing six times in February, three times in April.

The Cardinals bathe when there is deep snow on the ground, as well as during hot dry weather. The favorite time of day is between noon and three o'clock, though they also bathe around 8:00 a.m. and after 6:00 p.m., especially in May and June. They do not bathe together but in succession. Male usually follows female, and often each returns for a second splash. They bathe with English Sparrows (*Passer domesticus*), though perhaps from necessity rather than from choice.

The largest number of bathers was recorded on December 23, 1945, when five males and two females followed one after the other. Two more approached but were frightened away. There was five feet of snow on the ground, temperature 34° F. (time not noted). On February 1, 1948, four males and one female bathed with a host of sparrows in and out. This was at 12:30 p.m., with two feet of snow, temperature 32° F.

One episode of the bath is worth mentioning. On April 26, two male Cardinals attempted to join a female Cardinal in the bath. She rose protesting and called repeatedly. The males continued to splash until the female's mate arrived and drove at them, when they left hurriedly without protest. Then the attacking male took a bath, after which the female resumed her ablutions and he, having dried his feathers, flew to the rose bush and sang his full-throated *purty-purty*.—MIRIAM G. DICKINSON, 2006 Reid Avenue, Bluefield, West Virginia.



## EDITORIAL

James Boswell Young has found it impossible to continue as Secretary of the Club and Chairman of the Program Committee. To fill these vacancies until the next regular election of officers, the Executive Council has appointed Harold Mayfield of Toledo, Ohio.

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Our printers make every effort to see that everyone on the mailing list receives a perfect *Bulletin*, but occasionally a defective one slips by. Please check your *Bulletins* immediately on their arrival for errors in sequence of pages, soiled or crumpled sheets, and other defects. Return any defective copy to the Editor, and it will be replaced. Further, if the addressing machine slips, your *Bulletin* may fail to reach you. In such case, please notify the Editor promptly so that he may send you a copy.

## OBITUARY

ALBERT KENRICK FISHER, a Founder of the American Ornithologists' Union, died in Washington, D.C., on June 12, 1948, at the age of ninety-two. Although trained in medicine, he early turned his attention to ornithology, and in 1885 was, with his chief, C. Hart Merriam, a founder of the "Section of Ornithology" of the U.S. Department of Agriculture Division of Entomology (the "Section" later becoming the Bureau of Biological Survey and finally a part of the Fish and Wildlife Service). The importance of his work in economic ornithology and in the study of animal distribution was recognized by his election to the presidency of the American Ornithologists' Union in 1914. A list of his scientific contributions (some 150 notes, reviews, articles, and bulletins) was published in the *Proceedings of the Biological Society of Washington* (39:21-28) on his seventieth birthday, March 21, 1926.

FREDERICK WOODS HAECKER, engineer and ornithologist, died March 23, 1948, in Salt Lake City at the age of forty-five. He was a graduate of the Colorado School of Mines but became a river engineer on the Missouri. From 1941 to 1946 he edited *The Nebraska Bird Review*, and he was senior author of the most recent check-list of the birds of Nebraska (1945). He had been a member of the Wilson Ornithological Club for thirty years and was Chairman of its Committee on Affiliated Societies.

EDWIN LINCOLN MOSELEY, Professor Emeritus of Biology at Bowling Green State University (Ohio), died June 6, 1948, aged eighty-three. In 1885 he received the A.M. degree from the University of Michigan, and in 1887 went to the Philippines with the Steere Expedition. He afterward described two new flycatchers which he discovered there (*Ibis*, 1891), and his name was given to a kingfisher, *Halcyon lindsayi moseleyi* (Steere), from Negros Island. He was head of the Department of Biology of Bowling Green State University from 1914 until his retirement in 1936. In 1932 he served as Vice-President of the Wilson Ornithological Club.

## ORNITHOLOGICAL NEWS

Jean Delacour has been elected an Honorary Member and Ernst Mayr a Foreign Member of the British Ornithologists' Union.

Gustav Swanson, formerly Treasurer of the Wilson Ornithological Club, will be the head of the newly organized Department of Conservation at Cornell University.

Richard H. Pough has been appointed Curator of Conservation and Use of Natural Resources at the American Museum of Natural History.

Dwain W. Warner has taken the editorship of *The Flicker*, official organ of the Minnesota Ornithologists' Union.

### WILSON ORNITHOLOGICAL CLUB ANNOUNCEMENTS

The Wilson Ornithological Club, formerly an associate, is now an affiliate, society of the American Association for the Advancement of Science.

As an affiliated society we have the privilege of nominating a member of the Club who is also a fellow of the Association to represent the Club on the Association Council.

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Several years ago, the Wilson Ornithological Club contributed to the support of the Committee for the Preservation of Natural Conditions, of the Ecologists' Society of America. The work of this committee has now been transferred to the recently-established Ecologists' Union, and we have received an invitation to join that organization.

By a unanimous vote of the Executive Council, the Wilson Ornithological Club has accepted institutional membership and will contribute four dollars annual membership fee.

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In memory of S. Morris Pell, talented bird artist, one hundred dollars has been given to the Wilson Ornithological Club. The donor, who wishes to remain anonymous, has requested that the gift be used to help promising young bird artists. President Pettingill has asked the Research Committee to make the award.

### NEW LIFE MEMBER

EUGENE EISENMANN, President of the Linnaean Society of New York, received degrees from Harvard College and the Harvard Law School and is now a practicing lawyer in New York City. His particular avocational interests are in conservation of natural resources and the avifauna of Panama, where, as a child, he first became interested in birds. He is a member of several scientific societies and has published a number of articles and notes in ornithological journals. Members of the Wilson Ornithological Club will remember the stimulating article on vernacular nomenclature which Mr. Eisenmann wrote jointly with Hustace H. Poor and published in the December 1946 issue of the *Bulletin*.



ORNITHOLOGICAL LITERATURE

**BIRD RECOGNITION, I: SEA-BIRDS AND WADERS.** By James Fisher. Penguin Books, Harmondsworth, Middlesex, England, 1947:  $4\frac{1}{2} \times 7\frac{1}{8}$  in., 190 pp., with 114 figs. by Fish-Hawk, 77 maps (mainly by W. B. Alexander) and 72 charts. Paper. 2s 6d. (\$.75 in U.S. bookstores).

This is the first in a series of three pocket-size books, which together will comprise a field-guide to the birds of the British Isles. Although the title might lead one to expect them, ducks, geese, herons, and rails are not included in this volume. The volumes to be published later will cover "game birds, waterfowl, and birds of prey" and "perching and singing birds."

This first volume has special interest for Americans because many of the birds described, or closely related species, are found on our continent.

In the main body of the book, Fisher treats 72 sea birds and shore birds ("wadings" in British usage). For almost every species there is a page of text facing a picture of the bird, a map showing the bird's distribution in Britain, and a "year-cycle" chart telling its status at each season. A remarkable amount of information, going far beyond mere field identification, is compressed into a page of text under the headings: "Recognition," "Breeding" (if the bird nests or has nested in Britain), "Distribution," "Movements," and "To Read."

The introduction carries a conventional key to identification and a key to the habitats in which the birds are to be found when away from their breeding places. The habitat key is in tabular form, one table for sea birds and another for shore birds, listing the species at the left and indicating preferred habitats by blocks in the proper columns.

At the close of the book, without an introductory heading, there are 11 pages of pictures of shore birds, terns, and gulls in flight, showing mostly the winter or immature plumages of birds figured in breeding plumage elsewhere in the book. There are also a list of the 52 species that have been recorded less than 100 times in Britain and an index.

The main purpose of the volume is to assist the amateur in identifying birds in the field. That aim is accomplished exceedingly well. The comments on recognition are clear and practical, giving special attention to the characters that distinguish similar species. Further, the large amount of information about nesting, migration, and history of the various species, so neatly condensed in this little book, will make it useful as a reference work to many people who do not need it as a field guide; it will be especially useful to those who do not have access to Witherby's five-volume "Handbook of British Birds," which Fisher acknowledges as his principal source. Throughout much of the book Fisher has expressed himself in simply-worded phrases instead of in complete sentences; thus, without sacrifice of clarity, he has achieved a compactness of text particularly appropriate to a handbook of this kind.

The half-tone figures are skillfully done and, although in sepia, they are adequate to their purpose, particularly for this group of birds, in which color details are relatively unimportant for field identification.

The "year-cycle" chart is an ingenious adaptation of the familiar "pie chart." The weeks, months, and seasons are shown clockwise around the rim, and sectors are marked out within the dial to indicate the status of the bird at any time of the year. Thus, on a circle of  $2\frac{1}{4}$ -inch diameter, Fisher presents a summary which, in the case of the Woodcock, for example, supplies approximate dates for the following: birds in winter quarters; assembly of residents; early, main, and late passage of foreign birds in spring; eggs, first and second brood; early, main, peak, and late passage of foreign birds in fall; dispersal and passage of residents.

An interesting feature of the distribution maps is the use of the "vice-county" unit in blocking out (by solid color and shadow) the breeding areas and the areas

of non-breeding occurrence. Since the political divisions of Britain vary greatly in size and internal complexity, the vice-county system has been created to divide the counties into smaller areas of "roughly equal [biological] importance." However, the distribution maps are so small in this book that it would be difficult for the reader to identify the exact geographical location of some of the vice-counties of the interior.

The birds are arranged in the order of the British Check-list, which differs considerably from the order of the A.O.U. Check-list. The reader interested in the relationships among birds will notice also that the British scientific names differ from the American for some genera and species.

The inexpensiveness of this book should encourage its sale. However, the low price has been achieved partly through the use of pulp paper of low durability; better resistance to moisture and scuffing would be an advantage in a pocket field guide.

Incidentally, although the title page gives 245 Fifth Avenue, New York, as the American address of the publisher, the book is not obtainable there.

This excellent little book is another reminder of the high state of development of amateur bird study in England.—Harold Mayfield.

**THE BIRDS OF NANTUCKET.** By Ludlow Griscom and Edith V. Folger. Harvard University Press, Cambridge, 1948:  $5\frac{1}{2} \times 7\frac{1}{2}$  in., 156 pp., 17 photos, map. \$3.25.

This book "is the first of a series of faunal studies from areas of Massachusetts which are of exceptional interest for the variety and abundance of their bird life and the excellence of the historic record."

Nantucket island was early known as a paradise for sea and waterfowl, and there is a long record of its importance to sportsmen. This has been documented in part through publication by the late John C. Phillips of the "Shooting Journal of George Henry Mackay, 1865-1922" (Cosmos Press, Cambridge, Mass., 1929). The record of the non-game species, however, is not so clear, despite the occasional visits of such distinguished naturalists as T. M. Brewer, John C. Phillips, J. A. Allen, J. H. Farley, W. Sprague Brooks, E. H. Forbush, and the authors of the present volume. These last freely admit that there remains much to be learned about the bird life of this and other islands of the northeast. To emphasize the point they list nine "ornithological problems" that they recommend to the attention of bird students visiting Nantucket.

The fact that Nantucket is not on a regular land-bird migration route adds much interest to the rather large number of species that have been listed. Many of these were recorded by Miss Folger, who resided on the island for three full years and who had access to material in the files of the Maria Mitchell Association. Mr. Griscom, on the other hand, has had access to unpublished journals and diaries, and has examined specimens in the principal museum collections. The work covers not only Nantucket but also the smaller islands of Tuckernuck and Muskeget to the west.

The Introduction discusses the physiographic and climatic features and the land-bird migrants, gives an "historical summary," and notes the changes that have taken place in the bird life of the island. This is followed by a systematic list that differs in at least one respect from the usual list: it makes a special point of indicating what is not known. The list contains 274 species, of which 132 are land-birds.

The book is admirably written and may well serve as a model for future reports on insular avifaunas. The photographs used as illustrations are from the files of the National Audubon Society. The report is indexed and concludes with a bibliography.—Frederick C. Lincoln.

WING TO WING. By E. H. Ware. Illustrated with 26 original photographs by the author and 26 line drawings by Roland Green. Harper & Brothers, New York, 1946:  $5\frac{1}{2} \times 6\frac{3}{4}$  in., 159 pp. \$2.75.

During the recent war, E. H. Ware was able to continue his hobby of bird finding while serving with the Royal Air Force in Britain, Algeria, Tunisia, and Corsica. His objective was to make a "memory-collection" of the various species occupying countries where he was stationed. This book is a record of his accomplishment.

Mr. Ware relates with enthusiasm coupled with gentle humor his experiences in seeking species new to him. When each species is ultimately before him, he describes in an earnest, straightforward manner his first impressions. Especially good reading are the two chapters concerning his stay at Bordj Menaiel, Algeria, near the foothills of the Atlas Mountains. This French-Arab village and its countryside presented a peculiar mixture of friendliness and suspicion, of ancient and modern living, of squalor and prosperity. Confronted with such a situation his exploits for birds were occasionally exciting and not infrequently amusing. Also good reading are the chapters dealing with adventures in the highlands of Scotland and Corsica, where scenic beauty rivalled the birds for his attention.

"Wing to Wing" is not, and is not intended to be, a contribution to ornithology. It is written for persons who, like the author, genuinely enjoy bird finding as an end in itself. Roland Green's drawings adequately depict some of the rarer or more interesting birds which the author "collected." There is an index to all species mentioned in the text.—Olin Sewall Pettingill, Jr.

AMERICAN BIRDS IN COLOR. LAND BIRDS. By Hal H. Harrison. Wm. H. Wise & Co., New York, 1948:  $6\frac{5}{8} \times 9\frac{3}{4}$  in., xxiv + 486 pp. \$5.00.

Mr. Harrison has written good, brief accounts of the land birds of the United States and has added a recognition chart, in which birds are arranged by size and color, and distribution charts, in which birds are listed alphabetically under different regions. In the introduction he tells of the pleasures of bird watching and recommends five field guides, as well as Hickey's "Guide to Bird Watching."

There are 195 photographs in black and white taken by various people; many of these are good, but others exhibit pathetic specimens of stuffed birds. Of the 192 color photographs, a few are excellent; but with the majority, something has gone wrong in the reproduction process, and many of the pictures are too blue or too pale. I fear the author's efforts to help people recognize birds will be nullified by his publishers, who show the Scaled Quail, White-winged Dove, Mockingbird, and Broad-winged Hummingbird with almost no color at all, solid green-blue California Quail, blue and white Sparrow Hawks, pink Brown Thrashers, a blue Bank Swallow, and a brown and white Violet-green Swallow. These and many others of the color photographs, as well as the illustrations of mounted specimens, are worse than useless; they give false and (in the case of the mounted specimens) repulsive impressions of the birds. I cannot agree with the claim on the cover that "text and captions tell you everything you need to know about each bird," nor that this is "the most beautiful, colorful bird book ever created."—Margaret M. Nice.

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*Snowy Egret (Leucophoyx thula)*. Photographed by Allan D. Cruickshank  
at Aransas Refuge, Texas, April 1948.

## ORIGIN OF THE BIRD FAUNA OF THE WEST INDIES

BY JAMES BOND

**A**LTHOUGH our knowledge in ornithology of the West Indies (which include the Antilles, Cayman and Swan Islands, St. Andrew and Old Providence, and the Bahama Islands) far surpasses that in any other natural science, there has been no comprehensive zoogeographic study of the bird life of the region. During the present century many important data have been gathered, chiefly through taxonomic research and field work, enabling us to understand more clearly the relationships of a number of West Indian genera and species, and forcing us to revise our concepts of their origin.

### WEST INDIES CONSIDERED AS OCEANIC ISLANDS

Most students of West Indian zoogeography now consider the islands oceanic, at least in the sense that their vertebrate fauna was received across the sea. It seems probable that no land-bridge has connected any of the islands with the mainland since Oligocene time, when, geologists believe, the Antilles were almost entirely submerged (Schuchert, 1924: 593-595). The earliest land mollusks known from the West Indies are Miocene (H. A. Pilsbry, verbal information), although certain Antillean groups may have survived from an earlier period (Pilsbry, 1930: 222-223).

Referring to mammals, Simpson (1940:154) states that "in the West Indies the Pleistocene land mammals included only peculiar rodents, insectivores and ground sloths, without any of the ungulates, carnivores, and other groups abundant on all adjacent continental areas. This fauna, too, is inexplicable as a result of normal filtering on a land-bridge." Simpson suggests that mammals reached the West Indies by adventitious migration, because this theory explains "simply and completely, facts that the land-bridge theory does not explain" (p. 156). Some mammals have been introduced in the West Indies by man. I have seen *Procyon*, *Dasyprocta*, and the West Indian endemics, *Capromys* and *Geocapromys*, in captivity, and on a number of occasions have partaken of their flesh. Such animals are sometimes carried about in order to provide a supply of fresh meat. Chapman (1892:326) considered that the discovery of a *Geocapromys* on "Swan Island" (= Little Swan Island) "differing but slightly if at all from the Jamaican species,<sup>1</sup> points strongly towards the former extension of land in this direction." However, *Geocapromys* was presumably brought to this remote islet "by aborigines or by rafting" (Allen, 1942:111).

<sup>1</sup> The existing Jamaican form (*G. brownii*) is slightly larger and darker than that from Little Swan Island.

In discussing the origin of the herpetological fauna of the Antilles, Emmet Dunn states (*in litt.*): "I don't believe in land connections at all, except during glacial periods between islands on the same (40 fathom) bank; and I see no explanation of this fauna possible on terms of land connection with either Central or South America. I can point to Cuban genera which could only have come from Florida; from Europe; from Africa; from Central America; from South America. No conceivable juggling around of mainland forms in past times could have got that lot together at one time and place for a land-bridge or a close oversea hop. And Cuba has *by far* the best representation of mainland genera. This is a prime fact in the herpetological situation."

As a result of his study of West Indian land mollusks Pilsbry (1930:222) states that "it does not seem likely that there has been a direct connection between Cuba or Jamaica and any part of Yucatan or Central America later than Paleocene or Eocene."

But, to my mind, the strongest case in favor of considering the West Indies as oceanic islands is that presented by Myers (1938:356), who states that "the most striking feature of the fresh-water fish fauna of the West Indies is the complete absence of members of the primary division of fresh-water fishes, in particular the Ostariophysi, which swarm in all the waters of North, Central, and South America." He believes that these aggressive fishes, had they reached the Antilles, would have thriven and that nothing short of complete submergence of the larger islands would have destroyed them. Hence he concludes (p. 362) that "the only conceivable continental connection of a Greater Antillean land mass is one with Central America at a time when neither the North American nor the South American Ostariophysi had invaded much of Middle America. . . . Finally, if we are to suppose that all the South American Ostariophysi originally wended their way southward through Central America, I believe we should have to push any such continental bridge back into the Mesozoic, if indeed it ever existed at all."

Mayr (1944:186) considers that "the majority of the land bridges postulated during the past 50 years are to be rejected." He writes (*in litt.*) that since "the distances between the various Antilles are so much shorter than the well-substantiated jumps made by Pacific birds, I would not hesitate to accept transoceanic dispersal for the whole Antillean [Region] bird fauna without any major change of the present geographical contours."

I shall show that birds probably reached the West Indies over water, for the most part at times when the water gaps were smaller, as during the glacial periods of the Pleistocene. The former proximity of Jamaica to Honduras is indicated by contour maps of the Caribbean Sea. The shallow, submarine shelf is seen to extend to the Rosalind



Bank, far to the eastward of Honduras. A smaller shelf extends south-westward from Jamaica to the Pedro Bank. In the intervening area is a relatively deep (600–700 fathom) channel that may have been the only important water barrier separating Jamaica from Honduras.

For birds (as also for bats, reptiles, amphibians, and invertebrates) the problem of oversea transportation is obviously simpler than for mammals and fresh-water fishes. Nevertheless, numerous families of birds are remarkably sedentary, among which are the Galliformes which are absent, except by introduction, from the West Indies. True, there is a Bob-white (*Colinus virginianus cubanensis*) in Cuba and the Isle of Pines, but it has been suggested by Gundlach (1893:171) that the species was introduced in this Republic about the close of the eighteenth century.<sup>2</sup> In this connection it is of interest that the Rufous-tailed Chachalaca (*Ortalis ruficauda*), which has been introduced on two of the Grenadines, has evidently thriven on these islands. It is also noteworthy that there are no jays (Garrulinae) in the West Indies, although crows (Corvinae) are well represented in the Greater Antilles. Jays are much more sedentary than crows. For example, it is unusual to find jays on any of the islands off the coast of Maine (even such large islands as Mt. Desert and Grand Manan) during any season of the year, although the Blue Jay (*Cyanocitta cristata*) and (in the colder months) the Canada Jay (*Perisoreus canadensis*) are not rare on the adjacent mainland.

Under normal conditions a stretch of open water, such as a channel or strait, presents a very effective barrier over which, as I have stated (1942:97), "only the more aggressive birds are wont to cross." I should have added "if and when they are subjected to a physiological urge to do so." If a sedentary mainland species is found on an oceanic island its presence there must be regarded as having probably been brought about through purely fortuitous circumstances. A hurricane may sometimes be responsible, as suggested by Darlington (1938:278).

The dispersal of forms of life apart from winged creatures is brought about in a different manner. Flotsam must be a major factor in the spreading of plants, invertebrates, and probably of mammals. After heavy rains in the mountains the larger rivers in the West Indies bring down debris, part of which, on reaching a relatively calm sea, might not be affected by salt water, and yet be transported by winds and currents from one island to another. Thus, it seems to me that even delicate invertebrates, susceptible to salt water, might be carried some distance across a sea or ocean. Mayr (1944:182) states that "it has been found that even strictly oceanic islands in the Pacific may have rather rich faunas of snails, flightless insects, lizards, and other animals which were formerly believed to be able to spread only with help of

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<sup>2</sup> Cuban "quail" are certainly of mixed stock, and although those from the Isle of Pines are supposed to be true *cubanensis*, an adult male that I collected there can almost be matched with Florida individuals.

land bridges." He adds that "the most successful colonizers among the beetle fauna of eastern Polynesia are small flightless species that breed in dead twigs."

There is general agreement that South America and North America have been separated during most of the Tertiary. The two continents are believed to have been united last in middle or upper Pliocene when the Isthmus of Tehuantepec emerged and, of course, have remained united ever since. According to Mayr (1946:9) a previous connection is thought to date back to lower Eocene. During the Miocene there existed between North and South America a group of Central American and Antillean islands which I call the Caribbean Archipelago. During the existence of the Caribbean Archipelago the southern half of the North American continent was tropical and possessed a fauna distinct from that of South America. There is evidence that this "tropical North American fauna" existed at an early date in Central America and thence spread sporadically to the West Indies. This dispersal was doubtless accelerated by hurricanes. It is also apparent that in Pleistocene time a number of birds from southeastern North America established themselves on the West Indies, and it is noteworthy that all but one of these species are indigenous to Florida. The single exception is the boreal White-winged Crossbill (*Loxia leucoptera*), which I shall discuss later. It appears likely that all these birds became part of the indigenous fauna of the islands at times when they were not subject to a migratory urge. Unfavorable climatic conditions in the north not only forced birds south of their normal breeding ranges, but also apparently caused the extensive migrations from North America to the West Indies, Central America, and South America that we see today.

#### ANALYSIS OF THE AVIFAUNA

Irrespective of the manner by which the indigenous West Indian birds were originally established on the islands, it is obvious that the West Indian avifauna is fundamentally tropical North American. The same is true of the Central American avifauna, although here the northern element is much restricted, due primarily to competition that has resulted from the influx of South American species following the formation of the Central American isthmus. Chiefly as a result of such invasions, approximately 25 families of birds are indigenous to Central America (between Chiriquí, Panama, and the Isthmus of Tehuantepec) that are not represented in the West Indies.

There are certain important differences between the tropical North American element of the avifauna of the West Indies and that of Central America. In Central America there are motmots (Momotidae), a family believed to have arisen in northern Central America (Chapman, 1923:58); but there are no motmots in the West Indies, where they are replaced by the todies (Todidae). Again, the silky flycatchers (Ptilonotidae), which constitute a characteristic, but probably not

autochthonous,<sup>3</sup> Central American element, are absent from the West Indies, where they are presumably represented by palm-chats (*Dulidae*). The todies and palm-chats may have developed as families in the Greater Antilles, but I am inclined to believe that *Dulus*, which is a sturdy, strong-flying, bird and among the most abundant of Hispaniolan species, is a relict that developed on the mainland. If it were an ancient West Indian form we should expect representation of the genus on other of the larger islands. In regard to the todies, the most primitive of West Indian birds, it is noteworthy that there is only one genus in this family, whereas there are six genera of motmots, and five of these inhabit Guatemala. The most significant difference between the tropical North American elements in the avifauna of Central America and the West Indies is the apparent absence of native gallinaceous birds from the islands.

According to my "Check-list of Birds of the West Indies" (1945), there are in the West Indies 175 indigenous Recent genera, representing 58 families. Of these no less than 50 (representing 21 families) are endemic (i.e., not found elsewhere), of which number, 41 are found in the Greater Antilles, 14 in the Lesser Antilles, and 7 in the Bahama Islands (Table 1).<sup>4</sup> In contrast, the entire group of East Indian islands on the continental shelf, situated to the west of the "Wallace Line," possesses at most 7 endemic genera. It is thus evident that the West Indies constitute a well defined Subregion of the North American Region, with rather distinct Greater Antillean and Lesser Antillean Provinces. I include the Bahama Islands in the former.

Much has been written to show the homogeneity of various other faunas of the Greater Antilles, the veritable "heart-land" of the West Indies, but it is apparent that the same can hardly be shown for the bird fauna. The localized distribution of most West Indian genera in these islands indicates that Cuba, Jamaica, Hispaniola, and Puerto Rico have long been separated. An analysis of the endemic West Indian genera that inhabit the four important Greater Antilles reveals that 12 of the 19 found in Cuba are unknown from the other major islands; 11 of 18 found in Hispaniola and 11 of 17 found in Jamaica have not been reported from Cuba; 8 are found in Hispaniola but not in Jamaica, and 7 in Jamaica but not in Hispaniola. Nine West Indian endemic genera inhabit Puerto Rico, of which one (*Nesospingus*) is restricted to Puerto Rico, and two, both widespread in the Lesser Antilles, have not been definitely reported from the other three large islands. Only four of the West Indian endemic genera (*Todus*, *Saurorthera*, *Tolmarchus*, *Spindalis*) occur on all four islands (Table 2).

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<sup>3</sup> Jean Delacour informs me that the genus *Hypocolius*, of Asia Minor and northeast Africa, may be a member of this family.

<sup>4</sup> Although the number of genera here recognized is excessive according to modern generic concepts, it is less than are recognized in the "Catalogue of Birds of the Americas." A narrow generic concept is useful in zoogeographic studies.

TABLE 1  
DISTRIBUTION OF BIRD GENERA ENDEMIC TO THE WEST INDIES

	Endemic to Bahamas and Greater and Lesser Antilles	Endemic to Bahamas and Greater Antilles	Endemic to Greater Antilles	Endemic to Greater and Lesser Antilles	Endemic to Lesser Antilles
RALLIDAE			Cyanolimnas		
COLUMBIDAE			<b>Geotrygon</b> Sturnoenas		
CUCULIDAE		Saurothera /	Hyetornis		
STRIGIDAE			Gymnogaux Pseudoscops		
CAPRIMULGIDAE			Siphonorhis		
APODIDAE			Tachornis		
TROCHILIDAE			Trochilus Mellisuga	Sericotes <sup>4</sup> Orthorhynchus <sup>4</sup>	Cyanophaea Eulampis
TROGONIDAE			Temnotrogon Priotelus		
TODIDAE			Todus		
PICIDAE			Nesocleus Xiphidopicus Nesocites		
TYRANNIDAE		<b>Tolmarchus</b>			

HIRUNDINIDAE		Callichelidon /	Lamprochelidon	
TROGLODYTIDAE			Ferminia	
MIMIDAE	Margarops <sup>1</sup> /			Allenia Cincloerthia Ramphocinclus
TURDIDAE	Mimocichla /			Cichlherminia
DULIDAE			Dulus	
COEREBIDAE			Euneornis	
PARULIDAE			Microligea Teretistris	Catharopeza Leucopeza
THRAUPIDAE		Spindalis <sup>3</sup> /	Pyrrhuphonia Phaenicophilus Nesospingus Calyptophilus	
ICTERIDAE			Ptiloxena Nesopsar	
FRINGILLIDAE	Loxigilla <sup>2</sup>		Loxipasser Melopyrrha Loximitris Torreornis	Melanospiza
TOTALS	3	4	32	9 [50]

1. Also inhabits some islands in the southern Caribbean Sea.
2. Recorded on questionable evidence from British Guiana (Hellmayr, 1938:167, footnote; Bond, 1945:152, footnote).
3. Also inhabits Cozumel Island, off Yucatán.
4. Predominantly Lesser Antillean.

Approximately half of the endemic West Indian genera belong to cosmopolitan families of more or less doubtful origin. The remainder, excluding the todies (*Todus*) and palm-chats (*Dulus*), are members of tropical North American, or of South American, families.<sup>5</sup> I wish particularly to discuss the "South American" element as represented by the hummingbirds (Trochilidae), tyrant flycatchers (Tyrannidae), honey-creepers (Coerebidae), and tanagers (Thraupidae). Of these the tyrannids are unquestionably South American, while the remainder are presumably so. All these families are now found in North America.

In the latest classification of the Trochilidae (Peters, 1945) 123 genera are recognized, of which as many as 24 are confined to North and Middle America. In spite of the strikingly specialized forms of hummingbirds in South America, we can only assume that the family originated on that continent. It is possible that in North America hummingbirds were formerly more widely distributed than they are now. At present the more northern species are among the least specialized. Specialized forms would be greatly influenced by any change of climate, such as occurred during the Ice Age, affecting the flowering plants on which they depend. In spite of their aggressiveness many hummingbirds have a restricted range; for example, the beautiful little Bahaman Woodstar (*Calliphlox evelynae*), found on virtually every island and cay of the Bahamas, has not become established elsewhere. The West Indies possess numerous and notable species of this family, in particular the Streamer-tail (*Trochilus polytmus*) of Jamaica, and the tiny Bee Hummingbird (*Mellisuga* ["*Calypte*"] *helenae*) of Cuba, the smallest bird in the world.

Honey-creepers (Coerebidae), a heterogeneous group related to finches, tanagers, and wood warblers, comprise another family largely dependent on flowers. Currently, 10 genera are recognized, though certain of these (e.g., *Controstrum*) should, perhaps, be placed with the wood warblers (Parulidae). Six of the genera are found north of South America, but only one genus (in fact, one species) is endemic to Middle America. This is the aberrant Jamaican Orangequit (*Euneornis*), considered by some ornithologists as worthy of family rank. The internal structure of the three genera of Coerebidae found in the West Indies (*Coereba*, *Cyanerpes*, and *Euneornis*) was studied by Lucas (1894). He considered them more nearly related to the Australasian honey-eaters (Meliphagidae) than to the New World Parulidae or Thraupidae, usually held to be their nearest relatives, basing his conclusions primarily on the form of the tongue and pattern of the palate; but this likeness probably is superficial and merely reflects their similar feeding habits.

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<sup>5</sup> South America has the richest bird fauna of any of the world's continents, whereas North America has the most impoverished.

TABLE 2  
DISTRIBUTION OF ENDEMIC WEST INDIAN GENERA IN THE GREATER ANTILLES

	Cuba	Hispaniola	Jamaica	Puerto Rico		Cuba	Hispaniola	Jamaica	Puerto Rico
Cyanolimnas	x	-	-	-	Callichelidon	x	-	-	-
Geotrygon	-	-	x	-	Ferminia	x	-	-	-
Starnoenas	x	-	-	-	Margarops <sup>2</sup>	-	?	-	x
Hyetornis	-	x	x	-	Mimocichla <sup>3</sup>	x	x	-	x
Saurothera	x	x	x	x	Dulus	-	x	-	-
Gymnolaux	x	-	-	-	Euneornis	-	-	x	-
Pseudoscops	-	-	x	-	Microliga	-	x	-	-
Siphonothus	-	x	x	-	Teretistris	x	-	-	-
Tachornis	x	x	x	-	Pyrrhuphonia	-	-	x	-
Sericotest <sup>1</sup>	-	-	-	x	Spindalis	x	x	x	x
Trochilus	-	-	x	-	Phaenocophilus	-	-	-	-
Mellisuga	x	x	x	-	Nesospingus	-	-	-	-
Temnotrogon	-	x	-	-	Calyptophilus	-	-	-	-
Priotelus	x	x	-	-	Ptiloxena	x	x	-	-
Todus	x	x	x	x	Nesopsar	-	-	x	-
Nesocelus	x	-	-	-	Loxipasser	-	-	x	-
Xiphidopicus	x	-	-	-	Loxigilla	-	x	x	-
Nesocittes	-	x	-	-	Melopyrrha	x	-	-	-
Tolmarchus	x	x	x	x	Loximitris	-	x	-	-
Lamprochelidon	-	x	x	-	Torreornis	x	-	-	-

1. Has merely a toe hold in extreme eastern Puerto Rico. Another Lesser Antillean hummingbird genus (*Orthorhyncus*) inhabits nearby Vieques Island.

2. Not known to inhabit Hispaniola proper, although found on Beata, one of the nearby coastal islands.

3. The Grand Cayman Thrush (*Mimocichla ravidæ*) is probably a representative of an extinct Jamaican species of this genus.

There are as many as five <sup>6</sup> endemic West Indian genera of tanagers (Thraupidae), a so-called South American family. I feel, however, that tanagers may have developed independently, from similar fringillid stock, in tropical North America and in South America. It must be remembered that these birds are very close to the Richmondeninae, an American subfamily of "finches." As Griscom (1945:167) has pointed out: "With a number of tropical American birds there is no way to settle whether they shall be called tanagers or finches." If the tanagers are considered of purely South American origin, the numerous genera (some very distinct) found in the West Indies indicate that the family is highly aggressive, far more so than the tyrant flycatchers (Tyrannidae); yet the A.O.U. "Check-list of North American Birds" (1931) lists only one tanager genus, in comparison with 11 genera of tyrant flycatchers, as occurring in North America north of Mexico. This situation may be due to ecological factors rather than to remoteness of the region of family origin.

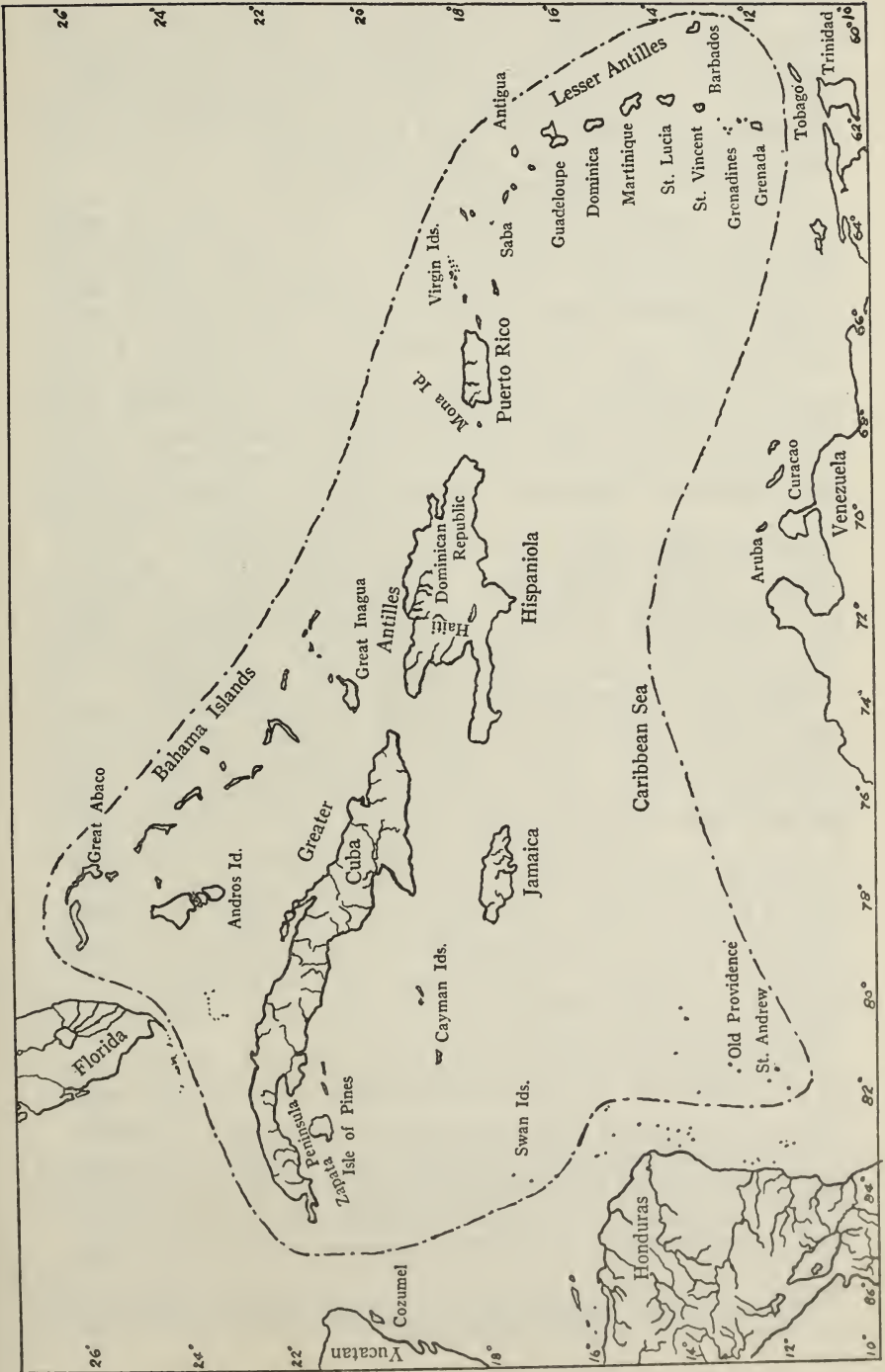
The troupial family (Icteridae) is more sharply marked than the tanager family (Thraupidae). There are some 30 icterid genera represented in South America, and 20 in North and Middle America. Many of these genera are restricted to one region or the other, and it seems futile to speculate on the continent of primary origin. The two genera confined to the West Indies, the Cuban *Ptiloxena* and the Jamaican *Nesopsar*, are closely related to widespread mainland genera, respectively *Dives* and *Agelaius*. In fact, recent study of the Cuban Blackbird (*Ptiloxena atroviolacea*) indicates that this species may be congeneric with continental blackbirds of the genus *Dives*.

The tyrant flycatchers (Tyrannidae) are the only unquestionably South American family of birds with endemic genera in North and Middle America. The tyrannids belong to a large group or suborder (Mesomyodi) of the Passeres, found in both the Old and New Worlds, but best represented in South America. How the Mesomyodi reached that continent is one of the great ornithological mysteries. They may have been derived from the west (via Antarctica?), since the tapaculos (Rhinocryptidae), with their center of abundance in Chile, are evidently allied to the New Zealand wrens (Acanthisittidae), and may represent the last successful mesomyodian invasion into South America. The Mesomyodi obviously arrived rather recently in North and Middle America. The northward spread was spearheaded by the comparatively aggressive tyrannids, of which a number of species have reached Canada. Other, more or less sedentary, mesomyodian families probably did not become established in Central America until later, since they have no endemic genera in Middle America and since only one species, the Jamaican Becard (*Platypsaris niger*), has arrived in the West Indies (where it is confined to Jamaica). It is of interest to note

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<sup>6</sup> One of these (*Spindalis*) is also found on Cozumel Island, Yucatán.





that the genus *Platypsaris* has reached the southern border of the United States and, except for the tyrannids, is the northernmost of mesomyodian genera. It is not surprising that the long-isolated Jamaican form, *P. niger*, is specifically distinct from its mainland relatives, whereas the form found on the Tres Marias Islands, off the western coast of Mexico, is conspecific with mainland birds.

There are 117 currently recognized genera of Tyrannidae, of which 10 are not indigenous to South America. Three of these are West Indian, and are certainly not well marked. Two so-called genera of the West Indies ("*Hylonax*" and "*Blacicus*") I have long discarded, while a third (*Tolmarchus*) might well be united with *Tyrannus*, from which it differs chiefly in the absence of attenuated outer primaries, a character of questionable value generically. Indeed, it seems likely that the Loggerhead Flycatcher (*Tolmarchus caudifasciatus*) reached the West Indies later than the Gray Kingbird (*Tyrannus dominicensis*), for the latter species, together with the Black-whiskered Vireo (*Vireo altiloquus*), has the now apparently unnecessary habit of migration to South America from the northern and western parts of its range. North and Central American genera of Tyrannidae, not indigenous to South America, are more or less closely related to South American genera; viz., *Deltarhynchus*, *Eribates*, and *Nesotriccus* are related to *Myiarchus*; *Nuttallornis* to *Contopus*; *Aechmolophus*, *Xenotriccus*, and *Aphanotriccus* to *Praedo* and to *Mitrephanes*. All are monotypic.

West Indian families believed of tropical North American origin (Mayr, 1946)<sup>7</sup> include the Troglodytidae, Mimidae, Vireonidae, and Parulidae. There are only two genera (one endemic) of wrens in the West Indies, but there are numerous thrashers, vireos, and wood warblers there, and the West Indian species in these families are more closely related to North and Central American, than to South American, forms. Numerous species of the northern subgenus *Vireo* (in which I include "*Laletes*" and "*Lawrencia*") are found in the West Indies, but none of the widespread southern genus *Hylophilus*, though it occurs in Trinidad and Tobago. Again, there are 8 indigenous West Indian species of the northern wood warbler genus *Dendroica*, but none of the southern *Basileuterus*.

The trogons, a pantropical group, are considered by Mayr (1946: 16) as probably of tropical North American or of Oriental origin. There are two endemic West Indian genera, one of which (*Temnotrogon*) is barely separable from the mainland genus *Trogon*. Two other West Indian families, the New World vultures (Cathartidae) and the limpkins (Aramidae), are considered by Mayr (p. 6) as of probable North American origin. This seems to be warranted by fossil evidence,

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<sup>7</sup> The reader will find on pages 26 and 27 of this work by Mayr a classification by origin of all the families of birds of the Americas.

but their inclusion in the North American element is purely tentative, since there are few avian fossils known from South America.<sup>8</sup>

Relationships of species belonging to genera that are indigenous, but not endemic, to the West Indies are usually more or less obvious. Northern forms are characteristic of the West Indies, even among the water birds. Thus we find among genera occurring in both North and South America the Great Blue Heron (*Ardea herodias*), not the Cooi Heron (*A. cooi*); the Green Heron (*Butorides virescens*), not the Black-crowned Heron (*B. striatus*); the White Ibis (*Guara alba*), not the Scarlet Ibis (*G. rubra*); and the remarkable South American genera of the Ardeidae and Threskiornithidae are absent. All of the West Indian land bird genera, exclusive of endemics, are found in North America (including Mexico) with the exception of two hummingbird genera (*Glaucis* and *Calliphlox*), both known from Central America. Of course the Antillean hermit (*Glaucis*), found in the West Indies only on Grenada, was derived from South America, but the Bahaman Woodstar (*Calliphlox evelynae*) has its nearest relative (*bryantae*) in Costa Rica and western Panama.

There is reason to believe that very few West Indian species of birds (and no West Indian genera) have invaded North or South America. The aggressive grackles probably originated in southern North America, and thence spread to Central America, the West Indies, and (recently) to extreme northern South America. Perhaps the most primitive of Central American grackles is the Nicaraguan species (*Quiscalus* ["*Cassidix*"] *nicaraguensis*), which bears a remarkable resemblance to certain races of the Lesser Antillean *Quiscalus* ["*Holoquiscalus*"] *lugubris*. The latter has now a toe hold in South America, where it is virtually confined to towns and settlements, occurring in an association or ecological niche not occupied by any other icterid.

Of the recent (probably Pleistocene) arrivals in the West Indies, a number were obviously derived directly from North America, e.g., a crane (*Grus*),<sup>9</sup> flicker (*Colaptes*), and crows (*Corvus*); others apparently from Central America, e.g., a rail (*Porzana*), jacana (*Jacana*), and potoo (*Nyctibius*). The most extraordinary of the recent northern immigrants is the Hispaniolan White-winged Crossbill (*Loxia leucoptera megaplaga*). Probably this Canadian and Hudsonian Zone species, which on the mainland of North America does not now breed south of

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<sup>8</sup> Of the 15 species of birds known in the West Indies only from subfossil bone fragments, the most interesting are two Bahaman eagles (*Calohierax* and *Titanohierax*), a peculiar rail (*Nesotrochis*), and the giant barn owls (*Tyto pollens* and *T. ostologa*). This material is not very enlightening, except as an indication of the former abundance of small mammals on these islands.

<sup>9</sup> The family Gruidae is considered of Old World origin by Mayr (1946: 19-20). He states that cranes "are known from North America as far back as the middle Pliocene—perhaps even earlier"; but Wetmore (1940: 48-50) records as many as 7 species of Gruidae from the Eocene. The Sandhill Crane (*G. canadensis*), the only species found in the West Indies, is reported from the Pliocene.

the Adirondacks of New York, reached the West Indies fortuitously during the Ice Age when it must have ranged farther south than at present. Finding climatic and ecological conditions (viz., pine forest) suitable, the bird has thrived in the mountains of Hispaniola at altitudes above 4,000 feet.<sup>10</sup> However, it is the other North American or "Holarctic" species, the Red Crossbill (*L. curvirostra*), that has spread southward into Central America.

Most of the recent arrivals in Cuba reached the island from the north. On the other hand, most of those inhabiting Jamaica were probably derived from the west, and some of these (e.g., the rail *Porzana flaviventer*, and Gray Potoo, *Nyctibius griseus*) have spread to Hispaniola. I am inclined to believe that two emberizine species, the Grasshopper Sparrow (*Ammodramus savannarum*) and the Andean Sparrow (*Brachyospiza capensis*) reached the Antilles from the west. The former does not breed in Cuba, where conditions seem favorable to its existence, and where it occurs as a rather rare but regular winter resident. The species is widespread in North and Central America, and is found in northwestern South America south to Ecuador. A closely related genus (*Myospiza*) occurs in South America. The only other indigenous species of this subfamily in the West Indies is the peculiar Zapata Finch (*Torreornis*), confined to a remote part of the Zapata Swamp in Cuba.<sup>11</sup> It is difficult to account for the dearth of members of this subfamily of finches in the West Indies, since the Emberizinae are well represented in both North and South America; and 17 genera, including both *Ammodramus* and *Brachyospiza*, inhabit Central America.

The Andean Sparrow (*Brachyospiza capensis*) is absent from North America (i.e., from north of the Isthmus of Tehuantepec), and is known in the West Indies only from Hispaniola, where it has a more circumscribed range than any other species (with the exception of the La Selle Thrush, *Turdus swalesi*), being confined to the Cordillera Central of the Dominican Republic. The Central American races of *Brachyospiza* likewise inhabit only the hills and mountains, but at the height of refrigeration of the Ice Age presumably occurred at low elevations (Griscom, 1932:25). During this period the species may well have inhabited Jamaica. Certain South American forms, such as the race found on Curaçao and Aruba, have become adapted to tropical,

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<sup>10</sup> Hispaniola is the only island in the West Indies with a distinct subtropical bird fauna, and even here few species are restricted to the Subtropical Zone, notably *Loxia leucoptera* and the Andean Sparrow (*Brachyospiza capensis*). In Cuba every species characteristic of the higher altitudes in the Sierra Maestra also occurs elsewhere at or near sea level, while all the species of other islands are known from elevations as low as 2,000 feet.

<sup>11</sup> The three genera of birds that are confined to the Zapata Swamp (*Cyanolimnas*, *Ferminia*, and *Torreornis*), are highly specialized in their adaptation to the conditions under which they occur, indicating that such habitats have existed for a long period in Cuba.

even arid tropical, conditions. I feel confident that *Brachyspiza* was developed in South America, probably during late Pliocene or early Pleistocene, and subsequently worked its way northward. The original stock that gave rise to *Brachyspiza* may have been derived from North America, where closely related genera (viz., *Zonotrichia*, *Melospiza*, and *Passerella*) exist today. If the Andean Sparrow had spread southward, as contended by Chapman (1940), we should expect the West Indian and Central American races to be the most differentiated because of long isolation, but this is not the case. The migratory form, *australis*, that breeds in southern South America, is the most distinct of the many races of this species. Again, if a North American *Brachyspiza* had been so "exceptionally well qualified" to colonize (the genus occurs in the Tropical, Subtropical, Temperate, and Puna Zones of South America), one would expect some representation of the species on the northern continent. Chapman was convinced that a southward movement took place in "postglacial" times, a period estimated by geologists as comprising 25,000 to 30,000 years; but it is unlikely that geographic variation such as exists among South American forms of this species could have developed in so short a period, for Wetmore (1933:238) believes that since the close of the Tertiary "there have arisen only some of the slight differences of color and size that distinguish the less well marked subspecies." I agree with Chapman (1940:385) that *Brachyspiza* is a poorly differentiated genus and consider that the widespread *B. capensis* should be regarded as congeneric with some, if not all, of the forms now included in the North American genera mentioned above. At present, however, it seems premature to call it, as Chapman does, a *Zonotrichia*.

#### VULNERABILITY OF INSULAR BIRDS

Decreased competition and comparative scarcity of predators tend to cause vulnerability in island populations. The individuals simply do not retain the traits necessary to the existence of their mainland representatives. For example, on Cozumel Island the Black Catbird (*Melanoptila glabrirostris*) is abundant and remarkably tame, whereas the same bird on the adjacent mainland is rare and very shy (Griscom, 1926:11). I have little doubt that if Black Catbirds from Cozumel were released in Yucatán they would soon perish, but that those from the mainland would survive if brought to Cozumel.

Although one species native to the West Indies has become established in South America (the grackle *Quiscalus lugubris*), it is unlikely that a genus peculiar to these islands could invade any continental area. It is axiomatic that a genus now confined to the West Indies is not necessarily of West Indian origin; that the occurrence of a genus both in the West Indies and in some part of the South or North American continents is an indication of its mainland origin.

Even the so-called West Indian genus *Tiaris* (the grassquits), one of the most abundant and widespread genera in the West Indies, but of local distribution in other parts of tropical America, probably originated in North or South America.

The Galápagos finches (geospizids), by far the most primitive of Galápagos land birds, are believed by Lack (1945:7) to be allied to the grassquits. I do not disagree, but consider that *Melanospiza*, a rare relict and monotypic genus confined to St. Lucia, is more closely related. Lack states (pp. 6-7) that the only diagnostic feature of the so-called subfamily "Geospizinae" is the presence of long, fluffy feathers on the lower back; and this timaliid-like character is as fully developed in the St. Lucian Black Finch (*Melanospiza*), the adult male of which bears a remarkable resemblance to the Medium Ground-finch (*Geospiza fortis*). Ridgway (1901:544), an astute taxonomist, noted the affinity of *Melanospiza* to *Tiaris* ["*Euethia*"].<sup>12</sup> It is possible that the St. Lucian Black Finch represents a primitive stock that invaded the Galápagos Islands and the West Indies, but has been extirpated on the mainland due to stress of competition. The geospizids of the Galápagos doubtless survived through lack of competition with mainland species and the absence of important predators.

In the West Indies it is unusual to find more than one species of a genus on any small island: where two such species associate, one is always dominant. Such conditions do not necessarily prevail on the mainland, nor even in Trinidad or on the four large islands of the Greater Antilles which offer diverse ecological habitats. As many as three resident species of *Dendroica* inhabit the pine forest of Grand Bahama and Abaco, but each appears to occupy a separate ecological niche. All may be found in the same tree, but the Olive-capped Warbler (*D. pityophila*) is apt to forage nearer the ground than the Pine Warbler (*D. pinus*); and the Yellow-throated Warbler (*D. dominica*), unlike the other species, may often be seen probing for food behind crevices in the bark, its long, narrow bill being well adapted to this method of feeding.

Recent arrivals in the Lesser Antilles include the Yellow-bellied Elaenia (*Elaenia flavogaster*). Previously, there had evidently been two invasions of the genus into the West Indies; the first (probably from Central America) represented by the Greater Antillean Elaenia (*E. fallax*), which inhabits Jamaica and Hispaniola; the second (possibly from Central America) represented by the Caribbean Elaenia (*E. martinica*), a species that has a most extraordinary range. Confined to the West Indies and other Caribbean islands, including mangrove islets off the coast of Yucatán, the Caribbean Elaenia is more numerous in the Lesser Antilles than elsewhere. It does not inhabit

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<sup>12</sup> In the latest classification of the Fringillidae (Hellmayr, 1938), *Melanospiza*, *Tiaris*, and the geospizids are placed in three separate subfamilies.

Puerto Rico nor other islands to the westward, except the Cayman Islands and some Caribbean islands off South and Central America. The species is exceedingly like *E. flavogaster* morphologically, but differs considerably in behavior, and may readily be identified in the field. Obviously, one would expect considerable competition between such closely related ("sibling") species where their ranges overlap. This is, indeed, the case. On Grenada, *E. flavogaster* has completely ousted *martinica* from the lower, hotter parts, and these two flycatchers now occur on this island as representative forms, one (*martinica*) inhabiting the mountains, the other (*flavogaster*) the lowlands. In the Grenadines only *flavogaster* is found at the present time. On St. Vincent, however, both *flavogaster* and *martinica* occur together near sea-level, with the former decidedly dominant.

It is apparent that a continental form arriving in the West Indies ousts its insular representative. Where, however, more than one species of a genus has entered this region from the mainland a different situation exists. In this case it appears that the first to become established on a small island will tend to keep out any allied form. This is well illustrated in the Apodidae by the distribution of Lesser Antillean swifts of the genus *Chaetura*. Three South American species have invaded the Lesser Antilles, but not more than one is known to occur on a given island.<sup>13</sup> Thus, the Gray-rumped Swift (*Chaetura cinereiventris*) is the Grenada species; the Short-tailed Swift (*Ch. brachyura*), the St. Vincent species; while the Lesser Antillean Swift (*Ch. martinica*) inhabits St. Lucia, Martinique, Dominica, and Guadeloupe. All of the above, in addition to two other species of *Chaetura*, have been recorded from Trinidad. Two of these Lesser Antillean swifts have been noted on islands northwest of Guadeloupe, where their occurrence must be considered accidental or casual. It is evident that these islands are too small to maintain even a single species of swift, and therefore fail to constitute "stepping stones" for the spread of these aggressive birds to Puerto Rico.

#### DERIVATION OF THE LESSER ANTILLEAN AVIFAUNA<sup>14</sup>

Most, if not all, birds that have arrived in the West Indies from South America have entered the region via Jamaica or Grenada, but it is astonishing that so few South American species have spread into these islands. Every ornithologist who has visited Grenada and Trinidad has been amazed at the difference between their avifaunas. The difference is even more marked if we compare the bird life of St. Lucia

<sup>13</sup> Although I have never found more than one species of *Chaetura* on St. Vincent and Grenada, it is quite possible that a second species exists on one or both of these islands.

<sup>14</sup> The Lesser Antilles comprise islands from Grenada north and northwest to the Anegada Channel. They do not include the Virgin Islands, although these have a Lesser Antillean element in their avifauna.

with that of the continental islands of Trinidad or Tobago. The inclusion of the latter islands as part of the West Indies would more than double the number of indigenous genera of land birds and add as many as 15 families to this Subregion.

Among the earliest birds to invade the Lesser Antilles from South America were hummingbirds (Trochilidae), for it is virtually certain that the Lesser Antillean genera *Orthorhyncus* (Antillean Crested Hummingbird) and *Sericotes* (Emerald-throated Hummingbird) were derived from the south, since only on the southernmost islands do we find racial variation: it would be futile to speculate whence came the others—the Garnet-throated Hummingbird (*Eulampis*) and Blue-headed Hummingbird (*Cyanophaia*). Of the recent arrivals (i.e., birds identical with, or not specifically distinct from, those of northern South America), as many as 14 are not found north of St. Vincent. One South American species, the Bananaquit (*Coereba flaveola*) is known to be highly aggressive. There is a record of the Trinidad race (*luteola*) from Grenada, a record of the Dominican race (*dominicana*) from Martinique, and I have seen the species at sea at least two miles off the coast of Antigua. The Glossy Cowbird (*Molothrus bonariensis minimus*) was unknown in the Lesser Antilles until 1899, but has since become established on these islands as far north as St. Lucia. Another example of an aggressive South American species is the Blue-black Grassquit (*Volatinia*), which inhabits Grenada and has been observed at sea between this island and Trinidad (Chapman, 1894:33). One important fact to remember is that all of the South American genera that have recently invaded the Lesser Antilles have likewise spread northward into Central America, or at least now inhabit Central America.

Northern elements in the Lesser Antilles include wrens (Troglodytidae), thrashers (Mimidae), thrushes (Turdidae), vireos (Vireonidae), and wood warblers (Parulidae). Among these families the genera and species endemic to the Lesser Antilles are, I believe, relicts, and were formerly more widespread in the West Indies. For example, the range of the Pearly-eyed Thrasher (*Margarops fuscatus*) is significant: primarily Lesser Antillean, this species ranged west to Mona Island, where it is abundant. It is also found on many of the southern Bahama Islands, but is not known to occur beyond Mona in the Greater Antilles except on the little island of Beata, off the southern coast of the Dominican Republic.

The genera endemic to the West Indies and found in the Lesser Antilles belong to five families, namely the hummingbirds, thrashers, thrushes, wood warblers, and the finches. St. Lucia has the richest, Grenada and Barbados the poorest, representation of these genera (Table 3), while as many as seven (three strictly Lesser Antillean) inhabit the small and geologically recent island of Saba.

The distinctness of the avifauna of the Lesser Antilles is probably due to their geographical isolation, affording the birds compara-



TABLE 3

DISTRIBUTION OF ENDEMIC WEST INDIAN GENERA ON THE LARGER LESSER ANTILLES

	Guade- loupe	Domi- nica	Marti- nique	St. Lucia	St. Vincent	Gren- ada	Barb- ados
Cyanophaia	—	x	x	—	—	—	—
Eulampis	x	x	x	x	x	—	—
Sericotes	x	x	x	x	x	x	x
Orthorhyncus	x	x	x	x	x	x	x
Allenia	x	x	x	x	x	x	x
Margarops	x	x	x	x	—	—	?
Cinclocerthia	x	x	x	x	x	—	—
Ramphocinclus	—	—	x	x	—	—	—
Mimocichla	—	x	—	—	—	—	—
Cichlherminia	x	x	?	x	?	—	—
Catharopeza	—	—	—	—	x	—	—
Leucopeza	—	—	—	x	—	—	—
Melanospiza	—	—	—	x	—	—	—
Loxigilla	x	x	x	x	x	x	x

tive freedom from competition. Scarcity of winter resident land birds on these islands is also a factor favoring the survival of the relicts. North American migrants abound in the Greater Antilles and the Bahamas and have certainly had a deleterious effect on the indigenous bird life. Thus, in Cuba, Jamaica, and Hispaniola, the Golden Warbler (*Dendroica petechia*) is chiefly restricted to mangrove swamps, whereas in the Lesser Antilles this warbler also inhabits secondary growth. The primitive Arrow-headed Warbler (*Dendroica pharetra*), of Jamaica, is confined to mountain forest, and is relatively less widespread than its ally, the Lesser Antillean Plumbeous Warbler (*D. plumbea*).

## DERIVATION OF THE BAHAMAN AVIFAUNA

It is the accepted opinion that the present Bahama Islands were submerged during Pliocene and (early ?) Pleistocene times, and have never been connected with any other land area (Schuchert, 1935: plate 16). All Bahaman birds must therefore be regarded as more or less recent arrivals, and this is soon evident to any student of the avifauna. The most notable Bahaman species are the Bahaman Woodstar (*Calliphlox evelynae*) and the Bahaman Swallow (*Callichelidon cyaneoviridis*). The former, as I have pointed out, has its nearest relative in Central America, the genus having evidently been extirpated in the intervening area. The latter comprises an ill-defined monotypic genus not entirely restricted to the Bahamas, since individuals evidently winter in Cuba. There is a decided Floridian element, including a Brown-headed Nuthatch (*Sitta pusilla*), on the northwestern islands of the group, but most of the birds have come from Cuba, probably having reached the islands as a result of hurricanes. Such storms may have carried Thick-billed Vireos (*Vireo crassirostris*) and bananaquits

(*Coereba*) to the Bahamas from the Cayman Islands. Neither is known to occur in Cuba, perhaps because their ecological niches had been filled by the Cuban Vireo (*Vireo gundlachii*) and Blue Honey-creeper (*Cyanerpes cyaneus*) respectively, although this honey-creeper and the bananaquit live side by side in tropical continental areas. The proximity of the Bahamas to Cuba in periods of glaciation is indicated by the extensive and extremely shallow Great Bahama Bank. The narrow gap presented by the Old Bahama Channel would not have prevented an influx of numerous Cuban birds into the northern islands.

Although some Bahaman forms (e.g., the Bahaman races of *Mimocichla plumbea* and *Spindalis zena*) are very distinct from those in Cuba, there is little variation in birds on these islands, only seven species breaking up into minor geographical races. For example, only one form of the highly plastic bananaquit (i.e., *Coereba flaveola bahamensis*) is found in the Bahamas.

It seems to me possible that the Bahaman forms of the Greater Antillean Bullfinch (*Loxigilla violacea*) and Black-faced Grassquit (*Tiaris bicolor*) may have been derived from Cuba, although neither species occurs there at present. Taking their place in Cuba are the Cuban Bullfinch (*Melopyrrha nigra*) and the Cuban Grassquit (*Tiaris canora*). In support of this theory, I might mention that Black-faced Grassquits of Hispaniola and Jamaica are identical, whereas Bahaman individuals represent a quite distinct subspecies. Indeed, one cannot mention a single land bird that can be said without question to have reached the Bahamas from Hispaniola. Perhaps the explanation is that the high mountainous "backbone" of this island is sufficient to dissipate a hurricane moving up from the Caribbean, even such a storm as that which devastated the southern coast of the Dominican Republic on September 3, 1930, one of the worst ever recorded in the West Indies. Probably as a result of this hurricane, four species reached Mona Island, and at least three of these, a Sparrow Hawk (*Falco sparverius dominicensis*), the White-winged Dove (*Zenaida a. asiatica*), and the Smooth-billed Ani (*Crotophaga ani*) are now established there as residents (Bond, 1946:2).

One of the most remarkable cases of bird distribution in the West Indies is that of the Bahaman Mockingbird (*Mimus gundlachii*), a species that is most nearly allied to South American forms of the genus. Its range is very circumscribed in Jamaica, where it is confined to arid sections near the southern coast. It also inhabits islets off the northern coast of Cuba and is widespread in the Bahamas, but is absent from Grand Bahama and Great Abaco, although present on the little mangrove cays north of these islands.

#### CONCLUSIONS

The West Indies are a group of oceanic islands, at least in the sense that their vertebrate fauna (mammals, birds, reptiles, amphibians,

and fresh-water fishes) did not reach this region by way of a land bridge. The islands comprise a Subregion of the North American Region, and may be divided into two provinces—the Greater Antillean Province (including the Bahama Islands) and the Lesser Antillean Province.

The avifauna of the West Indies is fundamentally and predominantly tropical North American, derived from the north and from the west. The South American element, which entered through Jamaica and the Lesser Antilles, is of comparatively recent arrival and comprises only members of aggressive families. The West Indies give us a rather clear picture of a tropical North American avifauna, which has been largely eradicated in Central America since the formation of the Central American isthmus, which permitted an influx of a great many more or less sedentary South American forms, for the most part of mesomyodian families. What is left of the tropical North American element in Central America is not unlike that which is present in the West Indies, but it is significant that there are no jays nor, apparently, any indigenous species of gallinaceous birds on these islands. A few West Indian genera (e.g., *Corvus*, *Sitta*, *Loxia*) are of Palaearctic origin, but these are also represented in North America.

The only so-called "South American" families with numerous endemic genera in the West Indies are the Trochilidae (hummingbirds) and Thraupidae (tanagers). The Trochilidae are probably, but not unquestionably, South American in origin; and the Thraupidae may have arisen independently and simultaneously from primitive fringillid stock in tropical North America and in South America, through parallel evolution due to specialized feeding habits.

The avifauna of the Bahama Islands was almost entirely derived from Cuba and Florida, with the Cuban element older and predominant.

There can be no doubt that dispersal of birds in the West Indies has been largely brought about by hurricanes, but the prevailing easterly trade winds have had little effect on bird distribution.

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THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

## BIRD WEIGHTS FROM SURINAM

BY FR. HAVERSCHMIDT

THE importance of bird weights has been stressed recently by a number of authors (e.g., Huxley, 1927; Baldwin and Kendeigh, 1938; Amadon, 1943). For palearctic birds our knowledge has become comparatively extensive, especially since the pioneer work by Heinroth (1922), and the vast material assembled by Weigold (1926) from migrant birds at Heligoland.

The latest summaries of bird weights from all over the world as given by Heinroth (1922) and Groebbels (1932) show how little is known about the weights of neotropical birds. It is not always possible for collectors to take weights of their specimens during expeditions in the tropical rain forest; that is primarily a task for the resident ornithologist. Following a suggestion by Ernst Mayr, I have weighed all birds since I started collecting in Surinam in June 1946, recording the weights on the labels of the specimens. Birds weighing more than 1,000 or less than 11 grams had to be omitted. The time between the actual killing and the weighing varied from 2 to 12 hours. In the following list I give weights for 216 species of birds, with the month of the year and, in most cases, the sex of the bird weighed.

The list makes possible some interesting comparisons. For example, the Guianan race of the worldwide Barn Owl (*Tyto alba hellmayri*) weighs 446–558 grams; its smaller relative from the middle of Europe (*T. a. guttata*), according to Niethammer (vol. 2, 1938:121), only 220–355 grams. The collecting of weights of worldwide species would be of the greatest interest.

Nomenclature in the following list is based on Peters (1931–1948) and Cory and Hellmayr (1918–1942).

HERONS. ARDEIDAE		Grams
<i>Pilherodias pileatus</i>	Mch. ♂	591
<i>Butorides s. striatus</i>	Dec. ♀ imm.	155
	Jan. ♂ imm.	181
	Mch. ♂	187
	Sep. ♂	173
<i>Florida caerulea</i>	May ♂	247
<i>Bubulcus ibis</i>	Dec. ♂	326
	Jan. 3 ♀♀	330, 341, 342
	3 ♂♂	346, 372, 380
	Feb. ♀, ♂	332, 368
	Mch. ♂	345
<i>Leucophoyx t. thula</i>	May ♂	277
<i>Hydranassa t. tricolor</i>	Apr. ♀	233
	May ♂	242
<i>Tigrisoma l. lineatum</i>	Apr. ♂, ♀	875, 737
	Jly. ♂ imm.	980

			Grams
<b>IBISES and SPOONBILLS.</b>			
<b>THRESKIORNITHIDAE</b>			
<i>Mesembrinibis cayennensis</i>	Mch.	♂	785
<i>Guara rubra</i>	Apr.	2 ♀♀	415, 520
	Jne.	♂ imm.	890
	Nov.	♂ imm.	637
<b>SWANS, GEESE, and DUCKS. ANATIDAE</b>			
<i>Dendrocygna autumnalis discolor</i>	May	♀	550
	Aug.	♂	500
<i>Anas b. bahamensis</i>	Nov.	2 ♂♂	475, 527
		2 ♀♀	505, 633
	Dec.	♂	533
<b>HAWKS. ACCIPITRIDAE</b>			
<i>Elanus l. leucurus</i>	Apr.	♂ imm.	272
<i>Elanoïdes forficatus yetapa</i>	Jan.	♀	435
	Jne.	♀	405
<i>Odontriorchis palliatus</i>	Mch.	♀	416
<i>Chondrohierax uncinatus</i>	Mch.	♀	235
<i>Ictinia plumbea</i>	Jan.	2 ♂♂	267, 267
<i>Helicolestes hamatus</i>	Nov.	♀	450
	Dec.	♀	435
	Mch.	?	395
	Apr.	♂	377
<i>Heterospizias m. meridionalis</i>	May	♀	921
<i>Buteo m. magnirostris</i>	Jly.	♂	206
	Aug.	♀	270
		2 ♂♂	260, 240
	Sep.	♀	268
	Feb.	♀	257
<i>Buteo albicaudatus colonus</i>	Oct.	♀ imm.	585
<i>Asturina n. nitida</i>	Nov.	♂	357
	May	♀ imm.	320
	Jne.	♀	516
<i>Leucopternis a. albicollis</i>	Oct.	♂	600
<i>Hypomorphnus u. urubutinga</i>	Sep.	♀ imm.	659
<i>Buteogallus aequinoctialis</i>	Jly.	♀	735
	Sep.	♂, ♀	760, 730
	Nov.	♂	634
	Jan.	♂ imm.	636
	Mch.	♀ imm.	600
<i>Busarellus n. nigricollis</i>	Apr.	♀	829
	May	♂	502
<i>Geranospiza caerulescens</i>	Apr.	♂	230
	May	♂, ♀	295, 284
<i>Herpetotheres c. cachinnans</i>	Aug.	♂	567
<i>Micrastur mirandollei</i>	Jne.	♀	556
<i>Daptrius a. americanus</i>	Apr.	♀	586
<i>Daptrius ater</i>	Jly.	♂	330
<i>Milvago chimachima paludivagus</i>	Mch.	?	251
	May	♀	326
	Aug.	♂, ♂ imm.	310, 235
<i>Falco peregrinus anatum</i>	Dec.	♂	575
<i>Falco a. albigularis</i>	Sep.	♂	120
	Oct.	♂	132
	Dec.	♂, ♀	108, 206
<b>CURASSOWS. CRACIDAE</b>			
<i>Ortalis m. motmot</i>	Jan.	♂	495
	Mch.	♂	500
	May	♂	493
	Oct.	♀	385

			Grams
PHEASANTS. PHASIANIDAE			
<i>Colinus cristatus sonnini</i>	Aug.	♂	117
LIMPKINS. ARAMIDAE			
<i>Aramus s. scolopaceus</i>	Dec.	♀	930
RAILS. RALLIDAE			
<i>Aramides c. cajanea</i>	Jne.	♀	462
<i>Porphyryla martinica</i>	Jly.	♀	213
SUN-GREBES. HELIORNITHIDAE			
<i>Heliornis fulica</i>	Oct.	♂ imm.	110
SUN-BITTERNS. EURYPYGIDAE			
<i>Eurypyga h. helias</i>	Nov.	♀	211
	Feb.	♂	295
JACANAS. JACANIDAE			
<i>Jacana spinosa jacana</i>	Mch.	♂	118
	Apr.	♂	112
PLOVERS. CHARADRIIDAE			
<i>Charadrius hiaticula semipalmatus</i>	Dec.	?	45
<i>Charadrius collaris</i>	Oct.	2 ♂♂	25, 23
	Nov.	♀	26
	Apr.	♀	27
<i>Charadrius wilsonia cinnamominus</i>	Nov.	♂	56
SANDPIPERS. SCOLOPACIDAE			
<i>Bartramia longicauda</i>	Mch.	♂	166
<i>Tringa flavipes</i>	Nov.	2 ♂♂	68, 79
<i>Tringa melanoleuca</i>	Mch.	?	145
<i>Tringa solitaria cinnamomea</i>	Sep.	♀	37
	Dec.	♂	38
<i>Actitis macularia</i>	Sep.	♂	37
	Oct.	♀	25
<i>Catoptrophorus s. semipalmatus</i>	Mch.	♀	236
<i>Limnodromus g. griseus</i>	Sep.	♂	81
<i>Capella p. paraguaiae</i>	May	♂	130
	Oct.	♂	88
<i>Ereunetes pusillus</i>	Sep.	♂	20
	Nov.	♂	22
	Mch.	?, ♀	22, 20
<i>Erolia minutilla</i>	Oct.	♂, ♀	17, 22
<i>Erolia fuscicollis</i>	Nov.	♂, ♀	23, 36
<i>Erolia melanotos</i>	Oct.	3 ♂♂	46, 55, 56
<i>Himantopus himantopus mexicanus</i>	Nov.	♂	149
	Dec.	?	132
GULLS. LARIDAE			
<i>Phaetusa s. simplex</i>	Jne.	♂	239
	Aug.	?	208
<i>Gelochelidon nilotica aranea</i>	Nov.	♀	154
<i>Sterna albifrons antillarum</i>	Sep.	♂	39
<i>Sterna superciliaris</i>	Jne.	♂	57
SKIMMERS. RYNCHOPIDAE			
<i>Rynchops nigra cinerascens</i>	Apr.	♂	298
PIGEONS. COLUMBIDAE			
<i>Columba speciosa</i>	Dec.	2 ♂♂	315, 296
<i>Columba cayennensis cayennensis</i>	Mch.	♂	193
	Jly.	♂	167



			Grams
<i>Columba plumbea pallescens</i>	Nov.	♂	110
<i>Columbigallina passerina griseola</i>	Jan.	♂	32
	Apr.	♂	34
	Sep.	♂	34
	Oct.	♂	29
	Nov.	2 ♂♂	27, 29
<i>Columbigallina t. talpacoti</i>	Jne.	♂	41
	Jly.	♀	45
	Aug.	♀	44
	Sep.	♀	52
<i>Columbigallina m. minuta</i>	Jne.	2 ♂♂	27, 34
	Sep.	♂	28
	Nov.	2 ♂♂	26, 30
		2 ♀♀	28, 34
<i>Leptotila r. rufaxilla</i>	Jan.	♂	135
	Oct.	♂	152
<i>Leptotila verreauxi brasiliensis</i>	Feb.	♂,♀	120, 100
	Mch.	♂	129
	Jne.	♀	121
	Aug.	♀	99
	Oct.	♂	113
<i>Oreopeleia montana</i>	Oct.	♂	85
PARROTS. PSITTACIDAE			
<i>Ara s. severa</i>	Jne.	♀	364
<i>Ara n. nobilis</i>	Feb.	♀	129
<i>Aratinga l. leucophthalmus</i>	Jly.	♂,♀	160, 165
<i>Aratinga pertinax chrysophrys</i>	Jne.	♀	78
	Aug.	♂,♀	90, 100
<i>Pyrrhura picta picta</i>	May	3 ♀♀	65, 69, 63
<i>Forpus p. passerinus</i>	Feb.	♀	20
	May	♂,♀	22, 23
	Jne.	♂,♀	20, 23
	Aug.	♂	21
<i>Brotogeris c. chrysopterus</i>	Apr.	♂,♀	53, 49
	Sep.	♂	49
<i>Pionites m. melanocephala</i>	Jly.	♂	152
		2 ♀♀	148, 130
<i>Pionus menstruus</i>	Nov.	♀	213
<i>Pionus fuscus</i>	Jly.	♂	199
<i>Amazona o. ochrocephala</i>	Nov.	♀	451
	Jan.	♀	406
<i>Amazona amazonica amazonica</i>	Jan.	♂,♀	298, 312
<i>Deroptyus a. accipitrinus</i>	Jan.	♀	270
	Feb.	♂,♀	211, 190
CUCKOOS. CUCULIDAE			
<i>Coccyzus a. americanus</i>	Apr.	♀	59
<i>Coccyzus m. minor</i>	Aug.	♀	63
<i>Piaya c. cayana</i>	Jly.	♂	93
	Aug.	♂	94
	Sep.	♂	84
	Oct.	♂	93
	Nov.	♂	101
<i>Piaya m. minuta</i>	Jan.	♂	38
	Apr.	♀	44
	Jne.	♀	37
	Sep.	♀	37
<i>Crotophaga major</i>	Mch.	?	169
	May	♂	159
<i>Crotophaga ani</i>	Jly.	2 ♂♂	95, 108
	Aug.	2 ♂♂	78, 99

			Grams
<i>Tapera n. naevia</i>	Mch.	♂	40
	Apr.	♀	41
BARN OWLS. TYTONIDAE			
<i>Tyto alba hellmayri</i>	Nov.	♀	498
	Apr.	♀	446
	Mch.	♂,♀	485, 558
TYPICAL OWLS. STRIGIDAE			
<i>Otus choliba crucigerus</i>	May	♂	142
<i>Pulsatrix perspicillata perspicillata</i>	Jne.	♂	591
	Dec.	♀	765
<i>Rhinoptynx c. clamator</i>	Nov.	♂	347
	May	♀	502
POTOOS. NYCTIBIDAE			
<i>Nyctibius grandis</i>	Nov.	♀	581
GOATSUCKERS. CAPRIMULGIDAE			
<i>Nyctidromus a. albicollis</i>	Sep.	2 ♂♂	49, 54
	Apr.	♂	53
<i>Chordeiles a. acutipennis</i>	Jan.	♂	46
	Nov.	♂	47
SWIFTS. APODIDAE			
<i>Chaetura s. spinicauda</i>	Oct.	♂	14
TROGONS. TROGONIDAE			
<i>Trogon m. melanurus</i>	Jly.	♂,♀	107, 88
<i>Trogon s. strigilatus</i>	Jly.	♀	69
	Aug.	♀	79
	Sep.	♀	73
	Nov.	♂	81
	Feb.	♂	78
KINGFISHERS. ALCEDINIDAE			
<i>Ceryle t. torquata</i>	May	♀	293
<i>Chloroceryle a. americana</i>	Mch.	♂	25
	Oct.	♀	23
<i>Chloroceryle i. inda</i>	Mch.	♂	46
	Apr.	♂	55
<i>Chloroceryle ae. aenea</i>	Dec.	♂	15
	Mch.	♂	11
	Apr.	♂,♀	11, 15
	May	♂	12
JACAMARS. GALBULIDAE			
<i>Galbula d. dea</i>	Apr.	♂	31
	May	♂,♀	22, 24
	Aug.	♂	25
	Oct.	♂	30
<i>Galbula galbula</i>	Jan.	♂	20
	Mch.	♀	20
	May	♂	18
	Jly.	♀	22
	Nov.	♀	21
PUFF-BIRDS. BUCCONIDAE			
<i>Notharchus t. tectus</i>	Jan.	♀	28
	Feb.	♂	23
	Oct.	♀	27
	Nov.	♂	21
<i>Bucco t. tamiata</i>	Dec.	2 ♀♀	33, 35
<i>Monasa atra</i>	Apr.	♂,♀	85, 91
	Oct.	♀	94.5
<i>Chelidoptera t. tenebrosa</i>	Sep.	♂	34
	Oct.	2 ♂♂	29, 32
		♀	37
	Nov.	♂	31

## BARBETS. CAPITONIDAE

Grams

<i>Capito niger</i>	Sep.	♂	44
	Nov.	♂	54
TOUCANS. RAMPHASTIDAE			
<i>Ramphastos tucanus</i>	Jly.	♂	690
	Aug.	♀	420
	Oct.	♂	540
<i>Pteroglossus aracari atricollis</i>	Feb.	♀	218
	Jne.	♂	210
	Apr.	♀	152
	May	♂	279
<i>Pteroglossus viridis</i>	Jly.	♀	130
	Dec.	♂	121
	Feb.	♀	120
<i>Selenidera culik</i>	Jly.	2 ♂♂	129, 135
		♀	138

## WOODPECKERS. PICIDAE

<i>Melanerpes cruentatus</i>	Feb.	2 ♂♂	60, 63
	Sep.	♂	56
<i>Chrysophilus p. punctigula</i>	Feb.	♂,♀	65, 61
	Nov.	♂	62
	May	♂	63
		2 ♀♀	52, 58
<i>Celeus elegans hellmayri</i>	Feb.	♀	154
	Apr.	♂	152
	Jne.	♀	139
<i>Celeus torquatus</i>	Jne.	2 ♂♂	107, 113
	<i>Dryocopus l. lineatus</i>	Mch.	♂
<i>Phloeocastes rubricollis</i>	Apr.	♂	217
	May	♀	158
	Aug.	♂	206
	Sep.	♂	210
	Jne.	♀	206
	Dec.	♂	197
	<i>Phloeocastes m. melanoleucos</i>	Mch.	♀
	Apr.	♀	251
<i>Veniliornis sanguineus</i>	Aug.	♂,♀	247, 251
	Jan.	♀	26
	Mch.	♂	30
	May	♂	24
<i>Veniliornis cassini</i>	Jly.	♂	24
	Sep.	♂,♀	30, 23
	Jly.	♂	27
	Sep.	♂	28
<i>Picumnus minutissimus</i>	Oct.	♀	33
	Jan.	♂	11
	Mch.	♀	13
	Dec.	♀	12

## WOOD-HEWERS. DENDROCOLAPTIDAE

<i>Xenops minutus ruficaudus</i>	Sep.	♂	11
	Feb.	♂	14
<i>Glyphorhynchus s. spirurus</i>	Aug.	♂	12
	Sep.	♀	13
	Oct.	♀	14
	Jan.	♀	38
	Aug.	♂	36
	Sep.	♂	35
<i>Dendroplex p. picus</i>	Oct.	2 ♂♂	35, 39
		♀	38

			Grams
<i>Xiphorhynchus guttatus polystictus</i>	Oct.	♀	49
	Nov.	♂	53
<i>Xiphorhynchus o. obsoletus</i>	Sep.	♂	37
<i>Dendrocincla f. fuliginosa</i>	Jly.	♂	42
<i>Dendrexetastes r. rufigula</i>	Apr.	♀	68
OVEN-BIRDS. FURNARIIDAE			
<i>Synallaxis albescens albigularis</i>	Aug.	♂	12
<i>Synallaxis r. rutilans</i>	Dec.	♂,♀	15, 16
	Jan.	♂	17
<i>Synallaxis g. gujanensis</i>	Apr.	♂	23
	May	♂	16
<i>Certhiaxis cinnamomea cinnamomea</i>	Oct.	♂	13
	May	♂	16
ANT-BIRDS. FORMICARIIDAE			
<i>Taraba major semifasciatus</i>	Nov.	♂	59
	Dec.	♂	55
	May	♀	57
<i>Sakesphorus c. canadensis</i>	May	♂	22
	Jly.	♂	20
	Sep.	♀	20
	Feb.	♀	25
<i>Thamnophilus d. doliatus</i>	Apr.	♀	25
	Jly.	♂	30
	Sep.	♂	32
	Oct.	♀	25
	Feb.	♂	25
<i>Thamnophilus p. punctatus</i>	Dec.	♂	20
	Jan.	♂,♀	21, 25
	Jly.	♂	21
	Sep.	2 ♂♂	17, 17
		♀	16
	Oct.	♂	22
<i>Sclateria n. naevia</i>	Jan.	♂	20
	May	♂	21
<i>Cercomacra n. nigrescens</i>	May	♂	19
<i>Cercomacra tyrannina saturator</i>	Jan.	♂	19
<i>Myrmoborus leucophrys angustirostris</i>	Jan.	♀	16
	May	♂	17
<i>Percnostola r. rufifrons</i>	Oct.	♀	26
	Nov.	♂	24
	Feb.	♂	29
	Jly.	♂	25
<i>Myrmoderus ferrugineus</i>	Oct.	♀	25
<i>Myrmoderus a. atrothorax</i>	Jan.	♂	18
	Sep.	♀	12
	Dec.	♀	16
COTINGAS. COTINGIDAE			
<i>Attila c. cinnamomeus</i>	Nov.	♂	41
	May	♀	28
	Jly.	♂	40
	Aug.	♂	37
	Dec.	♂	40
<i>Rhytipterna simplex frederici</i>	Sep.	♀	29
	Dec.	♂	36
<i>Pachyramphus rufus</i>	Feb.	♂	18
	Mch.	♀	15
	Jne.	♂	14
	Jly.	♀	17

			Grams
<i>Pachyramphus marginatus nanus</i>	Jan.	♂	21
	Oct.	♀	22
	Nov.	♀	22
<i>Pachyramphus polychopterus tristis</i>	Sep.	♂	17
<i>Platypharis minor</i>	Jan.	♀	36
<i>Tityra c. cayana</i>	Aug.	♀	60
	Sep.	♂	68
<i>Tityra inquisitor erythrogegens</i>	Jan.	♂	36
<i>Querula purpurata</i>	Apr.	♂	109
	Jly.	♂, ♀	95, 99
MANAKINS. PIPRIDAE			
<i>Pipra a. aureola</i>	Jne.	♂	14
<i>Manacus m. manacus</i>	Jly.	♂	15
	Aug.	♀	12
	Nov.	2 ♀♀	11, 15
	Feb.	♂	13
TYRANT FLYCATCHERS. TYRANNIDAE			
<i>Fluvicola p. pica</i>	Mch.	♂	13
	Jly.	♀	11
<i>Arundinicola leucocephala</i>	Jan.	♂	13
<i>Muscivora tyrannus</i>	Apr.	♂	35
	Jne.	♂	32
	Sep.	♂	36
<i>Tyrannus melancholicus despotes</i>	Sep.	♂	42
	Dec.	♀	37
	Feb.	♂	38
<i>Tyrannus dominicensis vorax</i>	Mch.	♂, ♀	50, 48
<i>Legatus leucophaeus leucophaeus</i>	Feb.	♂	19
	Apr.	♀	24
	May	♂	20
	Oct.	♂	21.5
<i>Myiodynastes maculatus maculatus</i>	Mch.	♀	40
	May	2 ♂♂	39, 48
		♀	46
	Aug.	♀	45
<i>Megarynchus p. pitangua</i>	Jly.	♂	61
	Dec.	♂, ♀	53, 52
<i>Myiozetetes c. cayanensis</i>	Dec.	♀	24
	Feb.	♂	26
	Oct.	♂	28
<i>Pitangus s. sulphuratus</i>	Jne.	♂ imm.	50
	Jly.	♂	57
	Sep.	♂	57
	Feb.	♂	49
<i>Pitangus l. lictor</i>	May	2 ♂♂	27, 25
		♀	23
	Jne.	♂	24
<i>Elaenia f. flavogaster</i>	Nov.	♂	22
<i>Elaenia cristata</i>	May	♂	16
	Oct.	3 ♂♂	14, 17.5, 18.5
	Dec.	♂	23
<i>Elaenia gaimardii guianensis</i>	Jan.	♂	11
<i>Cnemotriccus fuscatus fumosus</i>	Jne.	♀	26
<i>Empidonomus varius rufinus</i>	Jly.	♂	24
SWALLOWS. HIRUNDINIDAE			
<i>Progne ch. chalybea</i>	May	♂ imm.	30
	Sep.	♀	36
<i>Stelgidopteryx ruficollis cacabatus</i>	Mch.	2 ♂♂	14, 16
	Apr.	♀	15

			Grams
<i>Iridoprocne albiventer</i>	Apr.	♂	17
CROWS and JAYS. CORVIDAE			
<i>Cyanocorax cayanus</i>	Dec.	♀	175
WRENS. TROGLODYTIDAE			
<i>Thryothorus leucotis albipectus</i>	Jan.	♂	22
<i>Thryothorus c. coraya</i>	Feb.	♂	18
	Aug.	♀	19
	Dec.	♂	21
MOCKINGBIRDS. MIMIDAE			
<i>Mimus g. gilvus</i>	Jly.	♂	56
	Oct.	♂, ♀	58, 55
<i>Donacobius a. atricapillus</i>	Aug.	♂, ♀	38, 31
	Nov.	♂	33
THRUSHES. TURDIDAE			
<i>Turdus n. nudigenis</i>	Sep.	♀	58
	Oct.	♂	60
	Dec.	♀	67
<i>Turdus f. fumigatus</i>	Oct.	♂	75
<i>Turdus leucomelas ephippialis</i>	Apr.	♂	73
	Jly.	♂ imm.	55
	Feb.	♂	63
HONEY-CREEPERS. COEREBIDAE			
<i>Cyanerpes cyaneus cyaneus</i>	Oct.	♂	12
	Dec.	♂, ♀	15, 16
	Apr.	♂ imm.	12
<i>Dacnis c. cayana</i>	Sep.	♀	12
	Oct.	♂	12
		2 ♀♀	12, 13
TROUPIALS. ICTERIDAE			
<i>Xanthornus d. decumanus</i>	Aug.	♂	280
<i>Xanthornus viridis</i>	Jly.	♂	330
<i>Cacicus cela cela</i>	Nov.	♂	81
	Dec.	♂	103
<i>Cacicus h. haemorrhous</i>	Dec.	♀	74
	Feb.	♂	104
<i>Psomocolax o. oryzivorus</i>	Nov.	♂	120
<i>Molothrus bonariensis minimus</i>	Aug.	♂	36
	Oct.	♂	39
<i>Holoquisticus l. lugubris</i>	Aug.	2 ♂♂	60, 65
<i>Icterus chrysocephalus</i>	Nov.	♂	38
	Jan.	♀	41
<i>Icterus n. nigrogularis</i>	Dec.	♂	35
	Feb.	♀	30
	Mch.	♂	35
<i>Agelaius i. icterocephalus</i>	May	♂	35
<i>Leistes m. militaris</i>	May	♂, ♀	51, 39
<i>Sturnella magna praticola</i>	Oct.	♂, ♀	86, 73
TANAGERS. THRAUPIDAE			
<i>Tanagra v. violacea</i>	Feb.	♂	11
<i>Calospiza p. punctata</i>	Feb.	♀	13
<i>Calospiza m. mexicana</i>	Jly.	♂	27
	Sep.	♂	17
<i>Thraupis e. episcopus</i>	Dec.	♀	37
	Jly.	♀	32
<i>Thraupis palmarum melanoptera</i>	Aug.	?	45
	Sep.	2 ♂♂	37, 26
<i>Ramphocelus c. carbo</i>	May	♀	23
	Sep.	♂	26

			Grams
<i>Tachyphonus rufus</i>	Jne.	♂	33
	Jly.	♀	31
	Sep.	♂	34
	Oct.	♂	31
<i>Nemosia p. pileata</i>	Oct.	♂,♀	15, 15
	Jan.	♀	16
	Feb.	♂	15
	Apr.	♀	12
	May	2 ♂♂	15, 16
<i>Lamprospiza melanoleuca</i>	Apr.	♂,♀	32, 34
<i>Schistochlamys m. melanopis</i>	Jan.	♂	34
	Aug.	♂	38
FINCHES. FRINGILLIDAE			
<i>Saltator m. maximus</i>	Nov.	♀	55
<i>Saltator coerulescens olivascens</i>	Feb.	♂	48
	Mch.	♂	47
	May	♂	50
	Feb.	♂	24
<i>Cyanocompsa cyanoides rothschildii</i>	Mch.	♂	11
<i>Sporophila a. americana</i>	Jne.	♂	11
	Feb.	♂	12
	Oct.	♂	22
<i>Arremon t. taciturnus</i>	Nov.	♂	23
	Dec.	♂	28
	Oct.	2 ♂♂	14, 17.5
<i>Myospiza h. humeralis</i>		♀	15

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14 WATERKANT, PARAMARIBO, SURINAM, DUTCH GUIANA

## GENERAL NOTES

**Gannet in eastern Indiana.**—On December 5, 1947, a Gannet (*Morus bassanus*) was found by Mrs. Sparkle Crowe at the side of State Road 22, about three miles northwest of Portland, Jay County, Indiana. The Gannet had no obvious injury, was able to walk about, and it defended itself with its beak; it was kept alive for several days but apparently took no food. The stomach was empty and the body somewhat emaciated. The only mark of injury was a bare area about eight by two inches, extending diagonally across the breast. This suggested that the Gannet had flown into a wire. The specimen was a male in the speckled, yearling plumage. The bird and information on its capture was given to me by P. R. Macklin, of Portland. The skin is now in the Purdue University Wildlife Laboratory collection.

The only other record I find for Indiana is given by Butler (1906. *Auk*, 23:274) of an immature Gannet taken on Lake Michigan two miles from Michigan City in November 1904. The recent record for Indiana approximately coincides with records for Ontario and Ohio in the 1947 Christmas Bird Count (1948. *Audubon Field Notes*, 2, No. 2). On December 14 an immature Gannet was seen at Hamilton, Ontario. Another immature was caught alive at Toledo, Ohio, on December 22, and two individuals (ages not given) were reported at Cleveland, December 27.—CHARLES M. KIRKPATRICK, *Purdue University Agricultural Experiment Station, Lafayette, Indiana.*

**A Pleistocene record for *Mergus merganser* in Illinois.**—From excavations for the North Shore Channel of the Chicago drainage system F. C. Baker ("Life of the Pleistocene or Glacial Period," 1920, pp. 37, 85, 100, 109, 190, 394) obtained a nearly complete right humerus of a bird identified by R. W. Shufeldt as *Mergus serrator*. In September 1946, Leverett A. Adams, of the Zoological Museum, Urbana, Illinois, showed me this specimen, and subsequently he forwarded it to Washington for more critical examination.

The bone is dark brown in color, lighter at the ends, and is complete except for a jagged break in the shaft, probably made when the specimen was exhumed. On careful comparison I find that it is *Mergus merganser*, rather than *Mergus serrator*. It is the second record of *M. merganser* for the Pleistocene, the bird being known also from the Fossil Lake deposits of Oregon.

When specimens of the same sex of *merganser* and *serrator* are compared, the humerus in *merganser* is seen to be longer, the bone in three males measuring from 92 to 96 mm., and in three females from 85.5 to 89.3 mm. In three males of *serrator*, it measures 86.3 to 89.6 mm.; and in one female, 81.6 mm. The shaft is also slightly heavier in *merganser*. Since the fossil is 88 mm. in length, on this character it might be either the female of *merganser* or the male of *serrator*.

In the humerus of *merganser* the raised line toward the head of the shaft that forms the scar for the attachment of the muscle latissimus dorsi posterioris lies close to the upper side of the outer face. In *serrator* this line descends lower, and at a sharper angle, to or nearly to the center of this face. The fossil agrees with *merganser* in this character, and also has the slightly more robust shaft found in that bird. It is identified therefore as *M. merganser* (being similar in size to the female of *merganser*).

The fossil under discussion was found in the Wabash formation (late Pleistocene) at a spot 2,690 feet north of Foster Avenue, Bowmanville, a section now included in the city of Chicago, Illinois.—ALEXANDER WETMORE, *Smithsonian Institution, Washington 25, D. C.*



Eskimo Curlew and Whimbrel collected in Newfoundland Labrador.—On August 29, 1932, Ernest Doane collected a female Eskimo Curlew (*Numenius borealis*) at Battle Harbour, Labrador, from a small flock of curlews scattered about the barrens eating berries. When Doane approached within "long gun-shot range," all but two of the flock took wing. Having collected one of the remaining two, Doane realized that both were Eskimo Curlews. He was sure, however, that the other birds in the flock were Hudsonian Curlews (*Numenius phaeopus hudsonicus*). Doane wrote me that the bird he collected was very fat—unlike Hudsonian Curlews, which "never are." It is noteworthy that Murphy (1933. *Auk*, 50:101) reported a very convincing "probable record" of four Eskimo Curlews seen on Montauk Point, Long Island, just two weeks later than Doane's Labrador record. The last previously reported specimen of the Eskimo Curlew is apparently that taken April 17, 1915, near Norfolk, Nebraska (Swenck, 1916. *Smiths. Rept.* for 1915:338).

At Red Bay (Straits of Belle Isle), Labrador, Doane collected a male Whimbrel (*Numenius phaeopus phaeopus*) on May 14, 1932. Doane wrote that a single strange curlew had been reported to him about April 27 but he had discounted the report at first. Then others reported it, and finally Enos Yetman shot the bird for him on May 14. Doane recognized it as a Whimbrel and made special note of the fact that it was not unusually thin (as a stray might be expected to be) and that the testes were slightly enlarged. This specimen measures as follows: wing, 238 mm. (arc); tail, 103 mm.; culmen, 77 mm. It seems, therefore, to be typical *phaeopus*. Salomonsen (1935. *Dansk Orn. Foren.*, 29:112–113) gives the wing measurement of the male of the somewhat larger subspecies, *islandicus* (recorded a number of times in Greenland), as 240 to 260 mm. There seem to be but three previous records for any form of Whimbrel in North America exclusive of Greenland: off Sable Island, Nova Scotia, May 23, 1906; Great South Bay, Long Island, New York, September 4, 1912; Barrow, Alaska, June 10, 1938.—JOSSELYN VAN TYNE, *University of Michigan Museum of Zoology, Ann Arbor.*

Notes on care and development of young Chimney Swifts.—I had an unusual opportunity to observe nesting Chimney Swifts (*Chaetura pelagica*) on July 5, 1948, when we discovered a nest with four eggs in a chimney, directly opposite the flue opening, in the kitchen of our home near Columbia, Missouri. Since the flue was at eye-level, it was easy to make daily observations of the nest.

We partly closed the flue-opening with paper, leaving an aperture for observation purposes. The adult birds flushed readily, and care was necessary to avoid disturbing them. On the morning of July 17, all four eggs were hatched. The parent birds were more reluctant to leave the nest the last three days of incubation and the first few days after the hatch than they had been previously.

At hatching the young appeared to be completely naked and blind. They were brooded almost continuously until the sixth day, at which time the primaries were unsheathed. From the sixth to the tenth day after hatching, the young were brooded part of the time each day but not continuously. After the tenth day the young were not brooded during the day. By this time the tail and dorsal feathers were unsheathed, and the young were quite black, except one, which was smaller than the other three and still naked. This "runt" survived and left the nest with the others, but was about one week behind his nest-mates in early development. On and after the eighth day, the young preened considerably. The young left the nest on August 5, but remained in the chimney for several days thereafter. The exact time of their first flight could not be determined, but it was on or before the twenty-fourth day. All four were seen in the chimney on the twenty-first day after hatching.

During the first three days after hatching, cool rainy weather persisted, and the parent birds took turns feeding and brooding the young. While one brooded, the other foraged. When coming to the nest, the adult would alight and cling to the chimney wall at one side of and below the nest. The other would then fly out of the chimney, and the first bird would climb up to the edge of the nest and feed one or, more often, two of the young, then take its turn at brooding. A point of interest was that when the young begged for food they hung their heads over the edge of the nest and down, instead of holding them up as is the case with many tree- and ground-nesting birds.

Intervals between feedings varied from 6 to 20 minutes. On only one occasion was the food item observed. This was a medium-sized horsefly, which the young had difficulty in grasping and swallowing.—MAURICE F. BAKER, *Missouri Conservation Commission, Columbia, Missouri.*

**Alternate care of two nests by a Ruby-throated Hummingbird.**—An example of the alternate care of two nests by a female Ruby-throated Hummingbird (*Archilochus colubris*) was observed in Bloomfield Hills, Oakland County, Michigan, in July 1947.

Mrs. G. N. Sieger and her daughter, Betty, in whose garden the nests were found, made the initial discoveries, as well as a major part (110 hours) of the subsequent observations. My own observations were confined to five periods (June 20; July 13, 20, 27; August 2) totalling about 15 hours.

The first nest, discovered June 20, was saddled over an elm branch and fastened to an upright twig, 12 feet above the ground and 10 feet from the main trunk. This nest measured outside one inch in height by one and a quarter inches in diameter and three quarters of an inch in inside diameter; it contained no more than half the amount of material usually used in a completed nest and appeared to have been built hastily. There was one egg in the nest.

From June 20-22, the female was observed on the nest and about the nest site, but from June 23 through July 3, she was not seen on the nest during several periods of watching. From July 4 through 7, she was seen on and around the nest several times a day. No observations were made of the contents of the nest after June 20 until July 8, when Miss Sieger reported a nestling several days old.

On July 10, Mrs. Sieger discovered an apparently completed second nest three feet, nine inches down the same branch from the first. This was securely saddled on a live twig and well fastened to the larger branch with spider silk. This nest, measuring, outside, two inches in height by one and three-quarters inches in diameter and three quarters of an inch in inside diameter, contained at least double the amount of material used in the first and was heavily camouflaged with lichens.

During the afternoon of July 12, Mrs. Sieger several times observed the female alternately sitting on the lower nest and feeding the young in the upper nest. The interior of the second nest was not examined until the morning of July 13, when there were two eggs. During three and a half hours of observations on this date, the female was gathering food in the nearby flower garden, feeding the nearly full-sized young, sitting on the eggs in the lower nest, and chasing House Wrens, Robins, and Catbirds from the nest tree.

On July 14-15 a number of observations were made. The female spent her time gathering food, feeding the young, and incubating. About 7:30 p.m. on July 15, the young was exercising its wings on the edge of the nest in a manner which resembled flight. The next morning it apparently had left the nest and was not seen afterward.

The female continued incubating the eggs in the second nest. One egg hatched on the morning of July 25, the other during the late afternoon of July 26. Both

young left the nest on August 11; they were last seen on August 20, when they were feeding in the flower garden and perching in a tree near the nest site.

Only one adult hummingbird (the female) was seen in the vicinity during the entire period of observations.

Although I find no reference in the literature to the alternate care of two nests by one hummingbird of any North American species, Skutch in his article in Bent (1940. *U.S. Natl. Mus. Bull.* 176:461) writes of similar behavior in a White-eared Hummingbird (*Hylocharis l. leucotis*), which he found nesting in Guatemala.—WALTER P. NICKELL, *Cranbrook Institute of Science, Bloomfield Hills, Michigan.*

**The Calandria Mockingbird flashing its wings.**—In *The Wilson Bulletin* of June 1947 (pp. 71–73), Francis H. Allen carried forward a discussion begun by George Miksch Sutton (1946. *Wils. Bull.*, 58:206–209) on the North American mockingbird's (*Mimus polyglottos*) habit of lifting or flashing its wings when engaged in hunting insects on a lawn. He suggested, as a possible reason for the flashing, that the white patches thus displayed reflected light on the grass, thereby revealing sluggish insects and startling more active ones into betraying themselves by motion.

It has, until recently, seemed quite plausible to me that, whatever its function, the reason for the North American mockingbird's wing-flashing was connected with display of the white patches. My confidence in this theory was shaken in October 1947, however, during a visit to Argentina, when I observed the Calandria Mockingbird (*M. saturninus*), which has no white in its wings, doing the same thing in the same way.

I suggest that a good approach to many of these behavior puzzles in our North American species would be to inquire into possible similar behavior among related species abroad. In this particular case, a complete check on the many species of *Mimus* scattered throughout this hemisphere, some with white in their wings and some without, might provide a clue.—LOUIS J. HALLE, JR., 1423 *Shepherd St., N.W., Washington 11, D.C.*

**MacGillivray's Warbler in Cameron County, Texas.**—MacGillivray's Warbler, *Oporornis tolmiei*, is characteristically a bird of the west, breeding from Arizona and New Mexico to the Pacific Coast. During migration it occurs somewhat farther east and occasionally has been recorded as far as San Antonio, in central Texas, and at Gainesville, Cooke County, in the extreme northern and slightly more eastern part of the State. Most of the Texas records are for the extreme western counties. MacGillivray's Warbler has not previously been recorded from the lower Rio Grande country. In my collection are five specimens, all males, of *tolmiei* collected by H. H. Kimball at Los Fresnos, Cameron County: four, May 4, 1933, and one, May 5, 1933. My identification of these warblers was confirmed by George M. Sutton and Allan Phillips. Sutton's measurements of the tails of the specimens are, in mm.: 50, 54, 54, 56, 58. All the specimens have the typical plumage of MacGillivray's Warbler, and have the characteristic white spots, one above and one below the eye.

Judging from a comparison of the tail measurements and the color (a somewhat paler yellow) of the under parts with those of birds in similar plumage from the coast region of California and Oregon, the Los Fresnos specimens belong to the race recently described by Phillips as the Southern MacGillivray's Warbler, *Oporornis tolmiei monticola*. The slightly darker and grayer upper parts said to characterize this subspecies are evident in three males, questionable in the fourth, and not present in the fifth.—MAX MINOR PEET, M. D., *University of Michigan, Ann Arbor, Michigan.*

Nest-building adaptability of the Eastern Red-wing.—West Sister Island, Lucas County, Ohio, the most westerly of the Lake Erie island group, is a 90-acre limestone pile which rises abruptly from Lake Erie. It is 8.75 miles north-east of Jerusalem Township, Lucas County, the nearest mainland. Except for one small stretch near the lighthouse, cliffs 10 to 20 feet high are continuous around the island. The top is covered with a rather thin layer of soil. About 20 per cent of the area is grown with bluegrass, patches of nettles, and shrubs. The remainder is predominately hackberry forest. There are no swales or marshes on the island; in fact, not a single cat-tail grows there.

In spite of this situation the Eastern Red-wing (*Agelaius phoeniceus phoeniceus*) is the dominant songbird of the island. On June 16, 1946, Laurel Van Camp and I visited the island with a party of 15 members and guests of the Toledo Naturalists' Association. We found that the Red-wings had adapted their nest-building habits to the character of the island.

All the nests that we discovered held young. Several nests were more or less typically constructed in the bluegrass meadow. One was built in a shrub. Three were on a mat of bedstraw within the forest only a few inches above the ground and several in jack-in-the-pulpit plants. One nest was built in an abandoned Flicker's (*Colaptes auratus*) nest about 5 feet above the ground in an 8-foot-high tree stub, within but near the edge of the forest. The nesting cavity was at least 10 inches deep; it contained three or four nestlings.—LOUIS W. CAMPBELL, 4531 Walker Avenue, Toledo, Ohio.

Bronzed Grackle anointing plumage with orange-skin.—On June 22, 1948, about 6:00 p.m., I saw two Bronzed Grackles (*Quiscalus quiscula versicolor*) behaving curiously and watched them for at least 15 minutes. One, an adult female, was on the rear lawn, pecking at something in the grass and apparently anointing her wings. After each downward peck she grasped a primary feather at its base and pulled it through her mandibles. The other grackle, with the dark eyes and brownish plumage of a juvenile, was on a low, flat-topped compost heap about a yard from the adult female, standing among discarded halves of oranges from which the juice had been extracted. It bent down occasionally as if to touch one of the orange-skins but did not go through preening motions. It gave the impression of not knowing what to do. Every few minutes the adult stopped her preening and ran up to the juvenile, which immediately ran to the spot she had occupied. Then they immediately changed positions again, the adult pecking and preening, the juvenile standing among the orange-skins on the compost heap. Apparently startled by an automobile, they suddenly flew, and I investigated the spot in the grass where the adult female had stood. Several halves of fresh orange-skin had rolled from the compost, and one showed several newly-pecked areas from which the oily outer layer had been removed. This was clearly another instance of "anting" with substitute material.

During this observation the adult Bronzed Grackle anointed only the wing feathers, working from the underside, assuming a hunched position. The tail was invisible to me because it was bent downward in the grass.

There was evidence on several days during the following month (July) that fresh orange-skins had been pecked in the same manner, but my efforts to obtain further data were unsuccessful.

There are several instances on record of both Purple and Bronzed Grackles anointing the plumage with ants and various materials. Hervey Brackbill (1948, *Auk*, 65:70-73) observed Purple Grackles (*Quiscalus quiscula stonei*) using various species of ants on several occasions during late June, July, and early August. Mary Emma Groff and Brackbill (1946, *Auk*, 63:246-247) report Purple Grackles anting with juice from unripe English walnuts (*Juglans regia*) from early June

until mid-August. Mrs. H. N. Robinson (1945. *Ind.Aud.Soc.Yearbook*, 23:14) describes a Purple Grackle rubbing a grape on its body under the wing and apparently attempting to carry it, pushed upward under the wing.

G. Hapgood Parks (1945. *Bird-Band.*, 16:144) observed Bronzed Grackles in early July pecking green fruits of the cucumber tree (*Magnolia acuminata*), then passing the feathers of wings, tail, and body through the bill. Raymond W. Hill (1946. *Wils.Bull.*, 58:112) saw a male Bronzed Grackle in April repeatedly rubbing a moth ball on wing and body plumage.

Brackbill mentions that when two male Purple Grackles were present on two occasions during anting, both birds indulged in the act of raising the head, pointing the bill upward. At the beginning of my observation before I had made the age distinction, one of the birds pointed its bill upward as they exchanged places.

The field worker may go on indefinitely recording instances of anting with various juices, but no adequate explanation can be found without laboratory work, including an analysis of these materials and their effect on bird plumage.  
—AMELIA R. LASKEY, *Graybar Lane, Nashville 4, Tennessee.*

**Bird notes from southeastern Texas.**—In 1947 I spent some scattered days in the field in southeastern Texas; among the birds recorded, four seem worthy of report. Specimens collected are now in the California Academy of Sciences.

*Tringa solitaria solitaria.* Eastern Solitary Sandpiper. I took a small adult female April 26 on Galveston Island. Williams (1938. *Auk*, 55:66) reported this subspecies as a common migrant in Texas, but the only specimens reported from the State in recent years, since the subspecific distinctions have been well defined, were from the extreme south, in the Rio Grande valley (Griscom and Crosby, 1925. *Auk*, 42:529-530).

*Empidonax virescens.* Acadian Flycatcher. I saw the species many times and collected three adults near Willis, Montgomery County, between June 25 and July 30, along a creek in the mixed sweet gum-short leaf pine woodlands. I saw one young just out of the nest July 11. This record seems to represent the southern edge of the breeding range in eastern Texas for this species. Bent (1942. *Bull.U.S.Natl.Mus.* 179:196) lists Houston as the edge of the breeding range, but neither Williams (letter) nor I know of any basis for this.

*Hylocichla mustelina.* Wood Thrush. At Willis, Montgomery County, south of the known summer range, I heard a Wood Thrush singing July 12 and saw one (at the same spot) July 29. The species was not listed at all by Davis (1940. *Condor*, 42:83) from Brazos County, only a few miles to the west.

*Hirundo rustica erythrogaster.* American Barn Swallow. On July 8, with George G. Williams, I saw a group of nine Barn Swallows, of which about five were young of the year, around a small wooden bridge over a brackish stream on Galveston Island. Beneath the bridge were two nests—one containing four large young, the other, five eggs (a second laying?). On July 17 I returned and found the four young from the first nest on the wing; the second nest contained only three eggs and had apparently been abandoned. I collected one adult male and one juvenile; Dr. Herbert Friedmann, of the National Museum, confirmed my identification. The Barn Swallow has not previously been reported breeding in Texas east of San Antonio and the hundredth meridian. In Louisiana, Mississippi, and Alabama, the only breeding records are on coastal islands, where the race *insularis* breeds (Burlleigh, 1942. *La.State Univ.Mus.Zool.Occ.Papers No.* 11:179-183). George G. Williams has kindly provided the following excerpt from his own field notes: "June 19, 1934. One [Barn Swallow] on Galveston Island. No long tail. Sitting on fence beside road and very gentle. Probably a young bird."—J. DAN WEBSTER, *Jamestown College, Jamestown, North Dakota.*

**An unusual song of the Slate-colored Junco.**—On about March 22, 1948, I heard high in the trees about my home an unfamiliar bird song: a thin trill followed by a rapid group of soft *tweets*—usually four but sometimes less. The trill was like a junco's, but the complete song suggested a warbler. I could not locate the singer. On March 24 I again heard the song and this time found the bird about 60 feet up in an oak; it was a Slate-colored Junco (*Junco hyemalis*). After singing a minute or so longer it gave chase to another Junco a few feet away and was lost to sight. On March 25 I heard the same song, again given from a high perch. On each occasion that I heard the Junco it was about 8:00 a.m. Saunders (1942. Summer Birds of the Allegany State Park, N.Y. *State Mus. Handbook* 18:297) records, as unusual, a similar song by a Slate-colored Junco on its breeding ground.—HERVEY BRACKBILL, 4608 Springdale Avenue, Baltimore 7, Maryland.



Verdin (*Auriparus flaviceps*). Photographed by Allan D. Cruickshank  
near Brownsville, Texas, May 1948.





## EDITORIAL

Because of the pressure of other work your present Editor has asked to be relieved of the responsibility at the conclusion of the present volume, his tenth. He is grateful for the very generous help and encouragement received from members and friends throughout his editorship.

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The Council has been fortunate in securing the services of David E. Davis of Johns Hopkins University as the new Editor of *The Wilson Bulletin*.

Dr. Davis is a graduate of Swarthmore College and received the Ph.D. from Harvard for his studies on the social nesting habits of a subfamily of cuckoos, the *Crotophaginae*. His ornithological studies have taken him to Cuba, Panama, British Guiana, Brazil, and Argentina. He has also worked at the University of Chicago on the reproductive physiology of the domestic fowl and, for the Rockefeller Foundation, on the ecology of yellow fever in Brazil. Dr. Davis is now Assistant Professor in the School of Hygiene and Public Health of Johns Hopkins.

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The Membership Roll published in this issue contains 1,626 names and is the longest in the history of the Club. Gratitude is due to Dorothy Hobson and her assistants on the Membership Committee and to the many Members who have brought the Club and its *Bulletin* to the attention of other bird students.

The Roll was prepared by our faithful Treasurer, Burt L. Monroe, who has checked it throughout with the greatest care. Nevertheless, he assures us that there are certain to be errors in a list of this size, and he asks that Members notify him promptly of any inaccuracy or omission.

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We are grateful to the many Wilson Club members and friends who have helped in the preparation of the current volume of the *Bulletin*. We wish particularly to thank: W. J. Breckenridge, Allan D. Cruickshank, Harrison F. Lewis, Karl H. Maslowski, Ernst Mayr, R. Allyn Moser, Olin Sewall Pettingill, Jr., Nathan S. Potter, III, T. M. Shortt, George Miksch Sutton, Milton B. Trautman, Henry van der Schalie, and Alexander Wetmore.

## ORNITHOLOGICAL NEWS

The Sixty-sixth Stated Meeting of the American Ornithologists' Union was held in Omaha, Nebraska, October 11 to 14, 1948. The officers elected were: President, Robert Cushman Murphy; Vice-Presidents, Josselyn Van Tyne and Alden H. Miller; Secretary, Olin Sewall Pettingill, Jr.; Treasurer, R. Allyn Moser; Council Members, Austin L. Rand, John T. Zimmer, Frederick C. Lincoln, and A. J. van Rossem. The Council appointed Harvey I. Fisher, of the University of Illinois, Editor of the *Auk*, and awarded the Brewster Medal to David Lack of Oxford, England, for his work (published in 1945 and 1947) on the Galápagos finches. The following were elected: Fellows—Oliver L. Austin, Jr., Thomas D. Burleigh, James C. Greenway, Jr., Roger T. Peterson, Frank A. Pitelka; Members—Maurice Broun, Allen J. Duvall, Albert I. Good, Charles O. Handley, Sr., George E. Hudson, Joe T. Marshall, Jr., Charles K. Nichols, Max M. Peet, William H. Phelps, Jr., John McB. Robertson, James O. Stevenson, Robert W. Storer, Arthur Stupka, Wendell Taber, Ralph E. Yeatter.

The 1949 meeting will be held in Buffalo, New York.

William Vogt, ornithologist and ecologist, member of the Wilson Ornithological Club from 1935, has been awarded the Mary Soper Pope Medal by Cranbrook Institute of Science "for distinguished contribution to the field of plant sciences." Mr. Vogt is Chief of the Conservation Section of the Pan-American Union and author of the important new book, "Road to Survival."

As one of the exhibits at the Thirtieth Annual Meeting of the Wilson Ornithological Club, to be held in Madison, Wisconsin, in April 1949, the University of Wisconsin Library is preparing a display of bookplates used by ornithologists or designed by bird artists. Members owning such bookplates are requested to send copies to Gilbert H. Doane, Director, The General Library, University of Wisconsin, 816 State Street, Madison 6, Wisconsin.

### NEW LIFE MEMBERS



DR. FREDERICK E. LUDWIG received his medical training at the University of Michigan and now practises medicine at Port Huron, Michigan. With his father, C. C. Ludwig, he has carried on an extensive program of banding gulls and terns on Lakes Huron and Michigan since 1929. Major reports on the results of their banding Caspian Terns and Ring-billed Gulls were published in 1942 and 1943. Dr. Ludwig served in the Navy for three and a half years during World War II, retiring with the rank of Lieutenant Commander. While serving in the Solomon Islands region he made an extensive collection of birds, establishing many new distributional records.



RICHARD H. POUGH, a member of the Wilson Ornithological Club since 1938, is Curator of Conservation and Use of Natural Resources at the American Museum of Natural History. His interest in natural history dates from his boyhood days, and, after a short career as an engineer and businessman, he joined the staff of the National Audubon Society in 1936. He is a graduate of the Massachusetts Institute of Technology and also did work at Washington University, Harvard University, and the University of Colorado. His natural history interests have taken him over most of North America, the West Indies, and a good deal of Europe.

ORNITHOLOGICAL LITERATURE

CHECK-LIST OF BIRDS OF THE WORLD, Vol. 6. By James Lee Peters. Harvard University Press, Cambridge, Mass., 1948: 6 × 9 in., xi + 259 pp. \$6.50.

The sixth volume of Peters' monumental check-list of world birds completes his account of the non-passerine birds. The woodpeckers are the only North American family treated in this volume; the other families listed are: jacamars, puff-birds, barbets, honey-guides, and toucans. (The wry-necks are included in the woodpecker family.)

Three of ten woodpecker genera of the A.O.U. Check-List are changed: "*Centurus*" and "*Balanosphyra*" are included in the genus *Melanerpes*; "*Hylatomus*" is placed in the genus *Dryocopus*, along with four other New World species and two Old World species. Many readers will be very curious to know the facts behind these changes, and I hope Peters will publish a brief analysis of these cases in an ornithological journal, as he has previously done in the case of certain hawks, doves, owls, and toucans.

The "publisher's note" on the jacket contains the good news that in this volume the author has followed the definite policy of listing all synonyms published since 1900 (the date of volume 2 of Sharpe's Hand-list—the last previous complete revision of most of these families).

Two preoccupied names have been replaced: *Picus canus* "*ricketti*," of southeastern China, and *Melanerpes* (*Centurus*) *rubricapillus* "*rubriventris*," of Yucatán.

Peters' total of 395 species in the order Piciformes shows remarkably close agreement with the 389 species estimated for the order by Ernst Mayr in 1946 (*Auk*, 63:66).

Below is a tabulation of the genera, species, and subspecies treated in this volume:

	Genera	Species	Subspecies
Galbulidae, Jacamars .....	5	16	38
Bucconidae, Puff-birds .....	10	33	76
Capitonidae, Barbets .....	13	78	255
Indicatoridae, Honey-guides .....	4	13	36
Ramphastidae, Toucans .....	5	41	87
Picidae, Woodpeckers and Wry-necks .....	38	214	855
Totals .....	75	395	1347

There is a surprisingly marked change in the type used in this volume compared with that used in the earlier ones. Unfortunately, the paper used is even poorer than that used in volume 5, which was far poorer than that used in volume 4.

It is hard to understand why a University press cannot sell for less than \$6.50 an unillustrated, partly subsidized, 260-page volume for which there is an assured sale of a thousand copies.

I have nothing but praise for the author's work on this volume. His excellent judgment and uncanny accuracy in handling the extraordinary amount of detail involved have resulted in a volume which will be of the greatest help to ornithologists everywhere.—Josselyn Van Tyne.

CATALOGUE OF BIRDS OF THE AMERICAS. By Charles E. Hellmayr and Boardman Conover. Field Museum of Natural History, Zoological Series, 13, Part 1, No. 2, August 18, 1948: viii + 434 pp. \$4.10 postpaid.

This long awaited part of the indispensable Catalogue of Birds of the Americas covers the following orders: Sphenisciformes, Gaviiformes, Colymbiformes, Procellariiformes, Pelecaniformes, Ciconiiformes, and Anseriformes. There still remain to be published volumes containing the Falconiformes and the Charadriiformes. According to the preface, which is by the junior author, literature (as given in the Zoological Record) has been taken into account up to 31 December 1944. Some new forms described since that date and before 31 December 1946 have been included, and a few important recent papers are mentioned in the footnotes.

The general arrangement of this part is uniform with previously published parts and requires no comment, but perhaps some departures from current treatment of various groups, especially where the treatment differs from that accorded in the A.O.U. Check-List, may be mentioned.

*Phalacrocorax brasilianus* (Gmelin) replaces *Ph. olivaceus* (Humboldt), *Ardea occidentalis* Audubon is regarded as the white phase of *Ardea herodias wardi* Ridgway, and being of earlier date, replaces it. *Botaurus lentiginosus peeti* Brodkorb is recognized. The Lesser and Greater Snow Geese are maintained as specifically distinct. The White-cheeked Geese are divided into four species: *Branta leucopareia leucopareia* and *B. l. occidentalis*; *B. minima*; *B. canadensis parvipes*, *B. c. moffitti*, *B. c. interior*, and *B. c. canadensis*; *B. hutchinsii*. *Mergus serrator major* Schjølter is recognized as a valid race breeding in Greenland north to Upernavik and Scoresby Sound and wintering in southern Greenland.

The splitting up of the genus *Anas* comes as a shock—*Querquedula*, *Chaulelasmus*, *Mareca*, *Eunetta*, *Nettion*, *Pumanetta*, and *Dafila* are restored, although two of the most aberrant species, *A. specularoides* and *A. specularis*, are retained in *Anas*.

The radical rearrangement of the Anatidae proposed by Delacour and Mayr is referred to in a footnote on p. 283, but none of their proposals is adopted.

Some readers find statistics interesting, and for this reason it may be noted that the volume deals with 118 genera and 401 forms divided among 20 families.—J. L. Peters.

ISLAND LIFE: A STUDY OF THE LAND VERTEBRATES OF THE ISLANDS OF EASTERN LAKE MICHIGAN. By Robert T. Hatt, Josselyn Van Tyne, Laurence C. Stuart, Clifford H. Pope, and Arnold B. Grobman. Cranbrook Institute of Science, Bulletin No. 27. Copyright 1948: 179 pp., frontispiece, 43 figs., 1 map. \$4.00.

In the northeastern part of Lake Michigan, off the western shore of the Lower Peninsula of Michigan, lies a group of islands whose members vary in size from a few acres to nearly sixty square miles and in character from mere sand or gravel bars rising a few feet above lake level to wooded islands whose greatest elevations rise over 450 feet. Some are but a few yards from shore, others are situated fifteen or more miles from the nearest point on the mainland. While some scattered field work had been done previously on these islands, it was not until 1937 that the Cranbrook Institute of Science inaugurated a serious attempt at a faunal survey of the group as a whole. In cooperation with members of the staff of the Museum of Zoology of the University of Michigan, parties visited all of the larger and many of the smaller islands in the group, beginning early in the summer of 1937 and continuing during the summer months in 1938, 1939, and 1940. While observations were made in fields other than vertebrate zoology, this report covers amphibians, reptiles, birds, and mammals.

The book contains several chapters dealing with the geological and cultural history of the islands and their physical features, as well as accounts of the verte-

brate groups mentioned above. There is also a brief account of the modification of habits noted among certain species and a discussion of the factors of distribution. The results of the survey show what one would expect to be the situation in an island group such as this, namely, the absence of many mainland species for no apparent reason.

The book is most attractively gotten up, sturdily bound, and printed on an excellent grade of paper.—J. L. Peters.

**LIFE HISTORIES OF NORTH AMERICAN NUTHATCHES, WRENS, THRASHERS, AND THEIR ALLIES.** By Arthur Cleveland Bent. United States National Museum Bulletin 195. 1948: xii + 475 pp., 90 half-tone plates. \$1.75.

This is the sixteenth volume in "Bent's Life Histories." It deals with the nuthatches, creeper, wren-tit, dipper, wrens, mockingbird, catbird, and thrashers, a total of 28 species. The basic scheme of organization of Bent's life-history accounts is now well known to most students of birds. Those not familiar with them and without access to any of the recent volumes can refer to earlier, more extensive reviews (for example, Linsdale, 1942. *Wils. Bull.*, 54:219-220; Rand, 1947. *Wils. Bull.*, 59:179-181).

The species accounts, in this as in past volumes, consist of a series of topical headings under which a variety of information is assembled. Especially under such headings as "nesting" and "behavior," this information is a mixture of observational data and interpretive comment that runs the gamut from meaty, conscientiously phrased statements of carefully gathered facts to loose reporting loaded with appalling anthropomorphisms. Thus, in the account of the White-breasted Nuthatch, we have excerpts from the fine paper by Butts thrown into proximity with an absurd note, taking up more space than the first, on an incident between nuthatches and woodpeckers reported in 1918 in *Bird-Lore*. The latter might better have been omitted. We do not need to appeal to the ante-bellum period of the study of bird behavior in America to make the subject "lively."

The present volume deals with some of the most intensively studied American birds. The account of the House Wren draws heavily on the papers of Kendeigh and Baldwin for its most informative paragraphs, and accounts of the Mockingbird and Wren-tit, for example, rely in varying degrees on the expert studies by the Micheners and Erickson, respectively. The account of the Wren-tit, by the way, prepared by Miss Erickson herself, is a well-written, simplified version of her previously published work.

It follows from these comments that "Bent's Life Histories" are not the definitive studies they are sometimes thought to be. They are compilations, some of them authoritative summaries, most of them sketchy and fragmentary in their treatment of a species. The serious student must consult the literature to which Bent's accounts will often refer him. The published papers on the House Wren, for example, probably already exceed this volume in bulk. "Bent's Life Histories" would seem to serve two main purposes: first, to provide a general, more or less narrative description, following a topical outline, of the "haunts and habits" of North American birds useful to the reader who wants more information than our standard bird books offer; second, to provide students with clues to source materials and with items of information not otherwise available. In these respects, Bent's volumes are a real contribution to ornithology.

Contributors to this volume, other than Erickson, are W. M. Tyler (accounts of the White-breasted Nuthatch, Red-breasted Nuthatch, Brown Creeper), A. O. Gross (House Wren and Catbird), R. S. Woods (Cactus Wren and California Thrasher), and A. Sprunt, Jr. (Mockingbird). There is an excellent and especially large series of photographs included in this volume. (The lower figure of plate 30 is inverted.) A bibliography of 23 pages and index of 15 pages are provided.—Frank A. Pitelka.

BIRDS OF ARCTIC ALASKA. By Alfred M. Bailey. Colorado Museum of Natural History, Popular Series, No. 8, April 1, 1948: 6¾ × 10 in., 317 pp., 101 photos, 1 map. Cloth, \$4.50; paper, \$3.00; postage \$0.10.

This book is a compilation of previously published and new information resulting from the expedition of the Colorado Museum of Natural History to northwestern Alaska in 1921-22. The chapter on the vegetation of the Arctic Slope of Alaska, by Joseph Ewan, is excellent; it includes an historical account of previous collecting and a discussion of plant distribution and ecological relationships. Ewan mentions the "epochal and comprehensive Flora of Alaska being published by Dr. Eric Hulten of Stockholm," a much deserved recognition of that industrious scholar.

Bailey's narrative account of his expedition (104 pages) familiarizes the reader with the environment and gives a vivid picture of migration and bird activity.

In the annotated list Bailey does not attempt to give extensive life history data, but includes whatever life history and migration observations are warranted by the rarity of given birds. As an example, the first hand information on the nesting of the Yellow-billed Loon is very welcome. As might be expected, an interesting mingling of Siberian and Alaskan species was found.

Some difficult taxonomic problems are dealt with. When Bailey undertakes to clarify the status of the forms of Canada geese occurring in western and northern Alaska he inevitably runs into the perplexities that have puzzled other workers with these birds. His study of downy young of geese reveals significant differences, as well as similarities, among several forms; his data are a contribution to the subject, but his conclusions, although tentative, will probably arouse some disagreement.

In northwestern Alaska such birds as the Siberian and American Pintails, Rough-legged Hawks, Gyrfalcons, and Peregrine Falcons, find a meeting place. This may also be said of a few birds of the eastern Arctic and of western Alaska, such as the two Golden Plovers and the Solitary Sandpiper. The problem of the races of *Erolia ptilocnemis* appears to have been satisfactorily solved by Conover, whom Bailey refers to, though in my opinion there are some cases that still do not fit in.

Bailey agrees with the recent decision of the A.O.U. Committee on Nomenclature in recognizing *barrovianus* as a subspecies of the Glaucous Gull. There can now be no question about the validity of this race, which has been the cause of so much heated argument in the past. But we need breeding specimens from many localities in the Arctic to understand properly the nesting distribution. The whole question of the relationships of the Arctic gulls still deserves critical attention.

The reader must be impressed with the fact that the Colorado Museum of Natural History chose an area of unusual interest when they sent their expedition to northwest Alaska, where so many taxonomic-distributional problems await solution.

The illustrations on the whole are excellent and useful. Although photographs of dead birds are generally not appealing, the view of the three Yellow-billed Loons is of interest to anyone interested in external bird anatomy. Bailey has more than usual success with photographs of mounted groups; yet such photographs are always less satisfactory than those of living animals. However, it is hard to criticize the photograph of the polar bear group facing page 89, which is an outstanding artistic creation.

This book brings together a valuable lot of information on the ornithology of northwestern Alaska, with a number of new records of occurrence, nesting, and migration, with analyses of several important taxonomic problems, including many measurements and color comparisons. It will continue to be a useful reference work on the Alaskan avifauna—Olaus J. Murie.

THE FEEDING AND RELATED BEHAVIOR OF HUMMINGBIRDS, WITH SPECIAL REFERENCE TO THE BLACK-CHIN, *Archilochus alexandri* (Bourcier and Mulsant). By Frank Bené. *Memoirs of the Boston Society of Natural History*, Vol. 9, No. 1, October 1946: pp. 395-478, pls. 22-33, 4 figs. Cloth, \$2.50; paper, \$1.50.

The rather ambitious title of this paper is misleading. The publication contains detailed original work on one species of hummingbird, *Archilochus alexandri*, with some references to published data on feeding habits of other species. The observations on which the paper is based were made in Phoenix, Arizona, during the spring and summer months, 1939 to 1942.

Trapping and marking hummingbirds is admittedly difficult, and Bené felt that this difficulty was "overcome to a large extent by adopting a system of identification in which notations were made of individual differences in physiognomy and habits." However, I believe that Bené's methods of identifying individual birds cast a shadow of doubt on some of his results based on field observations. The type of reasoning that Bené used in identification of individuals is illustrated by the following passage (pp. 419-420): "There could be no question that this bird was one of the five or six that had been visiting the feeders the previous year. But which one of them? I resorted to the rule of elimination. She made no attempt to build her nest in the yard and ignored the nasturtium of which F1 [F indicates female] was very fond. So, tentatively, she was not F1. She spent very little time in the yard, unlike F3. . . . She was a fully grown adult. Apart from F1 only one female adult had been patronizing the feeders last year. Therefore, she was probably F2. She was in the habit of entering the yard from the north and leaving in the same direction, a routine which corresponded with F2's last year. Her nest was probably in an oleander across the alley where a neighbor, while trimming it, had found an old nest prior to this bird's arrival. The location of the nest corresponded with the direction of her departure from the yard. Therefore, in light of these clues I labeled her F2?."

Bené discusses "the quest for the optimum in breeding and feeding," "selection and defense of breeding and feeding territories," "feeding routine," "food consumption and regulation of diet," "feeding adaptation and technique," "flower preference," "sensory perception and recognition of sources of food," and "learning to feed." There is no question that many valuable contributions are to be found in this imposing list of topics. However, Bené's anthropomorphic treatment of the topics makes it very difficult to separate the wheat from the chaff. Bené also goes into considerable detail, the value of which I question, on the behavior of sick and injured hummingbirds.

Bené did not claim to be an experienced ornithologist. The present study was carried on during a period of illness preceding his death in 1943, before publication of this paper. He deserves credit for working under what must have been a tremendous physical handicap.

Although scientific names, some incorrectly spelled, are given for most of the plants, no attempt has been made by either the author or the editor to include scientific names of all the hummingbird species mentioned. The paper is well printed but there are several typographical errors. Many of the citations in the bibliography are incomplete. Since the paper was published after Bené's death, it seems to me that much of the responsibility for these obvious faults belongs to the editor.

The twelve plates in the paper reproduce some interesting photographs of hummingbird habitats, feeding and flight postures, and food plants.—Harrison B. Tordoff.

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\*Beach, Pearle Leenhouts (Mrs. Walter H.), 328 Parsells Ave.,  
Rochester 9, New York .....1941

Beard, Mrs. Dorothy Bradberg, 425 Jones St., Eveleth, Minnesota.....1948

Beard, Elizabeth Browne (Mrs. Allen Shelby), 9904 Berwick Rd.,  
Rosedale Gardens, Plymouth, Michigan .....1942

Beardslee, Clark Smith, 132 McKinley Ave., Kenmore 17, New York....1942

Beardsley, Miss M[argaret] Hortense, 410 S. Prospect St.,  
Ravenna, Ohio .....1941

Beck, Rollo Howard, Planada, California .....1943

Becker, George C[harles], 176 Garfield Ave., Clintonville, Wisconsin...1941

Becker, Mrs. Paul A., 251 E. Phelps Ave., Owatonna, Minnesota.....1944

Beckley, Oliver E[lihu], Hotchkiss Grove, Branford, Connecticut.....1948

Bedell, Miss Marie L., 1430 W. 20th St., Lorain, Ohio.....1940

\*Beebe, Ralph, 4169 Tenth St., Ecorse 29, Michigan.....1924

\*Beebe, William, 33 W. 67th St., New York City.....1944

\*Beecher, William J[ohn], Chicago Natural History Museum,  
Chicago 5, Illinois .....1948

Beemer, Mrs. Eleanor V[irginia], Pauma Valley, Pala, California.....1948

\*Begley, Devere Marshall, 508 N. Water St., Sparta, Wisconsin.....1947

Behle, William H[arroun], Department of Biology, University of Utah,  
Salt Lake City 1, Utah .....1935

\*Behrend, Fred W[illiam], 322 Carter Blvd., Elizabethton, Tennessee....1944

\*\*Belcher, Paul Eugene, 988 Jefferson Ave., Apt. 3, Akron, Ohio.....1938

\*Bell, Henry III, 296 W. Evergreen Ave., Chestnut Hill,  
Philadelphia 18, Pennsylvania .....1946

Bell, Ruth Estelle (Mrs. Harry A. Jr.), Route 1, Martinsville, Indiana...1948

\*Bellrose, Frank Jr., Illinois Natural History Survey, Havana, Illinois...1935

\*Bennett, Logan J[ohnson], Room 2248, Interior Bldg., Fish and Wildlife  
Service, Washington 25, D.C. ....1934

\*Bennett, Miss Mary A[llison], 623 E. Carroll St., Macomb, Illinois....1933

\*Bennett, Walter W., 5617 Harcourt Ave., Los Angeles 43, California...1945

\*Bennett, Rudolf, Department of Zoology, University of Missouri,  
Columbia, Missouri .....1932

\*Benson, Mrs. Mary Heydweiller, 183 Cherry Rd., Rochester 12,  
New York .....1937

Benson, Seth Bertram, 645 Coventry Rd., Berkeley 7, California.....1930

\*Bent, Arthur C[leveland], 178 High St., Taunton, Massachusetts.....1893

Berger, Andrew J[ohn], Department of Zoology, University of Michigan,  
Ann Arbor, Michigan .....1940

Berkey, William R., 33 Mill St., Kitchener, Ontario, Canada.....1948

- Bergstrom, E[dward] Alexander, 233 Ridgewood Rd., West Hartford 7,  
Connecticut .....1943
- \*Berkowitz, Albert Clarence, Tension Envelope Corporation,  
1912 Grand Ave., Des Moines 14, Iowa.....1946
- Berlin, Grace [Fern] (Mrs. Herbert), Route 1, Monclova, Ohio.....1946
- Berner, Lester M[ax], Box 418, Webster, South Dakota.....1948
- Berriman, Charles S., 4220 Broadway, Indianapolis, Indiana.....1948
- Beule, John D[avid], 312 W. 3rd St., Beaver Dam, Wisconsin.....1948
- \*Biaggi, Virgilio Jr., College of Agriculture, Mayaguez, Porto Rico,  
West Indies .....1945
- Bibbee, Paul Cecil, Athens, West Virginia.....1947
- Biddle, John, 16811 Fernway Rd., Shaker Heights 20, Ohio.....1945
- Bilby, H[enry] A[nthony], 9, Albert Rd., Hayes, Middlesex, England...1947
- \*\*\*Billington, Cecil, 761 Southfield Rd., Birmingham, Michigan.....1939
- \*Binnington, Miss Nora L[ouise], Catawissa, Missouri .....1941
- \*Birchett, Guess E[leanore] (Mrs. Joseph T.), 202 E. 7th St.,  
Tempe, Arizona.....1948
- Birkeland, Henry, Roland, Iowa.....1934
- \*\*Bishop, Dr. Louis B[ennett], 450 Bradford St., Pasadena 2, California..1903
- Bissonnette, Thomas Hume, Trinity College, Hartford 6, Connecticut...1939
- Black, Charles Theodore, 409 Agricultural Hall, Michigan State College,  
East Lansing, Michigan.....1935
- \*\*\*Blain, Dr. Alexander W[illis], 2201 Jefferson Ave., E., Detroit 7,  
Michigan .....1902
- \*Blake, Emmet R[eid], Chicago Natural History Museum, Chicago 5,  
Illinois .....1939
- Blanchard, Miss Dorothy, 2014 Geddes Ave., Ann Arbor, Michigan.....1948
- Blanchard, Harold H[oooper], 32 Calumet Rd., Winchester,  
Massachusetts .....1946
- \*\*Bleitz, Donald Lewis, 5338 Hollywood Blvd., Hollywood 27, California..1948
- \*Blincoe, Ben[edict] Joseph, 8766 N. Main St., Dayton 5, Ohio.....1919
- Blincoe, Edith S. (Mrs. Ben J.), 8766 N. Main St., Dayton 5, Ohio.....1926
- \*Boggs, Ira Brooks, West Virginia University, Morgantown,  
West Virginia .....1938
- Bohland, Michael F., 515 N. Walnut St., Batesville, Indiana.....1948
- Bohland, Mrs. Michael F., 515 N. Walnut St., Batesville, Indiana.....1948
- Bolt, Benjamin F[ranklin], 1110 Armour Blvd., Kansas City 3, Missouri.1914
- \*\*Bond, James, 1900 Race St., Philadelphia 3, Pennsylvania.....1945
- Bond, Richard M[arshall], 3322 S.W. Fairmount Blvd., Portland 1,  
Oregon .....1936
- Boorstin, Dr. Daniel J., 852 E. 57th St., Chicago 37, Illinois.....1946
- \*Borden, Richard, 1031 Canton Ave., Milton, Massachusetts.....1947
- \*Borell, Adrey Edwin, Soil Conservation Service, Box 1348,  
Albuquerque, New Mexico.....1936
- \*Borror, Donald J[oyce], Department of Zoology and Entomology,  
Ohio State University, Columbus 10, Ohio.....1927
- Boulton, Rudyerd, 3317 Dent Place, N.W., Washington 7, D.C.....1942
- Bourlière, Dr. F., 8 Rue Huysmans, Paris 6, France.....1945
- Bourne, Neil [Fitzroy], 39 Flatt Ave., Hamilton, Ontario, Canada.....1948
- \*Bourne, Raymond D[ory], 118 E. Vine St., Oxford, Ohio.....1946
- Bowdish, Beecher S[coville], Demarest, New Jersey.....1921
- Bowen, Leon W[alker], 77 Evergreen Ave., Bloomfield, New Jersey.....1942
- Bowen, Robert Marvin, 5009 Leeds Ave., Halethorpe 27, Maryland.....1947
- Bowers, J. Basil, 381 51st St., Oakland 9, California.....1942
- Bowman, Robert I[rvin], International House, University of California,  
Berkeley 4, California.....1948



- Boyd, Miss Elizabeth M[argaret], Mount Holyoke College,  
South Hadley, Massachusetts.....1941
- Boyd, Hugh J., 24 Bedminster Rd., Bristol 3, England.....1946
- \*Brackbill, Hervey [Groff], 4608 Springdale Ave., Baltimore 7, Maryland..1942
- \*\*\*Bradley, Miss Hazel L[ouise], 301½ Third St., Jackson, Michigan.....1944
- Bradley, Homer L., Sand Lake Refuge, Columbia, South Dakota.....1939
- Brandenburg, Miss Arminta A[lice], State Hospital, Toledo, Ohio.....1941
- \*\*\*Brandt, Herbert W., 2245 Harcourt Dr., Cleveland 6, Ohio.....1945
- \*Branum, Miss Florence [Pauline], 117 N. Ewing St., Lancaster, Ohio....1946
- Brauner, Joseph, 10817 Strathmore Dr., Los Angeles 24, California.....1942
- \*\*\*Brecher, Leonard C[harles], 1900 Spring Dr., Louisville 5, Kentucky....1939
- \*\*Breckenridge, Walter J[ohn], Museum of Natural History, University of  
Minnesota, Minneapolis 14, Minnesota.....1929
- Breiding, George H[erbert], 487 National Rd., Fulton, Wheeling,  
West Virginia .....1942
- Brennan, Bernard P., 658 Park Place, Brooklyn 16, New York.....1948
- Brereton, Dr. E[wart] L[ount], Box 99, Barrie, Ontario, Canada.....1943
- \*Brigham, Edward M[orris] Jr., Kingman Memorial Museum,  
Battle Creek, Michigan.....1931
- \*Brigham, H[erbert] Storrs Jr., 3817 Sedgwick Ave., New York City 63..1942
- Bristow, Harry Sherman Jr., Pine Ave., Cedars, Marshallton, Delaware..1942
- Broadbooks, Harold E[ugene], Museum of Zoology, University of  
Michigan, Ann Arbor, Michigan.....1948
- Brockschlager, Miss Mary Elizabeth, 518 E. Fourth St.,  
Cincinnati 2, Ohio.....1948
- \*Brokaw, De Witt P., 176 Rockview Ave., Plainfield, New Jersey.....1948
- Broley, Charles L[avelle], Delta, Ontario, Canada.....1946
- Brooks, Mrs. Benjamin Talbot, 191 Shore Rd., Old Greenwich,  
Connecticut .....1945
- \*Brooks, Earle A[mos], 166 Plymouth Rd., Newton Highlands,  
Massachusetts .....1933
- \*\*\*Brooks, Maurice Graham, Division of Forestry, West Virginia  
University, Morgantown, West Virginia.....1927
- Broome, Forrest Jones, 7411 Keeler Ave., Detroit 21, Michigan.....1947
- Broun, Maurice, Route 2, Kempton, Pennsylvania.....1935
- Brown, Clarence D., 222 Valley Rd., Montclair, New Jersey.....1938
- Brown, E[lmer] E[vans], Davidson College, Davidson, North Carolina..1945
- \*Brown, N. Rae, Faculty of Forestry, University of New Brunswick,  
Fredericton, New Brunswick, Canada.....1945
- Brownsey, Leah [Belle] (Mrs. Edgar George), 2911 San Isidro St.,  
Tampa 6, Florida.....1946
- Brueggemann, Miss Anna L[ouise], 584 Sheridan Ave., Columbus 9, Ohio.1943
- \*\*\*Bruns, James Henry, 1820 Jefferson Ave., New Orleans, Louisiana.....1941
- \*Bryens, Oscar McKinley, 231 S. Main St., Three Rivers, Michigan.....1924
- Buchanan, Forest Wendell, Amsterdam, Ohio.....1939
- Buchanan, Marjorie H. (Mrs. Keith), Box 531, Amsterdam, Ohio.....1946
- \*Buchheister, Carl W., 1006 Fifth Ave., New York City 28.....1943
- \*Buckstaff, Ralph Noyes, Oshkosh Public Musuem, Oshkosh, Wisconsin...1941
- \*\*Burelbach, Maj. Martin J., 510 W. 4th St., Chattanooga 3, Tennessee...1942
- \*Bures, Joseph August, 2316 Hayson Ave., Pittsburgh 16, Pennsylvania..1946
- \*Burget, Martin Lewis, Dyke, Colorado.....1948
- \*Burget, Russel Lincoln, 526 Devon Place, Toledo 10, Ohio.....1944
- \*Burland, Lee J[ohnson], Room 14, Fernow Hall, Cornell University,  
Ithaca, New York.....1939
- \*Burleigh, Thomas D[earborn], School of Forestry, University of Idaho,  
Moscow, Idaho .....1922

- \*Burlingame, Mrs. Virginia S[truble], 812 S. 8th St.,  
Bozeman, Montana ..... 1946
- Burner, Miss Florence H[elen], 5350 Reisterstown Rd.,  
Baltimore 15, Maryland..... 1948
- \*Burns, Maurice E[dward], 735 W. 10th St., Escondido, California..... 1948
- Burns, Robert David, 1805 Greenleaf Dr., Royal Oak, Michigan..... 1948
- \*Burr, Irving W[ingate], 265 Littleton St., West Lafayette, Indiana..... 1945
- \*Burt, William Henry, Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan..... 1928
- \*Butchart, G. Reeves, Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan..... 1943
- \*Butsch, Robert Stearns, Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan..... 1947
- Bytzko, Miss Anne, 13563 Arlington, Detroit 12, Michigan..... 1948
- Cadbury, Joseph Moore, Johnson Court 1, 16 E. Johnson St.,  
Germantown, Philadelphia 44, Pennsylvania..... 1943
- Cagle, Fred R., Department of Zoology, Tulane University,  
New Orleans 15, Louisiana..... 1942
- \*Cahalane, Victor H[arrison], National Park Service, Washington 25, D.C. 1933
- Caldwell, Miss Sara E[lizabeth], 220 E. Lincoln St., Findlay, Ohio..... 1946
- Calvert, Earl Wellington, Route 2, County Home, Lindsay,  
Ontario, Canada ..... 1937
- Calvert, Scott B., 5147 E. North St., Indianapolis, Indiana..... 1948
- Calvert, William J[onathan] Jr., 615 N. Pelham Rd.,  
Jacksonville, Alabama ..... 1942
- Camburn, F. Lawrence, Edwin S. George Reserve, Pinckney, Michigan... 1947
- Campbell, Mrs. Edith Abbott, Lyme Rd., Hanover, New Hampshire.... 1945
- Campbell, John David, 1222 W. State St., Geneva, Illinois..... 1944
- \*Campbell, Louis W[alter], 4531 Walker Ave., Toledo 12, Ohio..... 1926
- \*Campbell, Miss Mildred F[lorence], 29 N. Hawthorne Lane,  
Indianapolis 19, Indiana..... 1938
- \*Campbell, Thomas H[odgen], 24 15th Ave., Columbus 1, Ohio..... 1946
- Carlander, Kenneth Dixon, Department of Zoology, Iowa State College,  
Ames, Iowa ..... 1948
- Carnes, Mrs. Herbert E., 25 Kenwood Rd., Tenafly, New Jersey..... 1944
- Carpenter, Dorothea Shafer (Mrs. John L.), 402 Walnut St.,  
Alexandria, Indiana ..... 1946
- \*Carpenter, Floyd S., 2402 Longest Ave., Louisville 4, Kentucky..... 1934
- Carpenter, Forrest A[lmon], Des Lacs National Wildlife Refuge,  
Kenmare, North Dakota..... 1948
- Carpenter, Dr. John L[eland], 402 Walnut St., Alexandria, Indiana.... 1946
- \*Carpenter, Thomas L., 557 N. 68th St., Milwaukee 13, Wisconsin..... 1948
- \*Carroll, Col. Robert P., 305 Letcher Ave., Lexington, Virginia..... 1942
- \*\*\*Carrothers, Miss Vera, 14704 Alder Ave., East Cleveland 12, Ohio..... 1938
- Carson, L[enwood] B[allard], 1306 Lincoln St., Topeka, Kansas..... 1948
- Carter, Bertha May (Mrs. E. W.), Route 4, Bowling Green, Ohio..... 1946
- \*Carter, Dennis [Lee], Box 84, Thor, Iowa..... 1947
- \*Carter, Russell W[ebster], 126 N. MacArthur Blvd., Springfield, Illinois.. 1946
- Carter, T. C., Northwestern State College, Alva, Oklahoma..... 1947
- \*Cartwright, Bertram William, 59 Elm Park Rd., Winnipeg,  
Manitoba, Canada ..... 1930
- \*Case, Leslie Delos Sr., 616 Barber Ave., Route 1, Ann Arbor, Michigan... 1938
- Cassel, J[oseph] Frank[lín], Department of Zoology, Colorado A. & M.  
College, Fort Collins, Colorado..... 1940

- \*Cater, Milam B[rison], Box 133, Millboro, Virginia.....1944
- \*\*Cavendish, Miss Virginia G., 1661 Sixth Ave., Huntington,  
West Virginia .....1946
- \*\*Chalif, Edward Louis, 37 Barnsdale Rd., Short Hills, New Jersey.....1947
- \*Challey, John [Raymond], 1349 2nd St., N., Fargo, North Dakota.....1948
- \*\*Chambers, W[illie] Lee, Robinson Rd., Topanga, California.....1909
- Chance, Edgar P[ercival], Gurdons, Witley, Godalming, Surrey, England.1941
- \*Chapin, James P[aul], American Museum of Natural History, Central  
Park W. at 79th St., New York City 24.....1945
- Chapin, John L[adner], Physiology Department, Strong Memorial  
Hospital, Rochester, New York.....1947
- Chapman, Floyd B[arton], 1944 Denune Ave., Columbus 11, Ohio.....1932
- Chapman, Herman Floraine, 712 South Dakota Ave., Sioux Falls,  
South Dakota.....1947
- Chapman, Lawrence B., 1 Woodridge Rd., Wellesley 81, Massachusetts..1940
- Chapman, Mrs. Naomi Fran, Box 177, Flossmoor, Illinois.....1945
- \*Chase, Henry B. Jr., 517 Decatur St., New Orleans 16, Louisiana.....1932
- \*\*Chatham, Comdr. Thurmond, 112 Stratford Rd., Winston-Salem,  
North Carolina.....1945
- Chenault, Tandy P., Mount Sterling, Kentucky.....1948
- Chiavetta, Kenneth James, Conservation Commission, U.S.D.A. Bldg.,  
Elkins, West Virginia.....1948
- Childs, Henry E[verett] Jr., 441 Boynton Ave., Berkeley 7, California...1948
- Chilman, Ruth E[va] (Mrs. W. A.), 15464 Asbury Park,  
Detroit 27, Michigan.....1948
- Christine, Chad[wick] W[ilson], 420 Riverview Terrace,  
Maysville, Kentucky.....1947
- Christisen, Don[ald] M[erle], Route 2, Columbia, Missouri.....1947
- Christy, O. B., 2820 University, Muncie, Indiana.....1948
- \*\*Church, C[harles] T[homas], 70 Pine St., New York City 5.....1945
- Chutter, Miss Mildred C., Box 229, Athens, Ohio.....1936
- Clapp, G[eorge] Howard, Box 114, Hartland, Wisconsin.....1941
- \*\*\*Clarkson, Mrs. Edwin O., Wing Haven, 248 Ridgewood Ave.,  
Charlotte 7, North Carolina.....1940
- Clausen, Arthur William, 120 W. Main St., Dwight, Illinois.....1947
- \*Clay, William M[arion], Department of Biology, University of Louisville,  
Louisville 8, Kentucky.....1947
- Clemens, William B[ryson], 40 N. Church St., Cortland, New York.....1942
- Clement, Roland C[harles], 49 Tremont St., Fall River, Massachusetts...1941
- Clifford, Mrs. Scot, Brendonwood, Indianapolis, Indiana.....1948
- \*Clow, Miss Marion, Box 163, Lake Forest, Illinois.....1929
- \*Coffey, Ben Barry Jr., 672 N. Belvedere, Memphis 7, Tennessee.....1927
- Coffin, Anna Audenried (Mrs. Francis Hopkinson), 1512 Jefferson Ave.,  
Scranton, Pennsylvania.....1947
- Cogswell, Howard L[yman], Department of Zoology, University of  
California, Berkeley 4, California.....1944
- Collias, Nicholas E[lias], Department of Zoology, University of  
Wisconsin, Madison 6, Wisconsin.....1945
- Collins, Mrs. Edna, 1123 N. Hawthorne Lane, Indianapolis, Indiana.....1948
- Collum, Charles Edward, 1070 Lucile Ave., S.W., Atlanta, Georgia.....1947
- Collum, Thomas Francis, 1070 Lucille Ave., S.W., Atlanta, Georgia.....1947
- Coman, Edward L., 26 Lake St., Wakefield, Rhode Island.....1948
- Comfort, James F., 27 N. Iola Dr., Webster Groves 19, Missouri.....1947
- Common, Mrs. James A., 141 Flower Ave., W., Watertown, New York..1945
- Compton, Miss Dorothy M[ay], 22 Wilton St., Princeton, New Jersey...1945

- \*Compton, Lawrence Verlyn, Soil Conservation Service, Box 1898,  
Ft. Worth 1, Texas.....1923
- \*Congdon, Dr. R[ussel] T[hompson], Medical Arts Bldg.,  
Wenatchee, Washington.....1944
- Conkey, John H., 11 Chestnut St., Ware, Massachusetts.....1947
- Conn, Robert Carland, 769 Park Ave., Bound Brook, New Jersey.....1945
- \*\*\*Conover, [H.] Boardman, 6 Scott St., Chicago 10, Illinois.....1944
- \*Conrad, Charles L[ouis], 1206 Warwood Ave., Wheeling, West Virginia..1937
- \*Conway, Albert E., Department of Psychology, Lafayette College,  
Easton, Pennsylvania.....1939
- \*Cooch, Graham, 685 Echo Dr., Ottawa, Ontario, Canada.....1945
- Cook, Bill J[ames], 969 Congress Ave., Glendale, Ohio.....1948
- \*Cook, Miss Fannye Addine, State Fish and Game Commission,  
2550 N. State St., Jackson 44, Mississippi.....1923
- \*\*\*Cooley, Miss Eleanor Graham, R.F.D., Berwyn, Maryland.....1936
- Coombes, Robert Armitage Hamilton, Sea Bank, Bolton-le-Sands,  
Carnforth, Lancashire, England.....1936
- Corn, Lawrence R., 329 N. 41st St., Camden, New Jersey.....1945
- \*Cottam, Clarence, Fish and Wildlife Service, Department of the Interior,  
Washington 25, D.C.....1929
- Cottrell, George William Jr., 70 Lake View Ave.,  
Cambridge 38, Massachusetts.....1941
- \*Court, Edward J., 1723 Newton St., N.W., Mt. Pleasant, Washington, D.C..1944
- Cox, Dorothy Ploch (Mrs. Lawrence G.), Star Route,  
Crosslake, Minnesota.....1947
- \*Crawford, Gene H., Bowdoin National Wildlife Refuge, Malta, Montana.1948
- \*Creager, Joe C[lyde], L. A. Cann Rd., Drawer 1267,  
Ponca City, Oklahoma.....1947
- Crewson, Ray[mond] [Charles], 111 E. Texas Ave., Sebring, Ohio.....1947
- Crichton, Vincent, Chapleau, Ontario, Canada.....1948
- Crowder, Orville W[right], 2910 Guilford Ave., Baltimore 18, Maryland.1946
- \*Cruickshank, Allan Dudley, Highland Hall, Rye, New York.....1939
- Cruttenden, John Rudy, 2020 Maine St., Quincy, Illinois.....1945
- \*Cunningham, James W., 3009 E. 19th Terrace, Kansas City, Missouri...1935
- \*Currier, Edmonde S[amuel], 8541 N. Chicago Ave., St. Johns Station,  
Portland, Oregon.....1930
- \*Curtis, Miss Elizabeth L[ong], 5648 Beach Dr., Seattle 6, Washington...1935
- \*Curtis, Robert A[ndrews], Route 1, Goffstown, New Hampshire.....1945
- \*Dahlberg, Wendell O[scar], 11312 S. Michigan Ave., Chicago 28, Illinois.1939
- Dainty, Jack, 6 Wolfe Ave., Deep River, Ontario, Canada.....1947
- Dallas, George M., 18 Summit St., Philadelphia 18, Pennsylvania.....1948
- \*Dambach, Charles A., Department of Zoology and Entomology,  
Ohio State University, Columbus 10, Ohio.....1934
- Damon, David, Game, Forestation and Parks Commission,  
State Capitol, Lincoln, Nebraska.....1933
- \*Dana, Edward Fox, 57 Exchange St., Portland 3, Maine.....1939
- Danner, May S. (Mrs. John M.), 1646 Cleveland Ave., N.W., Canton, Ohio.1921
- Darby, Richard T[horn], 5029 Hazel Ave., Philadelphia 43, Pennsylvania 1948
- \*\*Darden, Constance S. (Mrs. Colgate W. Jr.), University of Virginia,  
Charlottesville, Virginia.....1943
- Davey, Dr. Winthrop N[ewbury], University Hospital,  
Ann Arbor, Michigan.....1941
- \*Davidson, William Mark, Box 66, Laurel, Maryland.....1933
- \*Davis, Clifford Vernon, Department of Zoology and Entomology,  
Montana State College, Bozeman, Montana.....1945

- \*Davis, Dr. David E[dward], School of Hygiene and Public Health,  
Johns Hopkins University, Baltimore 5, Maryland.....1940
- \*\*Davis, Mrs. Edward M., 159 E. Lyman Ave., Winter Park, Florida.....1946
- Davis, George, Route 5, Murfreesboro, Tennessee.....1936
- Davis, George W., 148 Northfield St., Montpelier, Vermont.....1941
- Davis, Howard Henry, Little Stoke, Patchway, Bristol, England.....1947
- \*Davis, John, Museum of Vertebrate Zoology, University of California,  
Berkeley 4, California.....1939
- \*Davis, L[ouie] Irby, Box 988, Harlingen, Texas .....1933
- \*Davis, Russell S., Clayton, Illinois.....1947
- Davis, W[illiam] B., Department of Wildlife Management,  
College Station, Texas.....1938
- Davis, William Franklin, 423 W. 46th St., Ashtabula, Ohio.....1947
- \*Davisson, A. Paul, 1112 Fleming Ave., Edgemont, Fairmont,  
West Virginia.....1947
- \*Dean, Mrs. Blanche Evans, 2100 20th Ave., S., Birmingham, Alabama ....1947
- \*Dear, Lt. Col. L[ionel] S[extus], Box 127, Port Arthur, Ontario, Canada 1939
- Dechen, Mrs. Lillian Orvetta, 14 Summer St., Port Dickinson,  
Binghamton 6, New York.....1939
- \*Decker, C[harles] O., 6450 Kenwood Ave., Chicago 37, Illinois.....1938
- Deevey, Edward S[mith] Jr., Osborn Zoological Laboratory,  
Yale University, New Haven 11, Connecticut.....1948
- \*DeGarmo, William Russell, 1570 Virginia St., E.,  
Charleston, West Virginia.....1946
- DeGroot, Dudley Sargent, West Virginia University,  
Morgantown, West Virginia.....1948
- Dehner, Rev. Eugene W[illiam], St. Benedict's College, Atchison, Kansas.1944
- Deichmann, [Kjeld] Henrik, Moss Glen, Kings County,  
New Brunswick, Canada.....1948
- \*\*\*Delacour, Jean [Theodore], American Museum of Natural History,  
Central Park W. at 79th St., New York City 24.....1944
- Delavan, Wayne G., Route 2, Box 61, Bronson, Kansas.....1943
- \*DeLury, Ralph Emerson, 330 Fairmont Ave., Ottawa, Ontario, Canada..1920
- \*Denham, Reginald [Francis], 100 Central Park, S., New York City 19....1948
- \*Denton, J[ames] Fred Jr., 1510 Pendleton Rd., Augusta, Georgia.....1935
- Derdiger, Mrs. Caroline V., 3122 15th Ave., S.,  
Minneapolis 7, Minnesota.....1944
- Derleth, August [William], Sauk City, Wisconsin.....1940
- \*\*de Schauensee, Rodolphe Meyer, Devon, Pennsylvania.....1945
- \*\*\*Desmond, Hon. Thomas C[harles], Box 670, Newburgh, New York.....1942
- \*Deusing, Murl, Milwaukee Public Museum, Milwaukee 3, Wisconsin...1937
- Devitt, Otto Edmund, 218 Eglinton Ave., E., Toronto, Ontario, Canada..1935
- Dice, Lee R[aymond], Laboratory of Vertebrate Biology,  
University of Michigan, Ann Arbor, Michigan.....1943
- Dickinson, J[oshua] C[lifton] Jr., Department of Biology,  
University of Florida, Gainesville, Florida.....1939
- \*Dickinson, Miriam S. (Mrs. William Winston), 2006 Reid Ave.,  
Bluefield, West Virginia.....1942
- \*Diem, Kenneth Lee, 2418 Santa Barbara St., Santa Barbara, California..1948
- Dietrich, Otto Killian, 225 Glendora Ave., Louisville 12, Kentucky.....1947
- \*Dilger, William C[hristopher], 126 Lake Ave., Hilton, New York.....1946
- \*Dingle, Edward von Siebold, Huger, South Carolina.....1921
- \*Dixon, Miss Clara, Albion College, Albion, Michigan.....1947
- \*Dixon, J[ames] B[enjamin], Route 1, Box 688, Escondido, California...1936
- Dixon, Keith Lee, International House, Berkeley 4, California.....1946
- \*Dobie, Mrs. J. Frank, 702 Park Place, Austin, Texas.....1948

- \*\*Dodge, Victor K[enney], 137 Bell Court West, Lexington 23, Kentucky. .1935
- \*Doenges, Miss Yuvon B[ernadine], Route 8, Defiance, Ohio. . . . .1948
- Doerhoefer, Basil, Route 6, Box 538, Louisville, Kentucky. . . . .1947
- \*\*Doering, Hubert R., 6522 Michigan Ave., St. Louis 11, Missouri. . . . .1945
- \*Dole, Sumner A[lvord] Jr., 19 Tahanto St., Concord, New Hampshire. .1947
- Domm, Lincoln V[alentine], Whitman Laboratory of Experimental  
Zoology, University of Chicago, Chicago 37, Illinois. . . . .1936
- Donahue, Miss [Henri]etta Helen, Department of Zoology,  
Botany and Zoology Bldg., Columbus 10, Ohio. . . . .1947
- \*Donnelly, Thomas Wallace, 1432 44th St., N.W., Washington 7, D.C. . . .1947
- \*Douglass, Donald W., Game Division, Michigan Department  
of Conservation, Lansing 13, Michigan. . . . .1929
- \*Downer, Alice Porter (Mrs. C. T.), Box 82, Lanham, Maryland. . . . .1945
- \*Downing, Paul E[arl], 835 Waukegan Ave., Highland Park, Illinois. . . .1943
- Drum, Miss Margaret, 217 South St., Owatonna, Minnesota. . . . .1937
- \*Dudley, John M[urchie], 20 Germain St., Calais, Maine. . . . .1944
- Duff, C. V., 1922 Tamarind Ave., Hollywood 28, California. . . . .1946
- Duff, James V[ictor], 418 Clark Hall, Pomona College,  
Claremont, California . . . . .1948
- Duffield, Marjorie O[lney] (Mrs. John W.), Institute of Forest Genetics,  
Placerville, California. . . . .1948
- Dugan, Caldwell Norton, 446 14th Ave., N.E., St. Petersburg, Florida. .1948
- \*\*\*Dugan, Dr. William Dunbar, 221 Pierce Ave., Hamburg, New York. . .1945
- \*DuMont, Philip A[tkinson], 4114 Fessenden St., N.W.,  
Washington 16, D.C. . . . .1928
- Dundas, Lester Harvey, Slade National Wildlife Refuge,  
Dawson, North Dakota. . . . .1943
- Dunt, R. H., "Lynhurst," Kenilworth Rd., Sale, Cheshire, England. . . .1948
- Durand, Miss Lucia Relf, 640 Middlefield Rd., Palo Alto, California. . .1948
- Dusi, Julian L[uigi], 251 Taylor Station Rd., Blacklick, Ohio. . . . .1941
- \*Duvall, Allen Joseph, Fish and Wildlife Service,  
Department of the Interior, Washington 25, D.C. . . . .1942
- Dyar, Mrs. Jessie Goss, 974 N. Audubon Rd., Indianapolis, Indiana. . .1948
- \*Dyer, William A., 112 Allen St., Union City, Michigan. . . . .1947
- \*Eagleson, Joseph P., 85 E. Gay St., Columbus 15, Ohio. . . . .1943
- \*East, Ben, Holly, Michigan. . . . .1948
- \*Eastman, Whitney H[askins], % General Mills, Inc.,  
General Mills Bldg., Minneapolis 1, Minnesota. . . . .1941
- \*Eastwood, Sidney Kingman, 5110 Friendship Ave.,  
Pittsburgh 24, Pennsylvania. . . . .1928
- Eaton, Stephen W[oodman], 808 S. Main St., Geneva, New York. . . . .1942
- Eckelberry, Don R[ichard], 47 Brentwood Rd., Bay Shore,  
Long Island, New York. . . . .1948
- Eddy, Garrett, 4515 Ruffner St., Seattle 99, Washington. . . . .1947
- \*Edeburn, Ralph M[ilton], Department of Zoology, Marshall College,  
Huntington, West Virginia. . . . .1947
- \*Edge, Mrs. Charles N[oe]l, 1215 Fifth Ave., New York City 29. . . . .1931
- \*Edwards, Ernest P[reston], Fernow Hall, Cornell University,  
Ithaca, New York. . . . .1947
- Edwards, James L., 27 Stanford Place, Montclair, New Jersey. . . . .1947
- \*\*Edwards, Robert Davis, % Stock Trend Service, 95 State St.,  
Springfield, Massachusetts . . . . .1945
- \*\*\*Edwards, Robert L[omas], Department of Biology, Harvard University,  
Cambridge 38, Massachusetts. . . . .1945
- Edwards, R[oger] York, Department of Zoology, University of British  
Columbia, Vancouver, British Columbia, Canada. . . . .1948

- \*Edwards, Sylvia P. (Mrs. Robert L.), Department of Biology,  
Harvard University, Cambridge 38, Massachusetts.....1946
- \*Eichman, Cuno, 3276 Daleford Rd., Shaker Heights 20, Ohio.....1948
- \*Eifert, Virginia S[nider] (Mrs. Herman D.), 705 W. Vine St.,  
Springfield, Illinois.....1941
- \*Eifrig, Charles William Gustave, Windermere, Orange Co., Florida.....1907
- Eighme, Miss Marietta M[uriel], 1201 N. Court St., Ottumwa, Iowa....1947
- \*\*\*Eisenmann, Eugene, 110 W. 86th St., New York City.....1942
- Eisenmayer, Miss Betty Jean, 1917 N. Main Ave., Springfield 1, Missouri.1948
- \*Ekblaw, George Elbert, 511 W. Main St., Urbana, Illinois.....1914
- \*\*Ekblaw, Walter Elmer, Clark University, Worcester 3, Massachusetts...1910
- \*\*Eklund, Dr. Carl M[ilton], Rocky Mountain Laboratory,  
Hamilton, Montana .....1945
- \*Elder, William H[anna], 105 Wildlife Conservation Bldg.,  
University of Missouri, Columbia, Missouri.....1938
- Ellarson, Robert S[cott], 431 Sterling Court, Madison 5, Wisconsin.....1948
- Ellett, C[layton] W[ayne], Department of Botany, Ohio State University,  
Columbus 10, Ohio.....1948
- \*Elliott, Richard M., 1564 Vincent St., St. Paul 8, Minnesota.....1940
- Ellis, Miss Hazel Rosetta, Keuka College, Keuka Park, New York.....1942
- Ellsworth, Miss Emma Margaret, 6331 N. 32nd St., Omaha 11, Nebraska.1948
- Emans, Miss Elaine V[ivian], Hutchinson, Minnesota.....1947
- Emerson, David L[owell], 25 Everett Ave., Providence, Rhode Island...1939
- \*\*\*Emerson, Guy, 16 E. 11th St., New York City 3.....1938
- \*Emilio, S[heward] Gilbert, Route 4, Laconia, New Hampshire.....1929
- \*Emlen, John Thompson Jr., Department of Zoology,  
University of Wisconsin, Madison 6, Wisconsin.....1936
- Empey, Miller, Freeland, Michigan.....1939
- \*English, Pennoyer Francis, Department of Zoology,  
Pennsylvania State College, State College, Pennsylvania.....1934
- Ennis, J[ames] Harold, Cornell College, Mt. Vernon, Iowa.....1942
- \*Erickson, Mary M[arilla], University of California Santa Barbara  
College, Santa Barbara, California.....1930
- Erickson, Ray C[hables], Malheur National Wildlife Refuge,  
Burns, Oregon.....1939
- \*\*Errington, Paul L[ester], Iowa State College, Ames, Iowa.....1932
- Eshleman, S[ilas] Kendrick III, 733 E. Lassiter St., Gainesville, Florida.1947
- \*Etz, Mrs. Elizabeth Cecilia, Thornhedge, Wheeling, West Virginia.....1940
- \*\*Eustice, Mrs. Alfred L., 1138 Sheridan Rd., Evanston, Illinois.....1944
- \*Evans, Dr. Evan Morton, 550 Park Ave., New York City.....1929
- \*Evenden, Fred G[eorge] Jr., 521 Hayes St., Woodburn, Oregon.....1948
- Everett, Miss Constance Antoinette, 206 Ninth St., N. E.,  
Waseca, Minnesota.....1948
- Eynon, Alfred E., 5 Beach Rd., Verona, New Jersey.....1947
- \*Eyster, Marshall Blackwell, 203 Vivarium Bldg., Wright and Healey Sts.,  
Champaign, Illinois.....1947
- Fales, John H[ouse], 1917 Elkhart St., Silver Spring, Maryland.....1939
- \*\*Fargo, William G[ilbert], 506 Union St., Jackson, Michigan.....1923
- \*\*Farmer, Earl Wilson, Box 1362, Steubenville, Ohio.....1946
- \*Farner, Donald S[ankey], Department of Zoology,  
The State College of Washington, Pullman, Washington.....1941
- \*Fawver, Ben J[unior], 512 W. White St., Champaign, Illinois.....1948
- Feeney, W. S., Box 132, Ladysmith, Wisconsin.....1937
- \*Feighner, Miss Lena Veta, 298-1 S. Tremont St., Kansas City, Kansas..1935
- \*\*\*Feigley, Miss Margaret D[enny], 544 Chestnut St., Winnetka, Illinois...1944
- \*Ferguson, William, 5907 Mason St., Omaha, Nebraska.....1946

- Fetherston, Miss Kathleen E[lizabeth], Pelee Island, Ontario, Canada...1946
- \*Fichter, Dr. Edson Harvey, 440 N. 26th St., Lincoln, Nebraska.....1948
- Finrock, Clarence Millard, School of Law, Western Reserve University,  
Cleveland 6, Ohio.....1948
- \*Finster, Miss Ethel B., Louisburg College, Louisburg, North Carolina...1931
- \*Fischer, Richard B[ernard], 140-19 Beech Ave., Flushing, New York...1942
- \*Fisher, Mrs. Glen, Route 3, Box 168, Oshkosh, Wisconsin.....1948
- Fisk, Frederick Charles, 490 First St., N.W., Linton, Indiana.....1948
- Flamm, Mrs. Ruth Marrieglgen, Lake Lillian, Minnesota.....1948
- Fleetwood, Raymond J[ludy], Bosque del Apache National Wildlife  
Refuge, San Antonio, New Mexico.....1931
- \*Fleisher, Edward, Brooklyn College, Brooklyn 10, New York.....1947
- Fleugel, James Bush, 1104 American National Bank Bldg.,  
Kalamazoo, Michigan.....1942
- \*Flexner, John Morris, 2204 Douglass Blvd., Louisville 5, Kentucky.....1948
- \*Floyd, Judge Joseph Larke, 302 Citizens Bldg., Canton, Ohio.....1903
- \*Fluekiger, Miss Dora Whitman, Hotel Dauphin, Broadway at 67th St.,  
New York City 23.....1948
- Flynn, Michael B[urke], 282 Rider Ave., Syracuse 4, New York.....1942
- \*Foley, Edward J[ames], 5349 N. Bay Ridge Ave.,  
Milwaukee 11, Wisconsin.....1947
- Folger, Miss Edith Virginia, 1 Vestal St., Nantucket, Massachusetts.....1946
- \*Foote, Maurice E[dwin], Route 1, Mantua, Ohio.....1932
- Ford, Edward R[ussell], Newaygo, Michigan.....1914
- Fordham, Stephen Crane Jr., Delmar Game Farm, Delmar, New York...1948
- Forsyth, Mrs. Louise A[nn], 71 Lebanon Rd., Hanover, New Hampshire 1940
- Forsyth, Max Allyn, 313 N. 16th St., New Castle, Indiana.....1948
- Foster, Ben R., Agricultural Station, Christiansted,  
St. Croix, Virgin Islands.....1947
- Foster, Edwin G[arfield], 36 Arvine Park, Rochester 11, New York.....1948
- Fowle, C[hables] David, Royal Ontario Museum of Zoology,  
100 Queen's Park, Toronto, Ontario, Canada.....1947
- \*Fox, Adrian C., Box 1451, Lincoln, Nebraska.....1937
- \*Fredrickson, Richard William, 1019 Kentucky St., Lawrence, Kansas...1947
- \*\*French, Mrs. Elizabeth Thomas, 1801 Las Lomas,  
Albuquerque, New Mexico.....1943
- French, Norman Roger, 1031 W. Edwards St., Springfield, Illinois.....1947
- \*Fries, Waldemar Hans, 220 Valley Rd., Merion Station, Pennsylvania..1947
- Fromholz, Miss Addie Nye, 1101 W. Cherokee Ave., Enid, Oklahoma...1947
- Frost, Herbert Hamilton, 178 E. 2nd St., S., Rexburg, Idaho.....1941
- \*Frye, O. Earle Jr., Box 834, Punta Gorda, Florida.....1940
- \*Fryman, Miss Kathryn E[lizabeth], 114 Oak St., Wyandotte, Michigan..1943
- Fulmer, Mary Frances (Mrs. L. R.), 437 Crane Ave., Kent, Ohio.....1947
- \*Furniss, Owen C[ecil], Port Alberni, Vancouver Island,  
British Columbia, Canada.....1934
- \*Gabrielson, Ira N[oel], 1807 Preston Rd., Parkfairfax,  
Alexandria, Virginia.....1913
- Gaillard, Stephen Lee, 9 Lee Place, Bronxville, New York.....1942
- Gaines, Jack Raymond, 411 W. Koch St., Bozeman, Montana.....1945
- Gairloch, Stanley S[tanford], Kingston, Rhode Island.....1948
- Gale, Dr. John S[umner], U. S. Veterans Administration Hospital,  
Indianapolis 44, Indiana.....1948
- \*Gale, Larry R[ichard], Greensburg Ave., Hodgenville, Kentucky.....1948
- \*Galley, John E[dmund], 1610 W. Holloway Ave., Midland, Texas.....1945
- Gallup, Frederick Norman, Escondido, California.....1947



- \*Gammell, Dr. R[obert] T[h Theodore], Kenmare, North Dakota.....1943
- \*\*Ganier, Albert F[ranklin], 2112 Woodlawn Dr., Nashville 5, Tennessee..1915
- Garner, William Vaughn, 447 E. Wacksworth St., Philadelphia 19,  
Pennsylvania .....1948
- Garrett, Miss [Mary] Lois, 1709 Chestnut St., Kenova, West Virginia..1942
- Garrison, David L[loyd], Lincoln, Massachusetts.....1940
- Gashwiler, Jay S., Fish and Wildlife Service, 436 Federal Bldg.,  
Salt Lake City, Utah.....1944
- \*Gates, Miss Doris [Berta], 814 W. 4th St., North Platte, Nebraska.....1948
- Gates, J. Herman, Box 346, Wakefield, Rhode Island.....1948
- Gensch, Robert Henry, U. S. Fish and Wildlife Service, 1001 Fidelity Bldg.,  
Kansas City 6, Missouri.....1939
- George, John L[othar], Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1939
- Gerstell, Richard, % Animal Trap Company of America,  
Lititz, Pennsylvania.....1939
- Gibbs, Robert H[enry] Jr., 304 College Ave., Ithaca, New York.....1948
- Gibbs, Walter C., 114 W. Thornapple St., Chevy Chase, Maryland.....1941
- \*Gier, Herschel Thomas, Department of Zoology, Kansas State College,  
Manhattan, Kansas.....1937
- Giernot, Bruno Benjamin, 1111 E. Burlington, Iowa City, Iowa.....1948
- Gifford, Harold, 3636 Burt Ave., Omaha, Nebraska.....1936
- Gilbert, Miss Kathryn Helen, 714 1st Ave., W., Grand Rapids, Minnesota.1945
- Gill, C[harles] T[erry], Box 1607, Harlingen, Texas.....1947
- \*\*Gillen, Harold W., Denslow Rd., New Canaan, Connecticut.....1944
- Gillette, Mary Howie (Mrs. Darwin Clay), Box 145, Ulster, Pennsylvania.1946
- \*Gillette, John Wells, Route 4, Niles, Michigan.....1948
- Gilligan, James P., Department of Biology, Boise Junior College,  
Boise, Idaho.....1938
- Giltz, Maurice L[eroy], Department of Zoology and Entomology,  
Ohio State University, Columbus 10, Ohio.....1939
- Ginn, William Edward, 511 E. Van Buren St., Columbia City, Indiana..1941
- Glazier, William H[enry] M[onroe], 36 High St.,  
Peterborough, New Hampshire.....1948
- Glenn, Robert W., 509 Orchard Ave., Avalon, Pittsburgh 2, Pennsylvania.1934
- Glore, W[alter] S[cott] Jr., 350 Maple Ave., Danville, Kentucky.....1947
- Glover, Fred A[rthur], Department of Zoology, Iowa State College,  
Ames, Iowa.....1947
- Goebel, Herman [John], 78-52 80th St., Brooklyn 27, New York.....1946
- \*\*Goetz, Christian John, 3503 Middleton Ave., Cincinnati 20, Ohio.....1930
- \*Goldman, George M., Emory at Oxford College, Oxford, Georgia.....1947
- Good, Ernest E[ugene], Stone Laboratory, Put-in-Bay, Ohio.....1937
- Goodman, John David, Department of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1944
- \*Goodridge, Edwin Tyson, Province Line Rd., Princeton, New Jersey...1944
- \*Gordinier, Earl J[erome], Ogemaw Game Refuge, St. Helen, Michigan...1948
- Gorrell, Mrs. E. C., 222 S. Monticello St., Winamac, Indiana.....1948
- \*Goslin, Charles R[ussell], 726 E. King St., Lancaster, Ohio.....1940
- \*Goslin, Robert M[artin], 316 Wilson Ave., Columbus 5, Ohio.....1936
- Gosner, Kenneth Lynn, 453 Mt. Prospect Ave., Newark, New Jersey...1948
- Gough, William McDonald, 28 Baby Point Rd., Toronto, Ontario, Canada.1944
- Graber, Mrs Jean W[eber], 1522 Polk St., Topeka, Kansas.....1948
- \*Gram, Margaret Edwards (Mrs. H. James Jr.), 207 McKinley Ave.,  
Detroit 30, Michigan.....1941
- \*Grange, Wallace, Babcock, Wisconsin.....1930
- \*Grant, Cleveland P[utnam], 245 Davis St., Mineral Point, Wisconsin...1928

- \*Grave, Miss Kathryn Ann, 4925 29th Ave., S., Minneapolis 6, Minnesota. .1947  
Graves, Miss [Cynthia] Katherine, 1209 N. Illinois Ave., Apt. 28,  
Indianapolis 2, Indiana. . . . .1942  
Gray, William Arthur, Room 646, 224 S. Michigan Ave.,  
Chicago 4, Illinois. . . . .1938  
Grayce, Robert, 141 Main St., Rockport, Massachusetts. . . . .1946  
Greeley, Fred[erick], 1121 Rutledge St., Madison 3, Wisconsin. . . . .1942  
\*Green, N[orman] Bayard, Zoology Department, Marshall College,  
Huntington 1, West Virginia. . . . .1943  
\*\*Greene, Albert E., 517 Oswego St., Ann Arbor, Michigan. . . . .1939  
\*Greene, Earle R[osenbury], 116 S. Scott St., New Orleans 19, Louisiana.1930  
Greenhalgh, Clifton M., 1230 E. 1st St., S., Salt Lake City, 2, Utah. . .1939  
\*Greenwell, Guy A., Mendon, Missouri. . . . .1947  
Greer, Rev. Edward C., 422 E. 10th St., Davenport, Iowa. . . . .1948  
\*Gregory, Stephen S[trong], Jr., Box N, Winnetka, Illinois. . . . .1922  
Griffee, W[illett] E., 510 Yeon Bldg., Portland 4, Oregon. . . . .1947  
\*Griffin, William W[elcome], 135 Peachtree Way, N.E., Atlanta, Georgia. .1946  
\*\*Grimes, S[amuel] A[ndrew], Route 6, Box 82 G, Jacksonville 7, Florida.1924  
\*Grimm, William C[arey], Box 274, Laughlinton, Pennsylvania. . . . .1939  
\*Grinnell, Lawrence I[rving], 710 Triphammer Rd., Ithaca, New York. . .1939  
\*\*Griscom, Ludlow, Museum of Comparative Zoology,  
Cambridge 38, Massachusetts. . . . .1937  
\*Groesbeck, William M[aynard], 376 Seneca Rd., Hornell, New York. . .1947  
Grose, E. R., Sago, West Virginia. . . . .1939  
\*Groskin, Horace, 210 Glenn Rd., Ardmore, Pennsylvania. . . . .1937  
\*Gross, Alfred Otto, 11 Boody St., Brunswick, Maine. . . . .1927  
\*Grube, G[eorge] E[dward], 52 Cayuga St., Trumansburg, New York. . .1948  
Gruenewald, Robert Franklin, Box 422, Sanborn, Iowa. . . . .1948  
\*Guelf, George F., Brockport, New York. . . . .1944  
Guhl, A[phaeus] M[atthew], Department of Zoology, Kansas State  
College, Manhattan, Kansas. . . . .1948  
Gullion, Gordon W[right], Department of Zoology, University of  
California, Berkeley 4, California. . . . .1947  
\*Gunderson, Harvey Lorraine, Museum of Natural History,  
University of Minnesota, Minneapolis 14, Minnesota. . . . .1941  
Gunn, W[illiam] W[alker] H[amilton], 49 Barrington Ave.,  
Toronto, Ontario, Canada. . . . .1945  
Hadeler, Miss Catherine [Wilma], 900 Harmon Ave., Dayton 9, Ohio. .1945  
\*Hadley, Thomas E., 48 Wellesley Dr., Pleasant Ridge, Michigan. . . . .1944  
\*Haessler, Dr. F[erdinand] Herbert, 324 E. Wisconsin Ave.,  
Milwaukee 2, Wisconsin. . . . .1947  
\*\*Hagar, Mrs. Jack, Box 339, Rockport, Texas. . . . .1930  
\*Hague, Florence S., Sweet Briar College, Sweet Briar, Virginia. . . . .1931  
\*Haines, Robert L[ee], 54 E. Main St., Moorestown, New Jersey. . . . .1947  
Haines, T. P., Biology Department, Mercer University, Macon, Georgia. .1941  
\*Hainsworth, William P[ickard], 216 Railroad Ave.,  
North Andover, Massachusetts. . . . .1930  
\*Hale, James B[all], 115½ 2nd St., N., Ladysmith, Wisconsin. . . . .1947  
\*Hall, Fred T., 1568 Winton Rd., N., Rochester 9, New York. . . . .1937  
\*Hall, George A[rthur], Department of Chemistry,  
University of Wisconsin, Madison 6, Wisconsin. . . . .1946  
\*Hall, Mrs. Gladys A[reta], 912 Douglas Ave., Kalamazoo 52, Michigan. .1947  
Halladay, Ian R[ussel], 218 Belsize Dr., Toronto 12, Ontario, Canada. . .1948  
\*Haller, Frank D[enver], Department of Forestry and Conservation,  
Purdue University, West Lafayette, Indiana. . . . .1940  
\*Hallman, Roy Cline, Box 826, Panama City, Florida. . . . .1928

Hallowell, Miss Essie V., 237 E. High St., Pendleton, Indiana.....	1948
**Hamann, Carl F[erdinand], Maple Lane, Aurora, Ohio.....	1947
*Hamerstrom, Frances (Mrs. Frederick N. Jr.), Edwin S. George Reserve, Pinckney, Michigan.....	1948
*Hamerstrom, Frederick N. Jr., Edwin S. George Reserve, Pinckney, Michigan .....	1934
**Hamilton, Charles W[hiteley], 2304 Goldsmith Ave., Houston 5, Texas ..	1948
*Hamilton, William J[ohn] Jr., Department of Zoology, Cornell University, Ithaca, New York.....	1933
*Hammond, Merrill C[lyde], Lower Souris Refuge, Upham, North Dakota	1939
Hampe, Irving E., 5559 Ashbourne Rd., Halethorpe, Baltimore 27, Maryland.....	1945
Hancock, James W[illiam], Route 1, Madisonville, Kentucky.....	1946
*Handley, Charles Overton Jr., 6571 Roosevelt Ave., Charleston 4, West Virginia .....	1941
*Handley, Charles Overton Sr., 6571 Roosevelt Ave., Charleston 4, West Virginia.....	1925
*Hann, Harry W[ilbur], 1127 Church St., Ann Arbor, Michigan.....	1930
*Hanna, Wilson Creal, 141 E. F St., Colton, California.....	1936
Hansman, Robert H[erbert], 1215 Avenue F, Fort Madison, Iowa.....	1948
Hanson, E[lmer] C[harles], 1305 Wisconsin Ave., Racine, Wisconsin....	1940
Hardy, [Cecil] Ross, Department of Zoology, Weber College, Ogden, Utah .....	1940
Hardy, Frederick C., 133 N. Central St., Apt. 2, Somerset, Kentucky....	1948
*Harford, Dr. Henry M[inor], 926 Argyle Bldg., Kansas City 6, Missouri..	1946
*Harkness, Reed B., 4908 Laclede Ave., St. Louis 8, Missouri.....	1942
Harley, James Bickel, Route 1, Box 394, Pottstown, Pennsylvania.....	1947
Harmon, Dr. Karl S., 209 S. Walnut St., Eldon, Missouri.....	1947
Harmon, Wendell H[arold], Humboldt, Nebraska.....	1947
Harper, Arthur R[oland], 559 Aeden Rd., Columbus, Ohio.....	1948
*Harper, Francis, Route 1, Mt. Holly, New Jersey.....	1930
Harrell, Byron Eugene, 1594 Stanford Ave., St. Paul 5, Minnesota.....	1943
Harrington, Dr. Paul, 813 Bathurst St., Toronto 4, Ontario, Canada....	1948
**Harriot, Samuel C[arman], 200 W. 58th St., New York City 19.....	1934
Harris, Dave, Box 84, Deadwood, South Dakota.....	1947
Harris, Stuart Kimball, 33 Lebanon St., Winchester, Massachusetts.....	1946
**Harrison, Hal H., 1102 Highland St., Tarentum, Pennsylvania.....	1941
Hartley, Albert Thomas, Columbiana, Ohio.....	1944
*Hartman, Frank A[lexander], Hamilton Hall, Ohio State University, Columbus 10, Ohio .....	1941
*Hartwell, Arthur M[owry], 1506 Mt. Curve, Minneapolis, Minnesota....	1940
Hartwell, Reginald Warner, 121 N. Fitzhugh St., Rochester 4, New York..	1947
Harwell, Charles Albert, 2630 Hilgard Ave., Berkeley 9, California....	1948
Haskins, Mrs. Edith D., 39 Park St., Hanover, New Hampshire.....	1941
Hasson, Mrs. Ethel May, Box 86, Centerburg, Ohio.....	1948
*Hatch, Miss [Clara] Grenville, 1548 Wilhelmina Rise, Honolulu 17, Hawaii .....	1948
Hausler, Mrs. M., 7348 Paxton Ave., Chicago, Illinois.....	1936
**Havemeyer, Henry O[sborne], Mahwah, New Jersey.....	1930
Haverschmidt, Fr., 14 Waterkant, Paramaribo, Surinam, Dutch Guiana .....	1946
*Hawkins, Arthur S., Lake Mills, Wisconsin.....	1936
Hawkins, B. L., Hamline University, St. Paul 4, Minnesota.....	1936
*Hawkins, Miss Naomi M., 94 College St., South Hadley, Massachusetts..	1948
Hawksley, Mrs. Janet P., 123 Lafayette Circle, Cincinnati, Ohio.....	1942
Hawver, Miss Marguerite N., 621 N. Grove St., Bowling Green, Ohio....	1946

- Hayward, Bruce J[olliffe], Museum of Natural History,  
University of Minnesota, Minneapolis 14, Minnesota.....1948
- \*Hayward, C[harles] Lynn, Brigham Young University, Provo, Utah....1947
- \*Hazard, Frank Orlando, Wilmington College, Wilmington, Ohio.....1946
- \*\*Hebard, Frederick V[anuxem], 1500 Walnut Street Bldg.,  
Philadelphia 2, Pennsylvania.....1940
- \*Heckler, Sydney B., 1207 N. 7th St., St. Louis 6, Missouri.....1942
- \*Hedges, Harold C[harles], Route 2, Lake Quivira, Kansas City 3, Kansas 1940
- Heed, William B[atles], 101 West Virginia Ave.,  
West Chester, Pennsylvania.....1947
- \*Heffelfinger, George W[right] P[eaavey] Jr., Route 2, Mound, Minnesota 1948
- \*Hefley, Harold M[artin], Department of Zoology, University of Arkansas,  
Fayetteville, Arkansas.....1942
- Heft, Orvil F., 15790 Lindsay, Detroit 27, Michigan.....1945
- \*Heidenkamp, Joseph Jr., 538 Glen Arden Dr., Pittsburgh 8, Pennsylvania..1942
- Heiser, J[oseph] M[atthew], 1724 Kipling St., Houston, Texas.....1939
- Helema, Miss Flarel Ann, 1224 W. Oklahoma Ave., Enid, Oklahoma....1947
- Helfer, Miss Louise, 111 Ninth St., Watkins Glen, New York.....1938
- \*Helm, Robert William, Route 4, Bozeman, Montana.....1947
- Helmer, Dorothy S[mith] (Mrs. John H.), 943 Judson Ave.,  
Evanston, Illinois.....1948
- Hendricks, G[eorge] Bartlett, % The Berkshire Museum,  
Pittsfield, Massachusetts.....1943
- \*Hendrickson, George O[scar], Department of Zoology, Iowa State  
College, Ames, Iowa.....1933
- Henning, Miss Kay Janice, 302 5th Ave., Decorah, Iowa.....1947
- Henning, Mrs. Tom, 710 5th Ave., Decorah, Iowa.....1947
- \*Henry, C. J., Lower Souris Refuge, Upham, North Dakota.....1933
- \*Hensley, Marvin Max, 203 Vivarium Bldg., Wright and Healey Sts.,  
Champaign, Illinois.....1947
- \*Henwood, Mrs. Ethel May, 604 W. Main St., Urbana, Illinois.....1941
- Herbert, Richard A., 961 Fox St., Bronx, New York.....1947
- \*Herman, Carlton M., 1060 Cragmont Ave., Berkeley 8, California....1946
- \*\*Hesterberg, Gene A[rthur], Michigan Department of Conservation,  
Escanaba, Michigan.....1948
- \*Hickey, J[oseph] J[ames], 424 University Farm Place,  
Madison 5, Wisconsin.....1940
- \*\*\*Hicks, Lawrence Emerson, 8 Chatham Rd., Columbus, Ohio .....1925
- Hiett, Lawrence D[avison], 1945 Ottawa Dr., Toledo 6, Ohio.....1929
- \*Higgins, Harold G[uymon], 455 S. 3rd St., E., Salt Lake City, Utah....1941
- Higgins, Thomas Francis, 32-73 43rd St., Astoria 3, New York.....1947
- Hill, Julian Werner, 1106 Greenhill Ave., Wilmington 56, Delaware.....1935
- Hill, Raymond W., 3316 Kenmore Rd., Shaker Heights,  
Cleveland 22, Ohio.....1941
- \*Hill, W[illis] Eugene, Station Communications, MCAS, El Toro,  
Santa Ana, California.....1948
- \*Hillmer, Davis B., 8228 Woodward Ave., Detroit 2, Michigan.....1926
- \*Hinds, Frank J., Biology Department, Western Michigan College of  
Education, Kalamazoo, Michigan.....1935
- \*Hinshaw, Thomas D[oane], 1827 San Juan Ave., Berkeley 7, California..1926
- \*Hiscock, L. Harris, 44 W. Lake St., Skaneateles, New York.....1948
- Hobson, Dorothy Madden (Mrs. L. G.), 1309 N. Pennsylvania Ave.,  
Apt. 39, Indianapolis 2, Indiana.....1935
- Hock, Raymond J[ames], Department of Zoology, Cornell University,  
Ithaca, New York.....1946

Hodges, Mrs. Elizabeth D[ole], 2923 Troost, Box 527, Kansas City 10, Missouri.....	1948
Hodges, Jim, 3132 Fair Ave., Davenport, Iowa.....	1946
Hoffman, Paul William, 8415 Kenyon Ave., Wauwatosa 13, Wisconsin...1940	
Hoffmeister, Linus C[hristian], 504 W. Ripa Ave., Lemay 23, Missouri...1939	
Hofslund, Pershing B[enard], Department of Zoology, University of Michigan, Ann Arbor, Michigan.....	1944
Hoke, Mrs. Glen A., 801 E. 21st St., Little Rock, Arkansas.....	1946
Holden, Fenn M[itche]ll, 920 Lake Angelus Shores, Pontiac 17, Michigan..1947	
*Holland, Harold May, Box 615, Galesburg, Illinois.....	1915
Holsen, James N., 612 Cuyler Ave., Princeton University, Princeton, New Jersey.....	1944
Hopkins, Ralph C[leary], Box D, Horicon, Wisconsin.....	1947
Horton, Louise D. (Mrs. M. B.), 360 Prospect St., Fall River, Massachusetts.....	1941
Hosler, Miss Maud L., Box 204, Palmer, Alaska.....	1948
Hostetter, D[avid] Ralph, Eastern Mennonite School, Harrisonburg, Virginia.....	1937
Hough, Mrs. Eleanor Sloan, 1515 Mariposa Ave., Boulder, Colorado....1941	
Hough, Mrs. Mary [Yeager], 19 North Dr., Lawrence Brook Manor, City Route 9, New Brunswick, New Jersey.....	1946
Houston, C[larence] Stuart, Box 459, Yorkton, Saskatchewan, Canada..1948	
*Hovind, Ralph Bernard, Box 321, Ladysmith, Wisconsin.....	1947
Howe, [Henry] Branch Jr., 414 W. Ponce de Leon Ave., Decatur, Georgia .....	1943
Howell, Joseph C., Department of Zoology and Entomology, University of Tennessee, Knoxville, Tennessee.....	1938
Howell, Thomas R[aymond], Museum of Vertebrate Zoology, University of California, Berkeley 4, California.....	1947
*Hoyt, J[ohn] Southgate Y[eston], Box 54, Etna, New York.....	1936
Hubbard, Dr. Hugh Wells, 3 Chien Yin Hsiang, Nanking, China.....	1947
Hubert, Mrs. Philip Arthur Jr., 17 Lenox Rd., Summit, New Jersey.....	1948
Hughes, Wallace, 6630 S. McArthur Ave., Apt. 83-D, Oklahoma City, Oklahoma.....	1947
Hulbert, Lloyd Clair, Montana State University, Missoula, Montana...1938	
Humphrey, Philip Strong, Apt. 84, G.I. Village, Amherst College, Amherst, Massachusetts.....	1948
*Hunt, Ormond Edson, General Motors Bldg., 3044 W. Grand Blvd., Detroit 2, Michigan.....	1937
Hurley, John B[eatty], 401 S. 17th Ave., Yakima, Washington.....	1937
Hurst, John W[ildeboor], 522 S. 6th St., Bozeman, Montana.....	1945
*Hutchinson, Arthur E., 40 Glendessary Lane, Santa Barbara, California..1940	
**Ingersoll, Albert M[ills], 908 F St., San Diego 1, California.....	1921
**Ingersoll, Marion C[ro]ry (Mrs. Raymond V.), Duck Island, Northport, Long Island, New York.....	1942
Ivor, H. Roy, Route 1, Cooksville, Ontario, Canada.....	1945
*Jackson, C[icero] F[loyd], University of New Hampshire, Durham, New Hampshire.....	1936
*Jackson, Francis Lee, 541 Hammond St., Chestnut Hill, Massachusetts...1941	
Jacobs, Miss [Chloe] Veda, 1221 21st Ave., Longview, Washington.....	1947
Jacobson, Dr. Malcolm A[rthur], 57 W. 57th St., New York City 19...1947	
James, Douglas Arthur, 25455 Dundee Ave., Huntington Woods, Michigan .....	1946
Jameson, E[verett] W[illiams] Jr., Division of Zoology, University of California, Davis, California.....	1941
Janson, Reuel G., Box 864, Mobridge, South Dakota.....	1947

- Janvrin, Dr. Edmund R[andolph] P[easlee], 38 E. 85th St.,  
New York City 28.....1942
- \*\*Jaques, F[rancis] L[ee], 610 W. 116th St., New York City 27.....1939
- Jeffries, Robert Harold, 5069 Nowaldo Ave., Indianapolis 5, Indiana....1948
- Jenkins, James H[obart], 2012 Eljosa Ave., Waycross, Georgia.....1939
- \*Jenner, William, 806 W. Davis St., Fayette, Missouri.....1933
- Jensen, Henry, Box 112, Park River, North Dakota.....1948
- \*Jensen, Mrs. Ove F., R.F.D., Maple City, Michigan.....1948
- Johnson, Albert George, Route 2, Box 457, Waukesha, Wisconsin.....1947
- Johnson, Allan E[dwin], 4201 Hillside Ave., Lincoln 6, Nebraska.....1948
- Johnson, Donald T[heodore], 2336 W. 108 Place, Chicago 43, Illinois....1947
- \*Johnson, Frank M[organ], 404 6th St., Fairmont, West Virginia.....1946
- \*Johnson, J[ohn] O[scar], 112 7th St., S.E., Watertown, South Dakota..1948
- Johnson, Miss Mabel Claire, 30 Westfield Rd., West Hartford  
Connecticut.....1946
- Johnson, Miss Myrtle Elizabeth, 4647 55th St., San Diego 5, California..1948
- \*Johnson, Mrs. Oscar, 38 Portland Place, St. Louis, Missouri.....1931
- \*Johnson, Robert A[nthony], 98 East St., Oneonta, New York.....1930
- Johnson, William M[cNutt], Route 6, Knoxville, Tennessee.....1939
- Johnston, David Ware, 1037 St. Charles Ave., N.E., Atlanta, Georgia....1943
- Johnston, James Weeks Jr., Department of Zoology, North Dakota  
Agricultural College, Fargo, North Dakota.....1948
- \*Johnston, Miss Verna R[uth], 1812 W. Sonoma Ave.,  
Stockton, California.....1941
- \*Jones, Harold C[harles], Box 61, East Carolina Teachers College,  
Greenville, North Carolina.....1929
- Jones, John C[ourts], 5810 Namakagan Rd., Washington 16, D.C.....1931
- Jones, Joseph Piper, Box 405, Chapel Hill, North Carolina.....1948
- \*\*\*\*Jones, Lynds, 352 W. College St., Oberlin, Ohio.....Founder
- \*Jones, S[olomon] Paul, 509 West Ave., N., Waukesha, Wisconsin.....1921
- \*Jones, Victor E[mmons], Idaho State College, Pocatello, Idaho.....1938
- Jorae, Miss Irene Frances, Central Michigan College of Education,  
Mt. Pleasant, Michigan.....1942
- Joyner, J[ohn] W[illiam] E[dwin], Box 647, Rocky Mount,  
North Carolina.....1947
- \*Jung, Clarence [Schram], 6383 N. Port Washington Rd.,  
Milwaukee 9, Wisconsin.....1921
- \*Jurica, E., Lisle, Illinois.....1940
- Kahmann, Karl W., Route 2, Hayward, Wisconsin.....1941
- \*Kahn, Dina H[ope] (Mrs. Reuben L.), 1122 Michigan Ave.,  
Ann Arbor, Michigan.....1938
- \*Kalmbach, Edwin Richard, Fish and Wildlife Service, 546 Custom House,  
Denver 2, Colorado.....1926
- Kampf, Roy C., 555 Ruth St., Bridgeport, Connecticut.....1948
- Karplus, Martin, 259 Otis St., West Newton 65, Massachusetts.....1947
- \*Kase, John C[harles], 501 Chestnut St., Mifflinburg, Pennsylvania.....1937
- Kaspar, John Loren, 392 23rd St., Oshkosh, Wisconsin.....1947
- Kassoy, Irving, 891 Faile St., New York City 59.....1948
- Kater, Leon, Dodd Rd., Route 1, Willoughby, Ohio.....1948
- \*Keating, Dr. F[rancis] Raymond Jr., 1414 Damon Court,  
Rochester, Minnesota.....1944
- \*Keefer, Charles A., Box 68, Austwell, Texas.....1947
- Keely, Josiah, Box 383, Huntington, Long Island, New York.....1947
- \*\*Kelker, George Hills, School of Forestry, U.S.A.C., Logan, Utah.....1938
- Keller, C[harles] E[dward], 637 Eastern Ave., Indianapolis 1, Indiana....1946
- Keller, Richard T[homas], 717 S. 16th St., St. Joseph, Missouri.....1943

- \*Kelley, Mrs. Eliza Mabel, 71 Division St., Newport, Rhode Island.....1948
- \*Kelley, William N[eal], Route 14, Box 1070, Affton 23, Missouri.....1948
- Kelly, George Fleming, Department of Research and Education,  
Solomons, Maryland.....1947
- \*Kelsey, Homer Stone, 16 Chestnut St., Spring Valley, New York.....1945
- Kelsey, Paul Manning, Route 1, Newfield, New York.....1948
- \*Kelso, Leon H[ugh], 1370 Taylor St., N.W., Washington 11, D.C.....1930
- \*Kemsies, Emerson, 102 Farragut Rd., Greenhills 18, Ohio.....1948
- \*Kendeigh, S[amuel] Charles, Vivarium Bldg., University of Illinois,  
Champaign, Illinois.....1923
- \*\*Kennedy, Bruce A[lbert] H[amilton], 389 W. 10th Ave., Columbus 1,  
Ohio .....1947
- \*Kennedy, Elizabeth Dean (Mrs. Walter Joseph), 514 Grand Ave.,  
St. Paul 2, Minnesota.....1948
- Kenyon, Karl W[alton], Fish and Wildlife Service, 2725 Montlake Blvd.,  
Seattle 2, Washington.....1948
- \*\*Kerr, Mrs. Mary Helen, 1246 Delaware, Springfield 4, Missouri.....1943
- \*Kersey, Lulu Brooks (Mrs. Glen B.), 647 Gordon Terrace,  
Chicago 13, Illinois.....1948
- Kessel, Miss Brina, University of Wisconsin, Madison 6, Wisconsin.....1946
- Key, Mrs. J. Frank, Buena Vista, Virginia.....1945
- Kiefer, Arthur S[amuel], 86 Erie Rd., Columbus 2, Ohio.....1948
- Kiefer, Elizabeth D[eyo] (Mrs. Francis), 243 Gratiot Blvd.,  
Port Huron, Michigan.....1941
- \*\*\*Kieran, John, 4506 Riverdale Ave., New York City 63.....1942
- Kildow, T[homas] Monroe, Box 520, Tiffin, Ohio.....1948
- \*Killip, Thomas III, 139 Edgeview Lane, Rochester 10, New York.....1946
- Kindler, Mrs. Grace E[mma], Sheridan Dr., Route 1, Lancaster, Ohio... 1937
- \*King, Miss Betty Jean, 3212 Maher St., Toledo, Ohio.....1947
- King, John Arthur, Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1947
- \*\*King, Louise E. (Mrs. Stanley), 1103 N. 2nd St., Ames, Iowa.....1944
- Kirby, Edward Vincent, 5145 Lowe Ave., Chicago 9, Illinois.....1945
- \*Kirkpatrick, Charles M., Department of Forestry, Purdue University,  
West Lafayette, Indiana.....1948
- Kizer, Richard Allen, 426 Forest Hill Dr., West Lafayette, Indiana.....1947
- \*\*Klein, Richard P[aul], Jackson Rd., Route 4, Chagrin Falls, Ohio.....1946
- \*Kletzky, Robert C[harles], Conservation Commission, U.S.D.A. Bldg.,  
Elkins, West Virginia.....1948
- Klimstra, W[illard] D[avid], Insectary, Iowa State College, Ames, Iowa..1948
- \*Klonick, Allan S., 828 Grosvenor Rd., Rochester 10, New York.....1941
- Kluge, Miss Helen H[enrika], Woodtick Rd., Waterbury 63, Connecticut..1942
- Knollmeyer, Lewis Edward, Department of Commerce and Economics,  
University of Vermont, Burlington, Vermont.....1945
- Knox, Miss Margaret R[ichardson], 4030 Park Ave.,  
Indianapolis 5, Indiana.....1937
- Koch, Peter, Cincinnati Museum of Natural History, Cincinnati 10, Ohio.1939
- Koehler, Mrs. Arthur, 2308 11th Ave., Los Angeles 16, California.....1941
- \*Kolb, C[harles] Haven Jr., 5021 Midwood Ave., Baltimore 12, Maryland.1937
- \*\*Kortright, Francis H[erbert], 633 Eastern Ave., Toronto 8,  
Ontario, Canada.....1943
- Kossack, Charles W[alter], 715 S. Division St., Barrington, Illinois.....1945
- \*Kozicky, Edward L[ouis], Department of Zoology and Entomology,  
Iowa State College, Ames, Iowa.....1943
- \*Kramar, Nada, 1906 K St., N.W., Washington 6, D.C.....1947
- \*Kramer, Theodore C[hristian], 1307 Granger Ave., Ann Arbor, Michigan.1939

- Kraus, Douglas L[awrence], Rhode Island State College,  
Kingston, Rhode Island.....1942
- Kreag, Keith K., 1348 Edgewood Ave., Birmingham, Michigan.....1942
- Krebs, Juanita F[ile] (Mrs. R. W.), 3416 North Blvd.,  
Baton Rouge 12, Louisiana.....1946
- Kritzler, Henry, Marine Studios, Inc., St. Augustine, Florida.....1945
- Krug, Howard H[enry], Chesley, Ontario, Canada.....1944
- Krumm, Kenneth, Lacreek National Wildlife Refuge, Martin,  
South Dakota.....1948
- Kubichek, Wesley Frank, Fish and Wildlife Service, Department of  
the Interior, Washington 25, D.C.....1947
- \*Kugel, Miss Agnes R[ose], Department of Botany, Grand Rapids Junior  
College, Grand Rapids, Michigan.....1946
- Kuitert, Louis Cornelius, Agricultural Experiment Station,  
University of Florida, Gainesville, Florida.....1938
- Kurth, E[rnest] A[lbert], 1024 Elm St., Grinnell, Iowa.....1947
- \*Kutz, George C[arl], 705 S. Holcombe St., Stillwater, Minnesota.....1944
- \*Kutz, Harry Leon, Maine Cooperative Wildlife Unit, University of  
Maine, Orono, Maine.....1939
- Kyle, Mrs. Jennie Lynne, 2905 E. 5th Ave., Knoxville 15, Tennessee.....1947
- \*Kyllingstad, Henry C[arrell], Mountain Village, Alaska.....1940
- Laakso, Martin, Westminster College, Fulton, Missouri.....1948
- \*Lacey, George Macrae, % D. M. Smythe, 3724 Pitt St.,  
New Orleans, Louisiana.....1945
- Lacey, Miss Mifton H., Box 614, Canton, Ohio.....1939
- Laffoon, Jean Luther, Department of Zoology and Entomology,  
Iowa State College, Ames, Iowa.....1940
- Lagler, Karl F., 514 Monroe St., Ann Arbor, Michigan.....1941
- Laing, Charles Corbett, 762 N. Van Buren St., Milwaukee 2, Wisconsin.....1948
- Lake, Robert N., Woodstock, Vermont.....1941
- Lambert, Adaline Train (Mrs. Howard T.), 1903 Ross St.,  
Sioux City, Iowa.....1947
- \*\*\*Lambert, Bert H., 16854 Wildemere Ave., Detroit, Michigan.....1936
- \*Lambert, Robert John Jr., 2802 Kenmore Ave., Dayton 10, Ohio.....1945
- Lanyon, Wesley E[dwin], 106 Cayuga Heights Rd., Ithaca, New York.....1943
- \*Larrabee, Austin Park, 306 S. 15th St., Yankton, South Dakota.....1921
- \*Larrison, Earl J[unior], Laboratory of Vertebrate Biology,  
University of Michigan, Ann Arbor, Michigan.....1946
- Larson, Goodman Kenneth, 310 W. 16th St., Grand Island, Nebraska.....1945
- \*Laskey, Amelia Rudolph (Mrs. Frederick Charles), Graybar Lane,  
Nashville 4, Tennessee.....1928
- Lastreto, C[arlos] B[artholomew], 605 Market St.,  
San Francisco 5, California.....1948
- \*Lattin, Jack D[aniel], 5726 W. Ohio St., Chicago, Illinois.....1945
- Latzko, Gordon Charles, 92 Gordon St., Ridgefield Park, New Jersey.....1948
- Lawlor, Mrs. Abigail, Victor, Iowa.....1947
- Lawrence, Mrs. Louise de Kiriline, Rutherglen, Ontario, Canada.....1946
- \*Lawrence, William Hobart, 1410 Decatur St., N.W., Washington 11, D.C.....1943
- Lay, Daniel Wayne, Box 133, Silsbee, Texas.....1939
- \*Layne, James N[athaniel], 6308 N. Oakley Ave., Chicago 45, Illinois.....1947
- \*Lea, Robert B[ashford], 24 N. Worth Ave., Elgin, Illinois.....1940
- Leavitt, Benjamin Burton, Department of Biology, University of Florida,  
Gainesville, Florida.....1947
- \*Lee, Forrest Byron, 1502 Kilian Blvd., St. Cloud, Minnesota.....1947
- \*Lee, [William] Donald, 431 Greenmount Blvd., Dayton 9, Ohio.....1947
- \*\*Lee, Miss Zell Charlotta, 1423 Douglas St., Sioux City 18, Iowa.....1946



- \*Leebrick, Karl C[layton] Jr., Route 3, Canastota, New York.....1946
- \*Leedy, Daniel L[ovey] Ohio Wildlife Research Unit, Ohio State  
University, Columbus 10, Ohio.....1936
- Legg, William C[larence], Mt. Lookout, West Virginia.....1939
- \*\*Lengemann, Miss Martha A., 360 Cedar St., Imlay City, Michigan.....1946
- \*Leopold, A[ldo] Starker, Museum of Vertebrate Zoology,  
Berkeley 4, California.....1940
- Lepingwell, Alan Rix, 3580 St. Joseph St., Lachine,  
Montreal 32, Quebec, Canada.....1947
- \*Leshner, Samuel W., Department of Zoology, Washington University,  
St. Louis 5, Missouri.....1941
- Levy, Alice K[lund] (Mrs. H. P.), 11680 Laurelwood Dr.,  
North Hollywood, California.....1941
- \*Lewis, Harrison Flint, Dominion Wildlife Service, Department of Mines  
and Resources, Ottawa, Ontario, Canada.....1939
- \*Lewis, Bro. Hubert, La Salle Institute, Glencoe, Missouri.....1940
- \*Lewis, Kenneth M[acKay], Children's Nature Museum, 849 Clifton Rd.,  
N.E., Atlanta 6, Georgia.....1947
- \*Lewy, Alfred, 2051 E. 72nd Place, Chicago 49, Illinois.....1915
- Lieftinck, John E[dmund], 1826 W. Market St., Akron 13, Ohio.....1945
- \*Ligon, James Stokley, P.O. Box 950, Carlsbad, New Mexico.....1948
- Linck, Miss Virginia M., 5015 Whitfield, Detroit 4, Michigan.....1948
- \*Lincoln, Frederick Charles, Fish and Wildlife Service,  
Washington 25, D.C.....1914
- \*Linsdale, Jean M[yron], Jamesburg Route, Monterey, California.....1928
- Linton, M[orris] Albert, 315 E. Oak Ave., Moorestown, New Jersey.....1941
- \*Livesay, Miss [Elizabeth] Ann, 712 S. MacArthur Blvd.,  
Springfield, Illinois.....1948
- \*Lloyd, C[lark] K., 11 N. Elm St., Oxford, Ohio.....1925
- \*Lloyd, Hoyes, 582 Mariposa Ave., Rockcliffe Park,  
Ottawa, Ontario, Canada.....1922
- Loetscher, Frederick W[illiam] Jr., 143 N. 3rd St., Danville, Kentucky..1946
- \*\*Logan, Dulaney, Route 1, Box 449, Louisville 1, Kentucky.....1947
- \*Logan, Mrs. Olivia Hambleton, Route 3, Breeze Hill, Camden, Ohio....1948
- Longley, William H[oward], 334 S. Albert St., St. Paul 8, Minnesota....1943
- Loomis, Mrs. Mary L., 1014 S. 30th Ave., Omaha 5, Nebraska.....1946
- Lord, Frederic P[omeroy], 250½ President St., Dunedin, Florida.....1939
- Lorenz, Mary Rachael (Mrs. Fred A.), Route 1, Ravenna, Ohio.....1947
- Lovell, Harvey B., 3011 Meade Ave., Louisville 13, Kentucky.....1936
- \*\*\*Low, Seth Haskell, Patuxent Research Refuge, Laurel, Maryland.....1931
- \*Lowe, William Joseph, 205 Second St., Bismarck, North Dakota.....1947
- \*\*\*Lowery, George H[ines] Jr., Museum of Zoology, Louisiana State  
University, University, Louisiana.....1937
- Lowther, Malcolm Alfred, 16213 Ashton Rd., Detroit, Michigan.....1944
- \*Ludwig, Claud C[ecil], 506 Wilson Bldg., Lansing, Michigan.....1938
- \*\*\*Ludwig, Dr. Frederick Edwin, 2864 Military St., Port Huron, Michigan..1941
- \*Lueth, Francis X[avier], 104A 5th St., Blakeley Island,  
Mobile, Alabama.....1947
- Lukens, William Weaver Jr., Upper Gulph Rd., Radnor, Pennsylvania...1947
- Lum, Miss Elizabeth C[aroline], Cincinnatus, New York.....1940
- Lundin, Harry, Sparbanksvägen 11, Stockholm 32, Sweden.....1948
- \*Lunk, William A., 29 Bell Run Rd., Fairmont, West Virginia.....1937
- Lupient, Mrs. Mary [Louise], 212 S.E. Bedford St.,  
Minneapolis 14, Minnesota.....1944
- \*Luthy, Ferd Jr., 306 N. Institute, Peoria, Illinois.....1937

- \*Lyman, Clara Cross (Mrs. Frederick C.), 1716 Colfax Ave., S.,  
Minneapolis, Minnesota.....1944
- Lyons, Mrs. Robert C., 25 Woodland St., Huntington, Long Island,  
New York.....1940
- MacFayden, Clifford J[ames], 179 Bowood Ave., Toronto,  
Ontario, Canada.....1948
- \*MacLulich, D[uncan] A[lexander], 15 Bellwood Ave., Ottawa,  
Ontario, Canada.....1933
- \*MacMullan, R[alph] Austin, Game Division, Department of Conservation,  
Lansing, Michigan.....1940
- MacPherson, Ralph J[oyce], 9331 Genessee Ave., Detroit 6, Michigan...1948
- McAlpin, Robert E., 24 College Manor Apts., East Lansing, Michigan...1948
- \*McAtee, Waldo Lee, 6342 Ellis Ave., Chicago 37, Illinois.....1911
- \*\*\*McCabe, Robert A[lbert], 424 University Farm Place,  
Madison, Wisconsin.....1942
- \*McCamey, [Benjamin] Frank[l]in [Jr.], Plant Science Department,  
University of Connecticut, Storrs, Connecticut.....1945
- McCausland, Robert Linsley, 2206 Chapline St., Wheeling,  
West Virginia.....1948
- \*\*McClary, Miss Susan C., N. Main St., Windsor, Vermont.....1945
- McClure, Miss Bernice, 2543 Woodburn Ave., Apt. 10,  
Cincinnati 6, Ohio.....1948
- \*McClure, H[owe] Elliott, Box 292, Station A, Bakersfield, California...1942
- \*McConnell, H. B., 142 E. Warren St., Cadiz, Ohio.....1948
- \*McCue, Earl Newlon, Box 104, Morgantown, West Virginia.....1941
- \*McCullagh, Dr. E[rnest] Perry, 2020 E. 93rd St., Cleveland, Ohio.....1937
- McDonald, Malcolm E., P.O. Box 42, Ann Arbor, Michigan.....1936
- McEntee, Elinor G. (Mrs. Howard G.), 490 Fairfield Ave.,  
Ridgewood, New Jersey.....1948
- \*\*McGaw, Elizabeth T[aylor] (Mrs. G. Hampton), 18 Beach St.,  
Woodsville, New Hampshire.....1945
- \*McGeen, Daniel S., 1231 Cass Lake Rd., Pontiac 9, Michigan.....1944
- McGraw, Ethel B. (Mrs. Harrison B.), 2559 Wellington Rd.,  
Cleveland Heights 18, Ohio.....1948
- \*\*\*McIlhenny, Edward Avery, Avery Island, Louisiana.....1910
- McInally, John [William], 32 Sydenham St., Simcoe, Ontario, Canada...1948
- \*McIntosh, William B[axter], 3523 Edgewood, Pittsfield Village,  
Ann Arbor, Michigan.....1942
- McIver, Samuel H., 6326 Knox Ave., S., Minneapolis 9, Minnesota.....1947
- \*McKeever, Christopher Killian, 1043 Carroll St.,  
Brooklyn 25, New York.....1948
- McKinley, Daniel L[awson], % Poultry Station, Mountain Grove,  
Missouri.....1948
- McKinley, George G[ael], P.O. Box 12, La Grange, Kentucky.....1945
- McKinney, Robert G[erhard], 86 Hurstbourne Rd., Rochester 9,  
New York.....1948
- McKinney, Mrs. Walter A., 2932 S. Woodward Blvd.,  
Tulsa 5, Oklahoma.....1945
- \*McKnight, Edwin T[hor], 5038 Park Place, Friendship Station,  
Washington, D.C.....1936
- \*McLaughlin, Frank W[in]nifred, 242 Mansion Ave., Audubon,  
New Jersey.....1948
- McManus, William Reid, Memramcook, New Brunswick, Canada.....1946
- \*McMath, Robert R., Lake Angelus, Route 4, Box 104,  
Pontiac, Michigan.....1934

- McMurray, Arthur A., Room 306-C, 864 Monroe St.,  
Memphis 3, Tennessee.....1939
- McNeill, Richard E[arl], 10638 Charlevoix Ave., Detroit 14, Michigan...1948
- Maass, Miss Frances B[lanche], 85-41 102 St., Richmond Hill, 18,  
New York City.....1948
- Mack, H[orace] G[ordon], % Gilson Mfg. Co., Ltd., Guelph,  
Ontario, Canada.....1937
- \*\*Mackenzie, Dr. Locke Litton, 829 Park Ave., New York City 21.....1947
- Maclean, Miss Dorothy W[illiams], 21 Ashley St., Hartford 5,  
Connecticut .....1939
- Magath, Dr. Thomas Byrd, Mayo Clinic, Rochester, Minnesota.....1935
- \*Magner, J[ohn] Marshall, 516 Bacon Ave., Webster Groves 19, Missouri.1948
- Magney, Mrs. G. R., 5329 Washburn Ave., S., Minneapolis 10,  
Minnesota .....1940
- \*Malcomson, Richard O., Central College of Education,  
Mt. Pleasant, Michigan.....1948
- Malley, Philip P., 114 Glendale Rd., Upper Darby, Pennsylvania....1935
- \*Mallory, Dr. Dwight H[arcourt], 17 Sherwood St., Brockville,  
Ontario, Canada.....1946
- \*Maness, Mrs. A. P., 101 Larchmont Ave., Chattanooga 4, Tennessee....1948
- \*Manley, C[alvert] H[amilton], 1113 Woodmont Ave.,  
New Kensington, Pennsylvania.....1946
- \*Manners, Edward Robert, 216 New Broadway, Brooklawn, New Jersey..1942
- \*\*Mannix, Lucille Marie (Mrs. J. R.), 790 Prospect Ave.,  
Winnetka, Illinois.....1947
- \*Manville, Richard H[yde], Department of Zoology, Michigan State  
College, East Lansing, Michigan.....1941
- \*Marfield, George R[owland], 1820 S. Olive Ave., Alhambra, California..1948
- \*Margolin, A[braham] S[tanley], Science Hall, West Virginia University,  
Morgantown, West Virginia.....1944
- \*Markle, Jess Matthew, 917 Sierra St., Madera, California.....1943
- Markle, Millard S., Earlham College, Richmond, Indiana.....1948
- \*Marshall, Raymond O[scar], Route 2, Columbiana, Ohio.....1945
- \*Marshall, Terrell, 372 Skyline Dr., Park Hill,  
North Little Rock, Arkansas.....1944
- Marshall, William H[ampton], Division of Entomology and Economic  
Zoology, University Farm, St. Paul 1, Minnesota.....1942
- Martin, Paul S[chultz], Box 532, West Chester, Pennsylvania.....1946
- \*Maslowski, Karl H[erbert], 1034 Maycliff Place, Cincinnati 30, Ohio....1934
- \*Mason, Charles Irving, Wildlife Research Laboratory, Delmar,  
New York.....1947
- Mason, C[harles] N[athan] Sr., 6432 31st St., N.W.,  
Washington 15, D.C.....1947
- Mason, Miss Esther, 2523 Montgomery St., Louisville 12, Kentucky.....1941
- \*Mathiak, Harold A[lbert], Box D, Horicon, Wisconsin.....1941
- Mayer, Bird Wells (Mrs. John H.), 103 S. Miller St.,  
Cynthiana, Kentucky.....1948
- \*Mayfield, G[eorge] R[adford], Vanderbilt University,  
Nashville, Tennessee.....1917
- \*Mayfield, Harold F[ord], 2557 Portsmouth Ave., Toledo 12, Ohio.....1940
- \*\*\*Mayr, Ernst, American Museum of Natural History, Central Park W.  
at 79th St., New York City 24.....1933
- \*Mazzeo, Rosario, 120 Elm St., North Cambridge 40, Massachusetts.....1947
- Meachem, Frank B., State Museum, Raleigh, North Carolina.....1948
- \*Mead, Corwin M., Grant, Nebraska.....1948
- Mead, Frank Waldreth, 227 Brighton Rd., Columbus 2, Ohio.....1948

- \*\*Meade, Gordon M[ontgomery], Box 25, Trudeau Sanatorium,  
Trudeau, New York.....1937
- \*\*Meitzen, Logan H[erman], Route 13, Box 515, Houston, Texas.....1947
- Mellinger, E[lnos] O[ren], Fish and Wildlife Service, Bull's Island,  
Awendaw, South Carolina.....1939
- Melone, Miss Theodora G[ardner], Geology Library, Pillsbury Hall,  
University of Minnesota, Minneapolis 14, Minnesota.....1947
- \*Meltvedt, Burton W., Paullina, Iowa.....1930
- Mendall, Howard L[ewis], 28 Pendleton St., South Brewer, Maine.....1936
- Meng, Heinz Karl, 116 Miller St., Ithaca, New York.....1943
- Mengel, Jane S[trahan] (Mrs. Robert M.), 20 E. Shore Dr.,  
Whitmore Lake, Michigan.....1948
- \*\*Mengel, Robert M[orrow], 20. E. Shore Dr., Whitmore Lake, Michigan..1937
- \*Meredith, Col. Russell Luff, % General Delivery, Augusta, Montana...1946
- \*Meritt, James Kirkland, 99 Battle Rd., Princeton, New Jersey.....1944
- \*\*Merry, Miss Katherine, State Teachers College, Wayne, Nebraska.....1944
- Messner, Clarence John, 308 McKinley, Grosse Pointe 30, Michigan....1944
- \*\*Metcalf, H[omer] N[oble], Department of Horticulture,  
Montana State College, Bozeman, Montana.....1944
- \*Metcalf, Zeno P[ayne], State College Station, Raleigh, North Carolina..1900
- \*Mewaldt, L[eonard] R[ichard], Department of Zoology,  
Washington State College, Pullman, Washington.....1947
- \*Meyer, Henry, Biology Department, Ripon College, Ripon, Wisconsin...1939
- \*\*Meyerriecks, Andrew J[oseph], 119-30 146th St., South Ozone Park 20,  
Long Island, New York.....1948
- Michaud, Howard H[enry], 824 N. Chauncey St.,  
West Lafayette, Indiana.....1938
- Michaux, Joy Houston (Mrs. Frank W.), 1607 Bluff St.,  
Wichita Falls, Texas.....1947
- \*Michener, Harold, 418 N. Hudson Ave., Pasadena 4, California.....1926
- Mickey, Arthur B[ayard], 1516 Rainbow Ave., Laramie, Wyoming.....1935
- Middleton, Douglas S[arsfield], 7443 Buhr Ave., Detroit 12, Michigan..1946
- \*Middleton, Mary Elizabeth (Mrs. Archie D.), Brady, Nebraska.....1948
- \*Mikkelson, Mrs. Herbert G., 4200 Chicago Ave.,  
Minneapolis 7, Minnesota.....1948
- Miles, Eleanor Burgess (Mrs. Philip E.), 1900 Arlington Place,  
Madison 5, Wisconsin.....1943
- \*Miles, Merriam Lee, 2350 Cherokee Ave., Baton Rouge, Louisiana.....1941
- \*Miller, Alden H[olmes], Museum of Vertebrate Zoology,  
Berkeley 4, California.....1930
- Miller, Mrs. Alice, 2200 Belmont, Dearborn, Michigan.....1944
- Miller, Mrs. Clarence Heath, 1354 Herschel Ave., Cincinnati 8, Ohio....1941
- \*\*Miller, Douglas Scott, 122 Lawrence Ave., E., Toronto, Ontario, Canada..1939
- Miller, Helen Burns (Mrs. Gilbert M.), Spring Gap, Maryland.....1948
- Miller, J[ames] Robert, 137 Haven Rd., University Heights,  
Syracuse, New York.....1946
- Miller, Loye H[olmes], University of California, 405 Hilgard Ave.,  
Los Angeles 24, California.....1939
- \*Miller, Lyle [DeVerne], 650 Almyra Ave., Youngstown, Ohio.....1947
- Miller, R[aymond] F[oster], Baker University, Baldwin City, Kansas...1945
- Miller, Richard W[ells], 113 W. 8th St., Cambridge, Ohio.....1948
- Miller, Ross J., 1630 Maryland Dr., Urbana, Illinois.....1948
- Miller, William R[osewarne], Fish and Game Service,  
Montpelier, Vermont.....1946
- Mills, Robert H[enry], 5115 Allen St., Bryan, Ohio.....1941

- \*Milnes, Miss Hattie K[ernahan], 331 Gowen Ave., Mt. Airy,  
Philadelphia 19, Pennsylvania.....1935
- Miner, Miss Edna Wolf, 2206 Brun Ave., Houston 6, Texas.....1947
- \*Minish, Edward C., 1047 Fairview Ave., Youngstown 2, Ohio.....1923
- \*Mitchell, Harold Dies, 378 Crescent Ave., Buffalo, New York.....1936
- \*\*Mitchell, Mrs. Osborne, Route 1, Streetsville, Ontario, Canada.....1933
- \*Mitchell, Mrs. R. V., Wade Park Manor, E. 107th St.,  
Cleveland 6, Ohio.....1943
- \*\*Mitchell, Walton I[ungerich], 398 Vassar Ave., Berkeley 8, California...1893
- Mockford, Edward [Lee], 4140 Graceland Ave., Indianapolis 8, Indiana..1946
- Mohler, Levi L[app], 1000 S. 35th St., Lincoln, Nebraska.....1942
- \*Mohr, Charles E[dward], Audubon Nature Center,  
Greenwich, Connecticut.....1947
- \*Monk, Harry C[rawford], 406 Avoca St., Nashville 5, Tennessee.....1920
- Monroe, Burt L[eavelle] Jr., Ridge Rd., Anchorage, Kentucky.....1946
- \*Monroe, Burt L[eavelle] Sr., Ridge Rd., Anchorage, Kentucky.....1935
- Monroe, Mrs. Frank, 1227 Center St., Bowling Green, Kentucky.....1948
- \*Monson, Gale, P.O. Box 1717, Parker, Arizona.....1933
- \*Montgomery, Robert Dudley Sr., Erie Shooting and Fishing Club,  
Erie, Michigan.....1948
- Moore, Miss Clara Alma, 576 E. Fall Creek Blvd., Apt. 5,  
Indianapolis 5, Indiana.....1939
- \*Moore, Miss Dora, 18 W. Carpenter St., Athens, Ohio.....1934
- Moore, George A[zro], 323 Admiral Rd., Stillwater, Oklahoma.....1928
- Moore, Robert B[yron], 3554 Hollywood Dr., Baton Rouge 5, Louisiana.1947
- \*\*\*Moore, Robert Thomas, Meadow Grove Place, Flintridge,  
Pasadena 2, California.....1939
- \*Moorman, Robert B., 693 Pammel Court, Ames, Iowa.....1941
- Moran, James Vincent, 1 Alfred St., Jamaica Plain,  
Boston 30, Massachusetts.....1943
- Morgan, Allen Hungerford, Cochituate Rd., Wayland, Massachusetts...1943
- Morgan, Thomas Nolen, 142 Woodland Ave., Oberlin, Ohio.....1947
- Morrell, Charles K., 119 E. Maxwell St., Lexington, Kentucky.....1943
- \*Morrell, Miss Elise, 1311 White Ave., Knoxville 16, Tennessee.....1942
- \*Morrissy, Thomas J[ustin], 325 McClellan Blvd., Davenport, Iowa...1946
- Morrison, [Percy] [Le]Roy, 843 Neil Ave., Columbus, Ohio.....1948
- \*Morse, John Salls, Route 3, Benton, Kentucky.....1947
- \*Morse, Margarette Elthea, 122 W. South St., Viroqua, Wisconsin.....1921
- Morton, Blanche L[iffick] (Mrs. Walter P.), 3434 E. Fall Creek Blvd.,  
Indianapolis 5, Indiana.....1948
- \*\*Morton, Duryea, Route 1, Sinking Spring, Pennsylvania.....1947
- Morton, Miss Thelma [Pauline], 1300 Burch Ave., N.W.,  
Cedar Rapids, Iowa.....1947
- Moser, Jane Myers (Mrs. R. Allyn), R.F.D. 1, Benson Station,  
Omaha 4, Nebraska.....1946
- \*Moser, Randolph, Aberdeen, Idaho.....1944
- \*\*Moser, Dr. R[euben] Allyn, R.F.D. 1, Benson Station,  
Omaha 4, Nebraska.....1940
- \*Mossman, H[arland] W[infield], 2902 Columbia Rd.,  
Madison 5, Wisconsin.....1948
- Moul, Edwin T[heodore], Department of Botany, Rutgers University,  
New Brunswick, New Jersey.....1942
- Moule, John W[illiam], 68 N. Oval St., Hamilton, Ontario, Canada....1948
- \*Mousley, William H[enry], 4073 Tupper St.,  
Westmount, Montreal, Canada.....1922

- \*\*Mudge, Edmund W. Jr., 5926 Averill Way, Dallas, Texas.....1939
- \*Muirhead, Miss Peggy Porter, University of Illinois, Biological Science  
Division, Navy Pier, Chicago, Illinois.....1940
- Munro, J[ames] A[lexander], Okanagan Landing, British  
Columbia, Canada.....1935
- \*Munter, Rear Admiral W[illiam] H[enry], 4518 52nd Ave., N.E.,  
Seattle 5, Washington.....1933
- Murdock, James Ingram, 311 Irving Ave., Glendale 1, California.....1940
- \*Murie, Adolph, McKinley Park, Alaska.....1932
- \*Murie, O[laus] J[ohn], Moose, Wyoming.....1934
- \*Murphey, Eugene Edmund, 432 Telfair St., Augusta, Georgia.....1935
- \*Murphy, Paul C[harles], 935 Goodrich Ave., Apt. 10,  
St. Paul 5, Minnesota.....1944
- Murray, Rev. J[oseph] J[ames], 6 White St., Lexington, Virginia.....1931
- \*Murray, Dr. Leo T., Box 138, Billings, Montana.....1948
- \*Musgrove, Jack W[arren], 2414 Adams Ave., Des Moines, Iowa.....1947
- Musselman, T[homas] E[dgar], 124 S. 24th St., Quincy, Illinois.....1940
- Myers, Buford M[acMartin] Jr., 2609 Calhoun St.,  
New Orleans 15, Louisiana.....1948
- Myers, William A., 3955 College Ave., Indianapolis 5, Indiana.....1948
- \*Naether, Carl [Albert], 4442 Woodman Ave., Sherman Oaks, California.....1948
- Nauert, Miss Erna, 7351 Sharp Ave., St. Louis 16, Missouri.....1948
- Naylor, Mrs. Robert, 617 S. Lake, Miles City, Montana.....1948
- Neal, Dorothy Phillips (Mrs. Charles), Box 133, Demorest, Georgia.....1946
- \*Necker, Walter L., 6843 Hobart Ave., Chicago 31, Illinois.....1947
- \*Neff, Johnson Andrew, 546 Custom House, Denver, Colorado.....1920
- \*Nelson, Arnold Lars, 3256 Van Hazen St., N.W., Washington 15, D.C....1932
- Nelson, Charles E[llsworth] Jr., 124 Oxford Rd., Waukesha, Wisconsin.....1937
- Nelson, Detlof B[ennett], 12039 S. Princeton Ave.,  
Chicago 28, Illinois.....1947
- Nelson, Mrs. Esther Marie, 515 E. Minnehaha Parkway,  
Minneapolis 9, Minnesota.....1945
- Nelson, Grace Sharritt (Mrs. Almer P.), Box 22, Jackson, Wyoming.....1946
- \*\*\*Nelson, Miss Theodora, 315 E. 68th St., New York City 21.....1928
- Nelson, Urban C., Box 358, Fergus Falls, Minnesota.....1939
- Nero, Robert William, Route 1, Box 427, Cudahy, Wisconsin.....1947
- \*Nessle, James P., 1823 Barrows St., Toledo 12, Ohio.....1936
- \*Netting, M[orris] Graham, Carnegie Museum,  
Pittsburgh 13, Pennsylvania.....1941
- Nevius, Mrs. Richard, Route 1, Greenville, Tennessee.....1940
- New, John, 340 W. 86th St., New York City 24.....1946
- \*\*Newlin, Lyman W[ilbur], Deephaven Park, Route 3,  
Wayzata, Minnesota.....1945
- Newton, Earl T[homas], 5145 Swope Parkway, Kansas City 4, Missouri.....1939
- \*Nice, L[eonard] B., 5725 Harper Ave., Chicago 37, Illinois.....1932
- \*\*\*Nice, Mrs. Margaret Morse, 5725 Harper Ave., Chicago 37, Illinois.....1921
- \*Nichols, Charles K[etcham], 212 Hamilton Rd.,  
Ridgewood, New Jersey.....1933
- \*Nichols, John Treadwell, American Museum of Natural History,  
Central Park W. at 79th St., New York City 24.....1941
- \*Nichols, L[eon] Nelson, 331 E. 71st St., New York City.....1937
- Nicholson, Donald John, 1224 Palmer St., Orlando, Florida.....1945
- \*Nickell, Walter Prine, Cranbrook Institute of Science,  
Bloomfield Hills, Michigan.....1943
- \*Nielsen, Beatrice Wise (Mrs. G. W.), 640 Elden Dr.,  
Campbell, California.....1945

- Nordquist, Theodore C., 2701 York Ave., N., Robbinsdale, Minnesota... 1941  
Noren, Oscar B., 17015 Kinloch, Detroit 19, Michigan..... 1945  
\*Nork, Theodore J., 451 Wrightwood Ave., Chicago 14, Illinois..... 1947  
Norman, James L[ee], Department of Zoology, University of Oklahoma,  
Norman, Oklahoma..... 1948  
\*Norris, Frank G[iles], Route 3, Steubenville, Ohio..... 1946  
Norris, Robert Allen, 165 Wilcox St., Athens, Georgia..... 1941  
Norris, Russell T[aplín], 50 Milk St., Newburyport, Massachusetts..... 1939  
\*Norse, William J[ohn], 531 W. 211th St., New York City 34..... 1939  
\*North, George W[ebster], 249 Charlton Ave., W., Hamilton, Ontario,  
Canada ..... 1941  
\*Northrop, Myron, % A. S. Aloe Co., 1831 Olive St., St. Louis 3, Missouri 1945  
\*Nowland, Paul J[ennings], 700 Equitable Bldg., Wilmington 7, Delaware 1947  
Nyc, Fred[erick] F[rancis] Jr., Box 869, Brownsville, Texas..... 1943  
Oakes, Clifford, 13 Olympia St., Burnley, Lancashire, England..... 1946  
\*Oberholser, Harry Church, 2933 Berkshire Rd., Cleveland Heights,  
Cleveland 18, Ohio..... 1894  
\*O'Brien, Louis E., 1225 Sliker Ave., Cincinnati 5, Ohio..... 1948  
\*O'Conner, Miss Esther [Laura], 4344 Locust Ave., Kansas City 4,  
Missouri ..... 1940  
\*Odum, Eugene P[leasants], Department of Zoology, University  
of Georgia, Athens, Georgia..... 1930  
Odum, Howard Thomas, Pittesboro Rd., Chapel Hill, North Carolina... 1946  
Oliver, Miss Mary C[lara], Ganado Mission, Ganado, Arizona..... 1934  
Olsen, Humphrey A., Pikeville College Library, Pikeville, Kentucky..... 1941  
\*Olsen, James H., Box 11, Worthington, Ohio..... 1947  
\*\*Olsen, Dr. Richard E., 3325 Franklin Rd., Route 3, Pontiac 19, Michigan 1938  
\*\*Olson, Mrs. Gladys E[lizabeth], 10017 Lake Ave., Apt. 102,  
Cleveland 2, Ohio..... 1942  
Olson, Mrs. Monrad J., Box 145, Sanish, North Dakota..... 1946  
Ommanney, G. G., Post Office 14, Hudson Heights, Quebec, Canada..... 1944  
\*\*O'Reilly, Ralph A. Jr., Davisburg, Michigan..... 1936  
Orians, Rev. Howard Lester, 2401 S. Williams St., Milwaukee 7,  
Wisconsin..... 1947  
Orr, Ellison James, 14 Dewey Ave., Waukon, Iowa..... 1947  
Orr, Mrs. Mary, Box 183, Reserve, New Mexico..... 1947  
\*\*Osborn, Hon. Chase S[almon], Zheshebe Minis (Duck Island),  
Sugar Island Star Route, Sault Ste. Marie, Michigan..... 1943  
\*Ott, Frederick Louis, % Jake Baer, 861 Wisconsin River Ave.,  
Port Edwards, Wisconsin..... 1941  
\*Overing, Robert, Route 4, Raleigh, North Carolina..... 1930  
Owen, Ollie, Cascadilla Hall, Cornell University, Ithaca, New York..... 1948  
\*Owre, Oscar T., 2625 Newton Ave., S., Minneapolis 5, Minnesota..... 1935  
Painton, Dr. Harry R., 175 Foothill Rd., Santa Barbara, California... 1939  
\*Palmer, Ralph S[imon], Department of Zoology, Vassar College,  
Poughkeepsie, New York..... 1934  
\*Palmer, T[hodore] S[herman], 1939 Biltmore St., N.W.,  
Washington, D.C. .... 1914  
\*\*Palmquist, Clarence O[scar], 7400 N. Odell Ave., Chicago 31, Illinois... 1945  
Pangborn, Mark W[hite], 125 E. 49th St., Indianapolis, Indiana..... 1948  
Parker, Clarence J[oseph], 821 N. Garfield Ave., Alhambra, California. 1948  
\*Parker, Dean Roberts, Box 202, University, Mississippi..... 1944  
\*Parker, Henry M[elville], 86 Buckingham St., Apt. 24,  
Cambridge, Massachusetts..... 1941  
\*Parkes, Kenneth Carroll, Laboratory of Ornithology, Fernow Hall,  
Cornell University, Ithaca, New York..... 1946

- Parks, Richard Anthony, 3754 Peachtree Rd., N.E., Atlanta, Georgia...1942  
 Parlee, Miss Phyllis Gertrude, Route 4, Mt. Airy, Maryland.....1945  
 Partch, Max L[orenzo], R.F.D., Lake Mills, Wisconsin.....1940  
 Pattison, Miss Thelma Elizabeth, 1903 Ruckle St.,  
 Indianapolis 2, Indiana.....1948  
 \*Paul, Mrs. Harold Gilmore, 84 N. Stanwood Rd., Columbus 9, Ohio...1948  
 Paynter, R[aymond] A[ndrew] Jr., 208 Forest Hill Rd.,  
 Hamden 14, Connecticut.....1946  
 \*Peasley, Mrs. Harold R[aymond], 2001 Nash Dr., Des Moines, Iowa...1934  
 Pederson, Donald P[enhallegon], University of Rochester Medical School,  
 Rochester 7, New York.....1948  
 Peelle, Miles L., 329 Rice St., Adrian, Michigan.....1940  
 \*\*\*Peet, Dr. Max Minor, 2030 Hill St., Ann Arbor, Michigan.....1935  
 Penner, Lawrence R., Department of Zoology and Entomology,  
 University of Connecticut, Storrs, Connecticut.....1940  
 Perkins, Mrs. Mary Loomis, 1305 S. 52nd St., Omaha 6, Nebraska.....1946  
 \*Perner, Miss Margaret E., 2487 Noble Rd., Apt. 23 B,  
 Cleveland Heights 21, Ohio.....1943  
 Peter, Miss Patricia, 302 Kerby Rd., Grosse Pointe Farms 30, Michigan 1947  
 Peters, Ellen, 442 5th St., Brooklyn 15, New York.....1942  
 \*Peters, Harold S[eymour], 54 Folly Rd., Charleston 50, South Carolina..1924  
 \*Peterson, Alfred, Box 201, Brandt, South Dakota.....1931  
 Peterson, Alvin M[artin], Onalaska, Wisconsin.....1948  
 Peterson, Mrs. C[harles] E[mil], Madison, Minnesota.....1936  
 Peterson, Liven A[dam], P.O. Box 1381, Billings, Montana.....1940  
 Peterson, Randolph L., Division of Mammals, Royal Ontario Museum of  
 Zoology, Toronto 5, Ontario, Canada.....1946  
 \*\*\*Peterson, Roger Tory, P.O. Box 7, Glen Echo, Maryland.....1942  
 \*Petrides, George A., Texas Cooperative Wildlife Unit, Box 254 F.E.,  
 College Station, Texas.....1942  
 \*\*\*Pettingill, Olin Sewall Jr., Carleton College, Northfield, Minnesota.....1930  
 Pettit, Dr. Lincoln C[oles], Hiram, Ohio.....1948  
 \*\*\*Phelps, William H[enry], Apartado 2009, Caracas, Venezuela.....1940  
 \*\*Philipp, Frederick B[ernard], Kings Highway, Middletown, New Jersey..1940  
 \*\*\*Phillips, Allan Robert, 113 Olive Rd., Tucson, Arizona.....1934  
 \*Phillips, Cyrus Eastman II, 255 Polk St., Warsaw, Illinois.....1944  
 \*Phillips, Homer Wayne, FPHA Dormitory B, San Jacinto Blvd.,  
 Austin, Texas.....1947  
 Phillips, Richard Stuart, 834 Liberty St., Findlay, Ohio.....1944  
 Pickett, Gertrude C[aroline] (Mrs. Franklin), 2503 17th Ave.,  
 Monroe, Wisconsin.....1947  
 Pieczur, Walter H[enry], 1143 Rogers Ave., Brooklyn 26, New York...1945  
 Pierce, Fred J[ohn], Winthrop, Iowa.....1947  
 \*Pierce, Robert Allen, Nashua, Iowa.....1941  
 \*Pinney, Miss Mary Edith, 2512 E. Hartford Ave., Milwaukee, Wisconsin 1948  
 \*Pirnie, Miles David, 715 S. Chestnut St., Lansing 15, Michigan.....1928  
 Pitelka, Frank Alois, Museum of Vertebrate Zoology,  
 University of California, Berkeley 4, California.....1938  
 Pittinger, Mrs. Cornelia Milhollin, Route 2, Gaston, Indiana.....1947  
 \*\*Pittman, James Allen Jr., 421 E. Concord, Orlando, Florida.....1945  
 Plath, Karl, 305 S. Cuyler Ave., Oak Park, Illinois.....1942  
 \*Platt, Dr. Ruth M[ontague], 441 Lyceum Ave., Philadelphia 28,  
 Pennsylvania.....1948  
 Pomeroy, Lawrence R., P.O. Box 212, Pass-a-Grille Beach, Florida...1948  
 \*\*Poole, Cecil A[very], 830 Chapman St., San Jose 11, California.....1942  
 Poor, Hustace Hubbard, 140 E. 40th St., New York City 16.....1935



- \*\*Porter, Dr. Eliot F[urness], Route 1, Box 5B, Santa Fe, New Mexico....1947
- \*Porter, T[homas] Wayne, Department of Zoology and Entomology,  
Iowa State College, Ames, Iowa.....1938
- \*Potter, David M., 1557 Timothy Dwight College, Yale University,  
New Haven, Connecticut.....1946
- Potter, Beatrice B[rown] (Mrs. George C.), 2111 Malvern Rd.,  
Charlotte 7, North Carolina.....1948
- \*Potter, Julian K[ent], 437 Park Ave., Collingswood, New Jersey.....1915
- Potter, Louis Henry, Route 2, West Rutland, Vermont.....1941
- Potter, Nathan S. III, 2002 Geddes Rd., Ann Arbor, Michigan.....1948
- \*\*Pough, Richard H[oooper], 33 Highbrook Ave., Pelham 65, New York....1938
- Prather, Millard F[illmore], 1129 Brown-Marx Bldg.,  
Birmingham 3, Alabama.....1940
- \*Preble, Norman A[lexander], Department of Biology, Union College,  
Schenectady 8, New York.....1941
- \*Prentice, Don Smith, 5216 East Dr., Rockford, Illinois.....1947
- Prescott, Kenneth Wade, Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1946
- \*Presnall, Clifford C[harles], 5315 Earlston Dr., Washington 16, D.C....1930
- \*Preston, Frank W[illiam], Box 149, Butler, Pennsylvania.....1948
- \*Prill, Dr. Albert G., Main St., Scio, Oregon.....1921
- \*Pritchard, C. G., Juniata, Nebraska.....1947
- Prucha, Miss Alma H., 3052 N. Maryland Ave., Milwaukee 11, Wisconsin 1942
- Putman, William L[loyd], Dominion Entomological Laboratory,  
Vineland Station, Ontario, Canada.....1945
- Putnam, Loren Smith, Department of Zoology, Ohio State University,  
Columbus 10, Ohio.....1942
- \*Pyle, George W[inner], South Valley Rd., Box 604, Paoli, Pennsylvania..1939
- Quam, Mrs. Mary Battell, 141 Joralemon St., Brooklyn 2, New York..1944
- Quay, Thomas L., Zoology Department, North Carolina State College,  
Raleigh, North Carolina.....1939
- Quimby, Don C., 4742 Garfield Ave., S., Minneapolis 9, Minnesota.....1942
- \*Ragusin, Anthony V[incent], P.O. Box 496, Biloxi, Mississippi.....1937
- Rahe, Carl W., 4666 Turney Rd., Cleveland 5, Ohio.....1931
- Ramey, Ralph E[merson] Jr., 174 S. Ardmore Rd., Columbus 9, Ohio..1948
- \*Ramisch, Miss Marjorie [Viola], 1835 Noble Rd.,  
East Cleveland 12, Ohio.....1943
- Ramsden, Charles Theodore, 8 & 19, Vista Alegre, Santiago, Cuba...1914
- Ramsey, James W[ilson], Route 5, Greenville, Pennsylvania.....1948
- Randall, Robert Neal, 117½ Fifth St., Bismarck, North Dakota.....1939
- Rapp, Robert R[umsey], 34 Main St., Ridgefield, Connecticut.....1948
- Rapp, William F[rederick] Jr., Gaylord Hall, Doane College,  
Crete, Nebraska.....1941
- \*Rausch, Robert [Lloyd], Department of Veterinary Science,  
University of Wisconsin, Madison 6, Wisconsin.....1947
- \*Rawson, George William, % CIBA Pharmaceutical Products, Inc.,  
Lafayette Park, Summit, New Jersey.....1947
- \*Rea, Gene, 2378 Neil Ave., Columbus, Ohio.....1948
- \*\*Rebmann, G. Ruhland Jr., 729 Millbrook Lane, Haverford, Pennsylvania 1941
- \*Reeder, Miss Clara Maude, 1608 College Ave., Houghton, Michigan...1938
- Rees, Earl Douglas, 1504 N. Main St., Findlay, Ohio.....1946
- Reese, C[arl] R[ichard], 266 E. Dunedin Rd., Columbus 2, Ohio.....1948
- \*\*Reese, Teresa S. (Mrs. Hans H.), 3421 Circle Close, Shorewood Hills,  
Madison 5, Wisconsin.....1941
- Regensburg, George E[rvin], 15 Mechanic St., Haddonfield, New Jersey..1948
- \*Reilly, E[dgar] M[ilton] Jr., 305 E. Veterans Place, Ithaca, New York..1946

- Reimann, Edward J[oseph], 4147 O St., Philadelphia 24, Pennsylvania..1947  
 Remington, Charles Lee, Osborn Zoological Laboratory,  
 Yale University, New Haven 11, Connecticut.....1944  
 \*Rett, Egmont Z[achary], Museum of Natural History,  
 Santa Barbara, California.....1940  
 Reuss, Alfred Henry Jr., 2908 Edison St., Blue Island, Illinois.....1936  
 Reynolds, Mrs. Perry J., 1652 Virginia Park, Detroit 6, Michigan.....1948  
 \*Reynolds, Ralph Jabez, 2645 Powell Ave., Columbus 9, Ohio.....1948  
 Reynolds, William Pius, 1330 Foulkrod St., Philadelphia 24, Pennsylvania 1948  
 Rice, Dale [Warren], 432 W. 42nd St., Indianapolis 8, Indiana.....1946  
 Rice, Mrs. Harry Wilson, 3940 Richfield Rd., Minneapolis 10, Minnesota 1940  
 Richardson, Mrs. Ethel E[nyheart], 887 Indian Rock Ave.,  
 Berkeley 7, California.....1948  
 Richdale, Lancelot Eric, 23 Skibo St., Kew, Dunedin SW1, New Zealand..1945  
 Richter, Carl H., 703 Main St., Oconto, Wisconsin.....1947  
 \*Ricker, W[illiam] E[dwin], Department of Zoology, Indiana University,  
 Bloomington, Indiana.....1943  
 Ricketts, Marc[us] H[anna], Box 342, Lancaster, Ohio.....1948  
 Rickly, Irvin B[linn], 240 Northridge Rd., Columbus 2, Ohio.....1948  
 \*Riggs, Carl D[aniel], Department of Zoology, University of Oklahoma,  
 Norman, Oklahoma.....1943  
 Riner, Miss Alice, 641 S. Roosevelt Ave., Wichita 9, Kansas.....1939  
 Ripberger, Louis Edward, Backmeyer Rd., Route 3, Richmond, Indiana..1948  
 Ripley, Miss Helen Lucile, 2101 Ray St., Lansing 10, Michigan.....1948  
 \*Ripley, S[idney] Dillon II, Litchfield, Connecticut.....1946  
 \*Ritchie, Dr. Robert C., 60 Chatsworth Dr., Toronto 12,  
 Ontario, Canada .....1944  
 Ritter, Rhys T[heophilus], Route 4, Bethlehem, Wheeling,  
 West Virginia.....1944  
 \*\*Roads, Miss Myra Katie, 463 Vine St., Hillsboro, Ohio.....1914  
 \*Robbins, Chandler S[eymour], Patuxent Research Refuge,  
 Laurel, Maryland.....1941  
 Roberts, Harold D., 218 N. Sixth St., Black River Falls, Wisconsin...1946  
 Roby, Edwin F[orrest], 427 N. Tracy Ave., Bozeman, Montana.....1948  
 \*\*\*Rogers, Charles Henry, East Guyot Hall, Princeton, New Jersey.....1903  
 Rogers, Gerald [Talbot], 13 B St., Perris, California.....1945  
 \*Rogers, Irl, 402 Alturas Ave., Modesto, California.....1937  
 \*\*\*Rogers, Miss Mabel T., 203 N. Columbia St., Milledgeville, Georgia...1947  
 \*Rogers, Mrs. Walter E., P.O. Box 385, Appleton, Wisconsin.....1931  
 Rognrud, Merle Jerome, Box 296, St. Ignatius, Montana.....1947  
 Rollis, Everest Jerold, 200 S. Monroe St., Stoughton, Wisconsin.....1948  
 Rooney, James P., 1514 S. 12th St., Yakima, Washington.....1947  
 \*\*\*Root, Oscar M[itche]ll, Brooks School, North Andover, Massachusetts..1940  
 Rorimer, Irene Tuck (Mrs. J. M.), 28 Outer Dr., Oak Ridge,  
 Tennessee .....1938  
 Rosene, Walter Jr., 1212 Jupiter, Gadsden, Alabama.....1942  
 \*Rosewall, O[scar] W[aldemar], Department of Zoology,  
 Louisiana State University, University, Louisiana.....1931  
 \*Ross, C[harles] Chandler, 7924 Lincoln Dr., Chestnut Hill,  
 Philadelphia 18, Pennsylvania.....1937  
 \*Ross, Hollis T., 29 S. 2nd St., Lewisburg, Pennsylvania.....1945  
 Roullard, Fred Pete, Agricultural Department, Fresno State College,  
 Fresno 4, California.....1948  
 Rowe, Kenneth C[hristian], 619 West Blvd., N., Columbia, Missouri...1947  
 \*\*\*Rudd, Dr. Clayton G[lass], 315 Medical Arts Bldg.,  
 Minneapolis 2, Minnesota.....1944

- Rudd, Robert L., Museum of Vertebrate Zoology, University of California, Berkeley 4, California.....1939
- Ruecker, Miss Emilie, Seapowet Ave., Tiverton, Rhode Island.....1943
- Ruhr, C[lifford] E[ugene], 1007 Laurel St., Atlantic, Iowa.....1947
- Ruthven, Miss Katherine N[orcross], 13225 Marlowe Ave., Detroit 27, Michigan.....1947
- Saari, Emil A., 272 S. Washington Ave., Columbus 15, Ohio.....1948
- Sabin, Walton B., 520 Euclid Ave., Syracuse 10, New York.....1945
- Sanders, Miss Ellen Allen, Campbellsville College, Campbellsville, Kentucky .....1948
- \*Satterly, J[ack], 100 Castlewood Rd., Toronto 12, Ontario, Canada...1947
- \*Satterthwait, Mrs. Elizabeth Allen, 806 W. Ohio St., Urbana, Illinois...1925
- \*Saugstad, N[els] Stanley, Route 4, Minot, North Dakota.....1939
- \*Saunders, Aretas A[ndrews], 361 Crestwood Rd., Fairfield, Connecticut..1934
- \*Saunders, George B[radford], Fish and Wildlife Service, 546 Custom House, Denver 2, Colorado.....1926
- Saunders, Richard Merrill, 9 McMaster Ave., Toronto 5, Ontario, Canada.....1948
- \*\*Savage, James, Buffalo Athletic Club, Buffalo, New York.....1939
- \*Sawyer, Miss Dorothy, 1656 Bradley St., Schenectady 4, New York....1937
- \*Schaub, Mary Hall (Mrs. J. B.), 1040 Isabella St., Wilmette, Illinois...1939
- Schildman, George J., 436 S. 9th St., Lincoln, Nebraska.....1947
- \*Schneider, Miss Evelyn J., 2207 Alta Ave., Louisville 5, Kentucky.....1935
- Scholes, Mrs. Doris Kathryn, 385 E. Hall St., Bushnell, Illinois.....1947
- Scholes, Robert T[hornton], 260 Crittenden Blvd., Box 243, Rochester 7, New York.....1946
- \*\*Schoo, Grace Harwood (Mrs. Clarence), 400 Maple St., Springfield 5, Massachusetts.....1948
- \*\*\*Schorger, A[rlie] W[illiam], 168 N. Prospect Ave., Madison, Wisconsin..1927
- \*\*Schramm, Wilson [Cresap], 321 Kensington Rd., Syracuse 10, New York..1944
- \*Schuette, C[onrad] H[erman] L[louis], 1446 Beaver Rd., Sewickley, Pennsylvania.....1942
- Schultz, Vincent, Ohio Cooperative Wildlife Research Unit, Ohio State University, Columbus 10, Ohio.....1948
- Schumm, William George, 302 C St., LaPorte, Indiana.....1944
- Schwalbe, Paul [Wayman], P.O. Box 64, Lenni, Pennsylvania.....1948
- \*Scotland, Minnie B[rink], 42 Continental Ave., Cohoes, New York.....1938
- Scott, Fred T., Pittsburg, New Hampshire.....1948
- Scott, Frederic R[obert], 4600 Coventry Rd., Richmond 21, Virginia....1947
- \*\*Scott, Peter, 8, Edwardes Square, London, W. 8, England.....1947
- Scott, Thomas G[eorge], Route 2, St. Paul 6, Minnesota.....1936
- \*Scott, W[alter] E[dwin], Mendota Beach Heights, Madison 5, Wisconsin.1938
- Scott, Mrs. Walter E[dwin], Mendota Beach Heights, Madison 5, Wisconsin.....1947
- Seaberg, Dr. John A[rthur], Veterans Administration Hospital, Minneapolis 6, Minnesota.....1944
- Sealander, John A[rthur] Jr., 203 Vivarium Bldg., University of Illinois, Champaign, Illinois.....1947
- \*\*Sedwitz, Walter W[illiam], 229 W. 36th St., New York City 18.....1947
- Seeber, Edward L[incoln], 186 Wabash Ave., Kenmore 17, New York...1944
- Seeley, George Mervil, 461 High St., Long Branch, New Jersey.....1945
- Seibert, Henri C., Ohio University, Athens, Ohio.....1941
- Selby, Gertrude Pellit (Mrs. James A.), Lookout Point, Ridgeville, Ontario, Canada.....1948
- \*\*Sener, Miss Ruth, 233 Charlotte St., Lancaster, Pennsylvania.....1943
- Serbousek, Miss Lillian, 1226 Second St., S.W., Cedar Rapids, Iowa.....1935

- \*\*Shackleton, Elizabeth C[atferall] (Mrs. Walter H.), Route 1, Box 76 A,  
Prospect, Kentucky.....1947
- \*\*Shackleton, Walter H., Route 1, Box 76 A, Prospect, Kentucky.....1947
- \*Shaffer, Chester M[onroe], 357 Hascall Rd., N.W., Atlanta, Georgia....1934
- \*Shaftesbury, Archie D., Women's College, University of North Carolina,  
Greensboro, North Carolina.....1930
- Shapiro, Jacob, New York State College of Forestry,  
Syracuse 10, New York.....1947
- Sharp, Ward M., Pennsylvania State College, 206 Forestry Bldg.,  
State College, Pennsylvania.....1936
- Shaub, Benjamin Martin, 159 Elm St., Northampton, Massachusetts....1948
- Shaver, Jesse M[ilton], George Peabody Teachers College,  
Nashville, Tennessee.....1922
- Shaw, Dr. Charles H[icks], Bremen, Ohio.....1941
- Shaw, Mrs. Elizabeth Martin, 6709 Kensington Ave.,  
Richmond 21, Virginia.....1943
- \*\*Shearer, A[mon] R[obert], Box 428, Mont Belvieu, Chambers Co., Texas 1893
- \*\*Shelar, Keller, State Teachers College, Slippery Rock, Pennsylvania.....1940
- \*Sheldon, Mrs. Dorothy Dean, Goose Lane, East Pembroke, Massachusetts 1948
- Shepard, Booth, 2709 Johnstone Place, Cincinnati 6, Ohio.....1948
- \*Sherwood, John Willitts, 26 Smith St., Salinas, California.....1936
- Shiple, Donald DeVries, Department of Biology, Lynchburg College,  
Lynchburg, Virginia.....1948
- Short, Wayne, 1000 5th Ave., New York City 28.....1941
- \*Shortt, Angus H[enry], 101 Morier Ave., St. Vital,  
Winnipeg, Manitoba, Canada.....1942
- \*Shortt, Terence Michael, Royal Ontario Museum of Zoology,  
Queen's Park at Bloor St., Toronto, Ontario, Canada.....1941
- Shuman, Miss Bertha C., 136 S. 19th St., LaCrosse, Wisconsin.....1947
- Sibley, Charles G[ald], Museum of Natural History,  
University of Kansas, Lawrence, Kansas.....1942
- Sieh, James G[erald], Department of Zoology, Iowa State College,  
Ames, Iowa.....1948
- \*\*Simmons, Mrs. Amelia C., 2742 N. Maryland Ave., Milwaukee 11,  
Wisconsin.....1943
- \*\*\*Simmons, Edward McIlhenny, Avery Island, Louisiana.....1942
- Simmons, Elbert R[ulen], Manti, Utah.....1947
- Simon, James R., Jackson Hole Wildlife Park, Moran, Wyoming.....1947
- Simon, Stephen Wistar, 7727 York Rd., Towson 4, Maryland.....1947
- \*\*Simon, Miss Tina, 1340 W. Elmdale Ave., Chicago 40, Illinois.....1945
- Sims, Harold L[ee], 714 St. Philip St., Thibodaux, Louisiana.....1942
- Sinclair, Miss Jean Louise, 1732 S.E. 46th St., Portland 15, Oregon....1948
- Sinclair, Kate Taylor (Mrs. Marshall Wray), 1338 Whitethorn St.,  
Bluefield, West Virginia.....1947
- \*Singleton, Albert Roland, 3968 Marburg Ave., Cincinnati 9, Ohio.....1948
- \*\*Sisman, Mrs. Lois Milner, Yonge, Aurora, Ontario, Canada.....1947
- Skaggs, Merit Bryan, 2066 Alton Rd., East Cleveland 12, Ohio.....1934
- Skuldt, Mrs. Dorothy R[andall], 28 E. Gilman St., Madison 3,  
Wisconsin.....1948
- Skutch, Alexander F[rank], San Isidro del General, Costa Rica.....1944
- Slack, Miss Mabel, 1004 Everett Ave., Louisville, Kentucky.....1934
- Sloss, Richard A., 65 Brower Ave., Woodmere, Long Island, New York..1948
- Smalley, Alfred E[vans], Open Hearth, Lewiston, Pennsylvania.....1946
- Smith, Albert G., Department of Biology, Loyola University,  
6525 Sheridan Rd., Chicago, Illinois.....1948

- \*Smith, Dr. A[rthur] F[rancis], Manning, Iowa.....1934
- Smith, Carl E[rnest], Halsey, Nebraska.....1947
- Smith, Earl E[mmett], Harvard Forest, Petersham, Massachusetts.....1947
- Smith, Miss Emily, Glen Ana and Bellecourt, Los Gatos, California....1948
- \*Smith, Frank R[ush], Route 2, Box 100, Laurel, Maryland.....1910
- \*Smith, Harry M[adison], Department of Zoology and Physiology,  
University of Wyoming, Laramie, Wyoming .....1936
- Smith, Luther E[ly], 1554 Telephone Bldg., 1010 Pine St.,  
St. Louis 1, Missouri.....1941
- \*Smith, Lewis MacCuen, 8040 St. Martins Lane, Chestnut Hill Station,  
Philadelphia, Pennsylvania.....1931
- Smith, Lloyd Mason, Desert Museum, Box 411, Palm Springs,  
California.....1948
- Smith, Orion O., 1539 Crosby St., Rockford, Illinois.....1936
- \*Smith, Robert L[eo], Route 1, Reynoldsville, Pennsylvania.....1945
- \*Smith, Roy Harmon, 183 N. Prospect St., Kent, Ohio.....1936
- Smith, Tarleton F., Box 1041, Douglas, Alaska.....1948
- Smith, Wendell Phillips, Wells River, Vermont.....1921
- \*Smith, Winnifred Wahls (Mrs. E. R.) Winghamen, Route 1,  
Two Rivers, Wisconsin.....1946
- Snapp, Mrs. R. R., 310 W. Michigan, Urbana, Illinois.....1940
- \*Snyder, L[ester] L[ynne], Royal Ontario Museum of Zoology,  
Queen's Park at Bloor St., Toronto 5, Ontario, Canada.....1929
- Sooter, Clarence Andrew, 1336 N. 40th St., Lincoln, Nebraska.....1940
- Spangler, Miss Iva M., 128 E. Foster Parkway, Fort Wayne, Indiana....1939
- \*Speirs, Mrs. Doris Huestis, "Cobble Hill," Route 2,  
Pickering, Ontario, Canada.....1936
- Speirs, J[ohn] Murray, "Cobble Hill," Route 2, Pickering, Ontario,  
Canada.....1931
- Spencer, Haven Hadley, Turpin Rd., Route 1, Box 349 A,  
Newtown, Ohio.....1946
- \*\*Spencer, Miss O[live] Ruth, 1030-25 Avenue Court, Moline, Illinois.....1938
- Sperry, Charles Carlisle, 1455 S. Franklin St., Denver 10, Colorado....1931
- Spofford, Walter R[ichard] II, Vanderbilt University Medical School,  
Nashville 4, Tennessee.....1942
- Springer, Paul F[rederick], Patuxent Research Refuge, Laurel, Maryland 1946
- \*Stabler, Robert M[iller], Colorado College, Colorado Springs, Colorado..1939
- \*Staebler, Arthur E[ugene], W. K. Kellogg Bird Sanctuary, Route 1,  
Augusta, Michigan.....1937
- \*\*Stahl, Miss Marjoretta Jean, Kimberly, West Virginia.....1942
- \*Stamm, Anne (Mrs. Frederick W.) 2118 Lakeside Dr.,  
Louisville 5, Kentucky.....1947
- Stanfield, Rodger Ord, 424 Piccadilly St., London, Ontario, Canada.....1948
- \*\*Stanley, Willard F[rancis], State Teachers College, Fredonia, New York.1946
- Stark, Miss Wilma R[uth], Meridian Hill Hotel, 16th St., N.W.,  
Washington, D.C.....1939
- Starrett, William C[harles], Department of Zoology and Entomology,  
Iowa State College, Ames, Iowa.....1933
- Stearns, Edwin I[ra] Jr., 92 Farragut Rd., Plainfield, New Jersey.....1945
- \*Steele, William Soles, 134 King St., Guelph, Ontario, Canada.....1948
- \*Steffen, Earnest William, 1000 Maplewood Dr., Cedar Rapids, Iowa....1944
- Steggerda, Morris, Kennedy School of Missions, Hartford 5, Connecticut.1941
- Stegle, Joseph J[ames], 220 Pondfield Rd., W., Bronxville, New York....1944
- Stephens, T[homas] C[alderwood], Box 188 M, Sioux City 20, Iowa....1911
- Stevens, Charles E[mo] Jr., 426 2nd St., N.E., Charlottesville, Virginia..1947

- \*Stevens, O. A., State College Station, Fargo, North Dakota.....1926
- Stevenson, Henry M[ills] Jr., Department of Zoology, Florida State  
University, Tallahassee, Florida.....1943
- Stevenson, James O[sborne], Fish and Wildlife Service, Department of  
the Interior, Washington 25, D.C.....1933
- \*Stewart, Paul A[lva], 8640 N. State St., Westerville, Ohio.....1925
- Stewart, Robert Earl, Patuxent Research Refuge, Laurel, Maryland.....1939
- Stidolph, Robert H. D., 114 Cole St., Masterton, New Zealand.....1945
- \*Stillwell, Jerry E., 8160 San Benito Way, Dallas 18, Texas.....1935
- \*\*Stine, Miss Perna M., Box 386, Olney, Illinois.....1931
- \*\*\*Stoddard, Herbert Lee, Sherwood Plantation, Route 5,  
Thomasville, Georgia.....1916
- Stofer, Martha Miller (Mrs. W. E.), 730 Grand Ave., Glen Ellyn, Illinois.....1948
- Stokes, Allen W[oodruff], Scudder, Ontario, Canada.....1945
- Stoner, Emerson Austin, 149 E. L St., Box 444, Benicia, California.....1947
- \*\*\*Stoner, Lillian C[hristiansore] (Mrs. Dayton), 399 State St.,  
Albany 6, New York.....1945
- \*Stophlet, John J[ermain], 2612 Maplewood Ave., Toledo 10, Ohio.....1934
- Storer, Robert Winthrop, Museum of Vertebrate Zoology,  
Berkeley 4, California.....1938
- \*Storer, Tracy I[rwin], Division of Zoology, University of  
California, Davis, California.....1928
- Stratton, Miss Nellie Mary, 209 Cutler St., Allegan, Michigan.....1945
- Straw, Richard M[yron], 973 W. County Rd. B, St. Paul 8, Minnesota..1947
- \*Street, Phillips B[orden], 520 Packard Bldg.,  
Philadelphia 2, Pennsylvania.....1946
- Street, Thomas M., Bottineau, North Dakota.....1940
- \*\*\*Strehlow, Elmer William, 721 W. Mason St., Green Bay, Wisconsin.....1941
- Stringham, Emerson, Box 986, Kerrville, Texas.....1940
- \*\*\*Strong, R[euben] M[yron], 5840 Stony Island Ave.,  
Chicago, Illinois.....Founder
- Strunk, William Franklin, Box 47, Ripley, West Virginia.....1944
- Struthers, Dana R., 4858 Fremont Ave., S., Minneapolis 9, Minnesota...1948
- \*Stultz, Mrs. Alma J., 2594 S. Durfee Ave., El Monte, California.....1946
- Stupka, Arthur, Great Smoky Mountains National Park,  
Gatlinburg, Tennessee.....1935
- \*\*\*Sturgeon, Myron T., Department of Geography and Geology,  
Ohio University, Athens, Ohio.....1934
- \*Sturgis, S[ullivan] Warren, 66 Marlboro St., Boston, Massachusetts....1941
- \*Sturm, [William] Louis, Glendale, Ohio.....1943
- \*Summerfield, Donald, Route 2, Box 4, Valley Station, Kentucky.....1947
- \*Suthard, James G[regory], 1881 Raymond Ave.,  
Long Beach 6, California.....1936
- Suttkus, Royal Dallas, Stimson Hall, Cornell University,  
Ithaca, New York.....1947
- \*\*\*Sutton, George Miksch, Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1920
- \*Swanson, Gustav [Adolph], Fernow Hall, Cornell University,  
Ithaca, New York.....1927
- \*Swedenborg, Ernie D[avid], 4905 Vincent Ave., S.,  
Minneapolis 10, Minnesota.....1929
- \*Swigart, Miss Marian, 601 N. Jackson Ave., Clinton, Illinois.....1948
- \*Swoger, Arthur [Glenn], 212 Oliver Ave., Pittsburgh 22, Pennsylvania..1943
- \*Taber, Wendell, 3 Mercer Circle, Cambridge, Massachusetts.....1936
- \*Taber, William R[ichard], New York State Conservation Department,  
Albany, New York.....1947

- \*Tabler, Fan Boswell (Mrs. William B.), 2923 Riedling Dr.,  
Louisville 6, Kentucky.....1947
- \*Tabor, Miss Ava Rogers, 305 Canal Blvd., Thibodaux, Louisiana.....1940
- \*Taintor, Mrs. Elizabeth Taber, 11 Story St., Cambridge, Massachusetts..1945
- Tallman, William S[weet] Jr., 4 Linden Place, Sewickley, Pennsylvania..1940
- \*Tanger, Louise F. A. (Mrs. C. Y.), 318 N. President Ave.,  
Lancaster, Pennsylvania.....1943
- Tanghe, Leo J[oseph], 852 Stone Rd., Rochester 13, New York.....1943
- Tanner, James Taylor, Department of Zoology, University of  
Tennessee, Knoxville, Tennessee.....1937
- Tarbell, Miss Carolyn [Elizabeth], 14 Elizabeth St., Delaware, Ohio.....1948
- \*\*\*Taylor, Arthur Chandler, 309 N. Drew St., Appleton, Wisconsin.....1929
- \*\*\*Taylor, Mrs. H. J., 900 Santa Barbara Rd., Berkeley, California.....1916
- \*Taylor, H[erbert] S[anton], 1369 Fair Ave., Columbus 5, Ohio.....1948
- Taylor, Miss Joanne, 1176 Shattuck, Berkeley 7, California.....1941
- \*Taylor, Joseph William, 590 Allen's Creek Rd.,  
Rochester 10, New York.....1946
- \*Taylor, Dr. R[obert] L[incoln], 810 Highland Dr., Flintridge,  
Pasadena 2, California.....1947
- \*Taylor, William Ralph, Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1940
- \*Teachenor, Dix, 1020 W. 61st St., Kansas City, Missouri.....1923
- \*Teale, Edwin Way, 93 Park Ave., Baldwin, Long Island, New York.....1948
- Terres, John K., 251 E. 48th St., New York City 17.....1939
- Terrill, Lewis McIver, 216 Redfern Ave., Westmount,  
Montreal 6, Quebec, Canada.....1948
- Thacher, S. Charles, 2918 Brownsboro Rd., Louisville 6, Kentucky.....1942
- \*Thomas, Edward S[inclair], 319 Acton Rd., Columbus 10, Ohio.....1921
- \*Thomas, Landon B[ailie], 1006 Blaine St., Edgerton, Wisconsin.....1947
- \*Thomas, Ruth H. (Mrs. Rowland), 500 E. Green St.,  
Morrilton, Arkansas.....1937
- Thompson, Daniel Q., 521 E. Mifflin St., Madison 3, Wisconsin.....1945
- Thompson, Donald R[uff], 217 N. Orchard St., Madison 5, Wisconsin..1947
- Thomsen, Mrs. Hans Peter, Route 3, Box 406, Beloit, Wisconsin.....1946
- \*Thorley, Robert F., 3 Midland Gardens, Bronxville 8, New York.....1946
- Thorne, Oakleigh II, Box 401, Millbrook, New York.....1947
- Thornton, Wilmot A[rnold], 602 Elmwood Place, Austin, Texas.....1948
- \*\*\*Thorp, George B[oulton], Carnegie Museum, Pittsburgh, Pennsylvania..1935
- Thurow, Gordon Ray, 829 Kensington Ave., Aurora, Illinois.....1948
- \*Tift, Richard, The Oaks, Newton, Route 1, Albany, Georgia.....1937
- \*Tilley, Francis Thomas, 26 Mohican Ave., Buffalo 8, New York.....1944
- Tinbergen, N[ikolaas], Zoölogische Laboratorium, Leiden, Holland.....1947
- \*Tipton, Dr. Samuel R[idley], 300 W. Adair Dr., Fountain City,  
Knoxville 18, Tennessee.....1941
- \*\*Todd, Elizabeth D. (Mrs. Paul H.), 918 W. Main St.,  
Kalamazoo 48, Michigan.....1939
- Todd, George K[endall], 1079 E. 33rd St., S., Salt Lake City 6, Utah....1943
- Todd, Henry O[liver] Jr., Woodberry Rd., Murfreesboro, Tennessee....1938
- Todd, Mabel Sellers (Mrs. A. P.), 2504 Winsted Lane, Austin, Texas....1940
- \*Todd, W[alter] E[dmond] Clyde, Carnegie Museum,  
Pittsburgh 13, Pennsylvania.....1911
- Tomich, P[rosper] Quentin, Hastings Reservation, Jamesburg Route,  
Monterey, California.....1948
- \*Tomkins, Ivan Rexford, 1231 E. 50th St., Savannah, Georgia.....1931
- \*\*Tordoff, Harrison B[ruce], Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1947

- \*\*Tout, Wilson, Box 678, North Platte, Nebraska.....1946
- \*Towle, Miss Helen Jessie, 5148 29th Ave., S.,  
Minneapolis 6, Minnesota.....1944
- \*\*Townsend, Miss Elsie White, Department of Biology, Wayne University,  
Detroit 1, Michigan.....1938
- \*\*\*Trautman, Milton B[ernhard], Stone Laboratory, Put-in-Bay, Ohio....1932
- \*Traylor, Melvin Alvah Jr., 759 Burr Ave., Winnetka, Illinois.....1947
- Trimm, H. Wayne, 1421 LeGore Dr., Manhattan, Kansas.....1943
- Trown, Robert Wilson, 47 Armadale Ave., Toronto, Ontario, Canada..1948
- \*Trussell, Miss Malvina, 10 W. Kennedy Ave., Statesboro, Georgia.....1946
- \*Tryon, C[larence] A[rcher] Jr., Department of Biological Sciences,  
University of Pittsburgh, Pittsburgh 13, Pennsylvania.....1942
- \*Tubbs, Farley F., Game Division, Department of Conservation,  
Lansing 13, Michigan.....1935
- \*\*\*Tucker, Mrs. Carll, Penwood, Mount Kisco, New York.....1928
- Tucker, Robert Edward, 245 N. Auburndale, Memphis, Tennessee.....1942
- \*Tucker, Walter A[ndrew], 728 S. Remington Rd., Columbus, Ohio.....1948
- Turner, William Clifton Jr., 420 S. Wille, Mt. Prospect, Illinois.....1948
- Tuttle, Dr. Carl, Berlin Heights, Ohio.....1948
- Tuttle, George Mott Jr., Main St., Youngstown, New York.....1941
- Tvedt, Harold B[loom], 105 S. Illinois St.,  
Martinsburg, West Virginia.....1941
- \*Twomey, Arthur C[ornelius], Carnegie Museum,  
Pittsburgh 13, Pennsylvania.....1936
- \*Tyler, Dr. Winsor M[arrett], 1482 Commonwealth Ave.,  
Brighton 35, Massachusetts.....1914
- Tyrrell, W. Bryant, 246 Park Ave., Takoma Park 12, Maryland.....1947
- \*Uhler, Francis Morey, Patuxent Research Refuge, Laurel, Maryland....1931
- \*\*Uhrig, Mrs. A. B., Box 28, Oconomowoc, Wisconsin.....1926
- Umbach, Miss Margaret, 2526 East Dr., Fort Wayne 3, Indiana.....1941
- Unger, Joseph J., 1457 S. 11th St., Omaha, Nebraska.....1947
- Ussher, Richard Davy, Nancy Lake Farm, King, Ontario, Canada.....1948
- \*Vaiden, M[eredith] G[ordon], Rosedale, Mississippi.....1937
- \*Vail, Donald Bain, 94 Sherwood Rd., Ridgewood, New Jersey.....1948
- Van Arsdall, C[hables] A[lexander], 1024 Beaumont Ave.,  
Harrodsburg, Kentucky.....1946
- Van Camp, Laurel F[rederick], Genoa, Ohio.....1943
- Van Coevering, Jack, 6170 Commerce Rd., Route 5, Pontiac 5, Michigan.1939
- Vandervort, Charles C[hampion], Laceyville, Pennsylvania.....1937
- Vandevender, Eva Minnie (Mrs. Lewis), Hepburn, Iowa.....1948
- Van Dyke, Henry, 809 E. Kingsley St., Ann Arbor, Michigan.....1948
- Vane, Dr. Robert F[rank], 600 Dows Bldg., Cedar Rapids, Iowa.....1946
- \*\*Van Pelt, Raymond Drake, 2687 Waverly Dr.,  
Los Angeles 26, California.....1946
- \*\*\*van Rossem, A[driaan] J[oseph], 2205 W. Adams St.,  
Los Angeles 7, California.....1939
- \*\*\*Van Tyne, Josselyn, Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1922
- \*\*Vaughan, William C[oleman], 115 Fairbanks Ave.,  
Kenmore 17, New York.....1938
- Vaurie, Charles, American Museum of Natural History, Central Park W.  
at 79th St., New York City 24.....1946
- \*Veghte, James Henry, 37 Holly St., Lennon Park,  
Colorado Springs, Colorado.....1947
- Vesey, W. Glenn, 102 E. High St., Painesville, Ohio.....1948
- Vilas, Mrs. Frances J., 26 Cambridge Rd., Madison 4, Wisconsin.....1948



- \*Visscher, Paul, Biology Laboratory, Western Reserve  
University, Cleveland, Ohio.....1924
- \*Voak, Mrs. Floyd S., 909 S. Custer Ave., Miles City, Montana.....1945
- \*\*Vollmar, Mrs. Joseph E., 6138 Simpson Ave., St. Louis 10, Missouri....1941
- \*von der Heydt, James A[rnold], Box 155, Nome, Alaska.....1947
- \*Vore, Marvin E[lmer], 1128 N. 8th Ave., Route 3,  
West Bend, Wisconsin.....1947
- \*Wade, Douglas E., Office of the Naturalist, Dartmouth College,  
Hanover, New Hampshire.....1936
- \*Wade, Katherine White (Mrs. Sydney J.), Box 73, Oakwood, Illinois...1940
- Wagar, Dr. Harold Wesley, 619 5th St., Brookings, South Dakota.....1947
- Wagner, Miss Esther E., 13 Locust Ave., Danbury, Connecticut.....1937
- \*Wagner, Nancy Elizabeth (Mrs. C. R.), South Lane Farm, Utica, Ohio..1947
- Wagner, Helmuth O., Apartado 7901, Sucursal 3, Mexico, D.F.....1945
- \*\*Walcott, Hon. Frederick Collin, Investment Bldg., Washington, D.C....1945
- \*Walker, Charles F[rederic], Museum of Zoology, University of Michigan,  
Ann Arbor, Michigan.....1939
- Walker, M[yril] V[incent], Zion National Park, Springdale, Utah.....1943
- Walker, William Herbert, 23 Wolfe Ave., Deep River, Ontario, Canada..1948
- \*\*Walkinshaw, Lawrence Harvey, 1703 Central Tower,  
Battle Creek, Michigan.....1928
- \*Wallace, Miss Edith Adell, 421 W. 8th Ave., Gary, Indiana.....1945
- \*Wallace, George J[ohn], Zoology Department, Michigan State College,  
East Lansing, Michigan.....1937
- Wallner, Dr. Alfred, 13938 Calvert St., Van Nuys, California.....1941
- Walters, Miss Kathleen, 312 Crane, Royal Oak, Michigan.....1944
- \*Wampole, John H[enry], Box 447, Grant, Nebraska.....1944
- Wandell, Willet N[orburt], Natural History Survey, Urbana, Illinois...1944
- \*Wangaard, Arthur C[arl], 4902 12th Ave., S., Minneapolis 7, Minnesota.1948
- Wangnild, Miss Lillian M[arie], 2818 Gaylord St., Denver 5, Colorado..1943
- Wanless, Harold R[ollin], 704 S. McCullough St., Urbana, Illinois.....1940
- Ward, Edward P., 109 E. Main St., Moorestown, New Jersey.....1948
- Warner, Dwain Willard, Museum of Natural History, University of  
Minnesota, Minneapolis 14, Minnesota.....1946
- \*Waterman, Ralph T[en Eyck], 13 Meadow Rd.,  
Poughkeepsie, New York.....1947
- Watson, Frank Graham, % Shell Chemical Corporation, Box 2527,  
Houston 1, Texas.....1937
- Watson, James Dewey Jr., 7922 Luella Ave., Chicago 17, Illinois.....1945
- \*Watson, Robert J[ames], Box 75, Blacksburg, Virginia.....1943
- Waycheshen, Anton, High Hill, Saskatchewan, Canada.....1948
- Weaver, Mrs. Alice Helen Brown, 1434 Crain St., Evanston, Illinois....1948
- Webb, Vada Hart (Mrs. T. R.), 1535 Ambler Ave., Abilene, Texas.....1946
- \*Weber, Louis M[arkus], House Springs, Missouri.....1941
- \*\*Webster, Clark G[ibbons], Patuxent Research Refuge, Laurel, Maryland..1948
- Webster, J[ackson] Dan, Jamestown College, Jamestown, North Dakota.1939
- Weingraff, Abraham, 316 W. 97th St., New York City 25.....1948
- \*Weiser, Virgil Leonard, 507 2nd Ave., E., Dickinson, North Dakota....1946
- Welch, Arthur, 431 Rosendale Rd., Burnley, Lancashire, England.....1947
- Welles, Mary Pyke (Mrs. George M.), R.F.D. 1, Elmira, New York...1938
- \*Welty, Carl, Route 1, Beloit, Wisconsin.....1948
- \*\*Wernicke, Maleta Moore (Mrs. Julius F.), Gull Point,  
Escambia Co., Florida.....1944
- Westerskov, Kaj [Ejvind], Ohio Wildlife Research Unit, Ohio State  
University, Columbus 10, Ohio.....1947

- Weston, Henry G[riggs] Jr., Department of Zoology, Science Bldg.,  
Iowa State College, Ames, Iowa.....1947
- \*\*Weston, Robert, Salmon Pool Farm, Brewer, Maine.....1944
- Wetherbee, David K[enneth], Museum of Natural History, 12 State St.,  
Worcester 8, Massachusetts.....1947
- \*Wetmore, Alexander, U.S. National Museum, Washington 25, D.C.....1903
- \*Weydemeyer, Winton, Fortine, Montana.....1930
- \*Weyl, Edward Stern, 6909 Henley St., Philadelphia 19, Pennsylvania....1927
- \*\*Wheatland, Miss Sarah B[igelow], 532 State St., Bangor, Maine.....1942
- Whitaker, Mrs. Lovie M., School of Journalism, University of  
Oklahoma, Norman, Oklahoma.....1947
- White, Miss Dorothy, 25 N. Audubon Rd., Indianapolis, Indiana.....1948
- \*Whitehead, Miss Edith May, 1130 Grand Ave., Carthage, Missouri.....1947
- \*Whiting, Robert A[rchie], 1228 Chittock Ave., Jackson, Michigan.....1947
- \*Whitney, Nathaniel R[uggles] Jr., % John Sealy Hospital,  
Galveston, Texas.....1942
- \*Whittier, Mrs. Lida, 2830 E. 130th St., Cleveland 20, Ohio.....1943
- \*\*Widdicombe, Harry T., 439 Fulton St., E., Grand Rapids 3, Michigan...1943
- Widmann, Berthold, 4621 Wesley Ave., Los Angeles 37, California.....1936
- \*Wiggin, Henry T[aylor], 151 Tappan St., Brookline, Massachusetts.....1941
- \*Wilcox, Harry Hammond Jr., Department of Anatomy, Medical School,  
University of Pennsylvania, Philadelphia 4, Pennsylvania.....1938
- Wilcox, LeRoy, Speonk, Long Island, New York.....1944
- Wilder, Theodore G[arfield], 125 Oxford Rd., Waukesha, Wisconsin....1948
- Wiles, Harold O[liver], 623 Campbell Ave., Kalamazoo 51, Michigan....1936
- Wilkowski, William [Walter], 119 Bronson Court,  
Kalamazoo 12, Michigan.....1943
- \*Williams, George G., The Rice Institute, Houston, Texas.....1945
- \*Williams, Jack Dixon, 124 E. Lincoln St., Findlay, Ohio.....1948
- \*Williams, Laidlaw O[nderdonk], Route 1, Box 138, Carmel, California..1930
- \*Willis, Cornelius G[rinnell], 750 Subway Terminal Bldg.,  
Los Angeles 13, California.....1948
- Willis, Franklin E[lling], Marietta, Minnesota.....1946
- Willis, Miss Myra G., 1726 4th Ave., S.E., Apt. C, Cedar Rapids, Iowa..1944
- \*\*Wilson, Archie F[rancis], 1322 Braeburn Rd., Flossmoor, Illinois.....1937
- \*Wilson, Bruce Vernon, Box 2, Okemos, Michigan.....1943
- \*Wilson, Gordon, 1434 Chestnut St., Bowling Green, Kentucky.....1920
- \*Wilson, Harold Charles, Ephraim, Wisconsin.....1938
- Wilson, John Elder, 332 Magnolia St., Rochester, New York.....1948
- Wilson, Myrtha M. (Mrs. Henry E.), Route 3, Box 118,  
Raleigh, North Carolina.....1942
- \*Wilson, Rowland S[teele], 2130 E. Broad St., Columbus 9, Ohio.....1941
- \*Wilson, Ruth (Mrs. Carl), 11285 Lakepointe, Detroit 24, Michigan....1941
- \*\*\*Wineman, Andrew, 150 Michigan Ave., Detroit, Michigan.....1934
- \*\*\*Wing, Harold F[rancis], Route 3, Jackson, Michigan.....1941
- \*Wing, Leonard [William], Department of Wildlife Management,  
Texas Agricultural and Mechanical College, College Station, Texas...1924
- Winn, Howard Elliott, 398 N. Elm St., West Bridgewater, Massachusetts 1947
- Wistey, Lorene S., South English, Iowa.....1944
- Witmer, S[amuel] W[enger], 1608 S. 8th St., Goshen, Indiana.....1948
- Woerner, H[erbert] Ray, Route 3, Lancaster, Pennsylvania.....1947
- \*Wolcott, Richard Hugh, 957 Gillett's Lake, Route 2, Jackson, Michigan..1948
- Wolfe, Harold R[eclus], Biology Bldg., University of Wisconsin,  
Madison 6, Wisconsin.....1947
- Wolff, John L[udwig], 38 Crane Rd., Scarsdale, New York.....1948

*Wolfson, Albert, Department of Zoology, Northwestern University, Evanston, Illinois.....	1944
*Wollam, Miss Mary [Kathryn], Mendon, Ohio.....	1946
*Wood, Dr. Harold B[acon], 3016 N. Second St., Harrisburg, Pennsylvania	1932
*Wood, Merrill, 811 N. Allen St., State College, Pennsylvania.....	1945
**Woodward, Miss Barbara, Wolcott St., Le Roy, New York.....	1943
*Worley, John G[raves], 237 Charleston St., Cadiz, Ohio.....	1936
Wright, Miss Audrey Adele, 1312 Hepburn Ave., Louisville, Kentucky....	1941
Wright, Bruce S[tanley], 736 King St., Fredericton, New Brunswick, Canada.....	1948
Wright, Lt. Col. Dana [Monroe], State Game Farm, St. John, North Dakota.....	1943
Wright, Howard F[ord], 2152 N. Meridian St., No. 302, Indianapolis 2, Indiana.....	1948
*Wright, James H[enry] III, State Rd., Cornwells Heights, Pennsylvania	1947
*Wright, J[ohn] T[homas], Route 5, Box 618, Tucson, Arizona.....	1941
Wright, Philip L[incoln], Montana State University, Missoula, Montana.	1940
Wright, Thomas J. Jr., 17 Mechanic St., Wakefield, Rhode Island.....	1939
*Wyatt, Miss Grace, College Station, Murray, Kentucky.....	1946
Wydallis, William Francis, 306 E. First St., Van Wert, Ohio.....	1948
Wylie, William L[ewis], 1310 National Rd., Wheeling, West Virginia...	1947
*Yeager, Lee E[mmett], Colorado Wildlife Research Unit, Colorado Agricultural and Mechanical College, Fort Collins, Colorado.	1939
*Yeatter, R[alph] E[merson], Illinois Natural History Survey, Urbana, Illinois.....	1932
Yergason, Dr. Robert Moseley, 50 Farmington Ave., Hartford 5, Connecticut.....	1946
Young, Howard [Frederick], 2205 Chamberlain Ave., Madison 5, Wisconsin.....	1947
Young, J. Addison II, 60 Argyle Ave., New Rochelle, New York.....	1942
**Young, James B[oswell], 514 Dover Rd., Louisville 6, Kentucky.....	1937
*Young, J[oseph] O[ran], 131 W. 74th St., Chicago 21, Illinois.....	1947
**Young, Miss Nettie T[anton], 1788 National Rd., Wheeling, West Virginia.....	1947
Youngman, Phillip M[errill], % General Delivery, West Yarmouth, Cape Cod, Massachusetts.....	1947
Zander, Mrs. Verna M[arie], Department of Physiology, Veterinary Bldg., Colorado State College, Fort Collins, Colorado.....	1948
*Zimmerman, Dale, 480 N. Almont St., Imlay City, Michigan.....	1943
*Zimmerman, Fred R[obert], 4110 Birch Ave., Madison 5, Wisconsin...	1935
Zimmerman, James H[all], 2114 Van Hise Ave., Madison 5, Wisconsin..	1947
*Zirrer, Francis, Route 1, Birchwood, Wisconsin.....	1943
Zoll, Faye W. (Mrs. Frank K.), Edgewood, Route 8, Anderson, Indiana..	1947
*Zurcher, Miss Olga Celeste, 133 S. Richardson Ave., Columbus 4, Ohio..	1948

#### THE WILSON ORNITHOLOGICAL CLUB ANNUAL MEETING

Members are reminded that the dates set for our Thirtieth Annual Meeting, at Madison, Wisconsin, the first to be held in the spring, are April 21-23, 1949. The sessions, which include a joint program with the Wisconsin Society for Ornithology, will extend from Thursday through Saturday. Field trips are being arranged for Sunday. Several exhibits are planned, including one of bird photographs and paintings. Headquarters will be at the Wisconsin Memorial Union on the campus of the University of Wisconsin.

Full details will be given in the Secretary's letter to the Members, which will be mailed in January.

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In addition to names of species and of authors, this index includes references to the following topics: anting, banding, bibliography, display, ectoparasites, food, localities by state, province, and country, migration, nesting, new forms noticed, releasers, sex reversal, taxonomy, voice, weights, zoogeography.

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