almost white, the brown areas clearly distinct. The subterminal band of black on the tail was about the same throughout the series, and there was considerable tendency to barring at the bases and near the shafts of feathers in birds not obviously fully mature. Some specimens had noticeable barring on the upper surface of the outer vane of the outermost rectrices. One specimen, a male, was very pale above, especially on the head, where the wide, light margins of the feathers gave a mottled and streaked appearance.

The adult males averaged (inches): tarsus, 2.07; wing, 13.9; tail, 7.97; the adult females averaged: tarsus, 2.25; wing, 14.9; tail, 8.44.

Duck Hawk

Of the two specimens of this species secured, one was an immature female weighing 2 lb. 7 oz., the stomach of which held a few feathers of a Robin. The other was an adult male, very fat, weighing 1 lb. 10 oz., with an empty stomach.

The immature female was in normal, perfect plumage, the tips of the rectrices being a little frayed, perhaps from being used as a brace against rocks while the bird was eating its prey.

The plumage of the adult, while perfect in appearance, was not complete. The primaries were all new and of full length, save the two distals. The outermost had not yet been molted, though it was in excellent condition, and the adjacent quill had barely broken from its sheath. All of the rectrices were apparently new, but the pair adjacent to the outermost were just breaking from their sheaths.

The plumage of the underparts of this specimen was soiled in appearance, this being due, I believe, to actual coloring of the feathers, for the specimen was thoroughly washed.

The lengths of the immature female, in inches, were: tarsus, 1.86; wing, 14.94; tail, 7.56; of the adult male: tarsus, 1.29; wing, 12.25; tail, 6.13.

State Board of Game Commissioners,
Harrisburg, Pa.

INDIVIDUALITY IN BIRD SONG*

BY LUCY V. BAXTER COFFIN

Since Darwin voiced the idea that the bird with the finest song was the choice of the female, the songs of birds have been discussed from various angles. Latterly has come the idea that a bird's song is a mark of his own individuality. From observations over several

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years, I am convinced if we have discerning ears and are observant we will find that birds may be recognized by their voices as readily as human beings are.

In 1914, while at our Indiana farm, my attention was arrested by hearing a Song Sparrow give a song which called to my mind the opening bars of a familiar Scotch ballad. Bird songs had been of particular interest to me and I wondered why I had never before noticed that similarity in a Song Sparrow song, and I grew more attentive. Then I realized that of all the Song Sparrows on this farm no two sang alike. This broadened into the realization that every place I went I heard a different song—always recognizable as a Song Sparrow, but never the same song.

The next summer when we returned to The Brooks, we were again greeted by the Scotch ballad of the previous year; the same bird was still there. This brought the thought that individual birds can be recognized by the song. The recurrence of this song was so regular that we looked forward each season, on our return, to being greeted by an old friend.

The vegetation near the house at The Brooks is attractive to Song Sparrows, with shrubbery near a small brook running at the foot of the door yard, consequently each year a Song Sparrow nests near by. The Scotch bird was in this locality three summers, then we heard it no more. Its successor stayed four years, the longest period of residence of one bird thus far. One individual song has now been repeated with us the last two summers.

This winter I went back to The Brooks on the seventh of February, a soft-aired, sunshinny February day when we look expectantly for Bluebirds. On the way out to the farm Song Sparrows were singing. The question arose whether they had stayed in the same locality or were they more northerly birds that had moved down for the winter. This led to wondering whether the Song Sparrow of last summer would be heard at The Brooks. As I stepped out into the sunshine of the south porch, to my pleasure and interest the same song of last summer rang out into the sunshine. By the individual song of this bird I learned it had stayed in the same locality through the winter. It had been in this particular section of this particular farm for two summers and this winter. By its song we learned this.

Each Song Sparrow has more than one song. In my notebook for August 23, 1917, is entered:

"This particular Song Sparrow has three different songs. One day he seemed to be giving a lesson to one of the young; he sang, the young one made a crude effort; this was heard several days; at the end of the week, the young had formed a song, but not like that of the mature bird. Whether it was a conscious effort to teach or whether the young was trying to imitate must be conjectured."

Different songs seem to be used for different conditions. This sparrow uses its best and most sprightly song for its day-break song. If it sings it later, it is in a slower tempo and less ringing. Only a hard storm causes a Song Sparrow to cease singing. After a severe storm has passed, it bursts out with its most vigorous song.

While these observations were in progress in Indiana Mr. A. E. Saunders was also observing variation in bird songs, but more scientifically, in Connecticut, publishing his observations in the *Auk* of April, 1924. He records one Song Sparrow singing June 19, 23, and 24, 1922, later October 14, in a certain locality, and writes the following:

"A bird may remain in its summer locality and sing from its headquarters in October, after the mating season and post-nuptial season are over."

Other birds he mentions particularly are the Field Sparrow, Meadowlark, and Wood Thrush. The Field Sparrow and Meadowlark have also been observed at The Brooks. Last summer one Field Sparrow had an ecstatic song of thrills on five different notes. Another one always gave an ascending scale, and never sang the descending scale described by Chapman. One Meadowlark at The Brooks sang often in a particular apple tree. Its song was so unlike the usual Meadowlark song that not until I saw it was I certain of its identity.

Of the male and female Robins nesting near the house the alarm notes were perceptibly different. The male's was deeper and richer; hers was thin and high-pitched, quite suggesting hysteria. The Baltimore Oriole did not once sing the song formerly familiar—so familiar that by whistling it I always received a response from the bird. These observations over several years lead me to the conclusion that it is not the species alone but the individual bird as well that may be recognized by the song, and that a careful listener may learn more from the bird's song than has yet been realized.

At present there is no satisfactory way of recording these bird songs so they may be studied by others. Mr. Saunders has carefully worked out a graphic method, while Wheeler and Nichols use quite different ones, but neither of them can be vocalized by any one else. The natural scale and rhythm of the bird is not the tempered scale of the piano nor the conventional rhythm of our written music. This is

an unworked field in which some musician naturalist should make a study.

That the different call-notes and songs are prompted by different emotions is another phase. That crows have mentally evolved a language is not tenable, but that different circumstances and conditions bring forth different pitch and tone and quality of "caw" is undeniable.

That the nesting impulse is the sole cause of song cannot be the case. Never have I heard a fuller, more varied cardinal song than the one heard on the seventh of last February. We find many birds singing in September after the nesting and molting are past. There are resident species that are heard on fine days through the winter.

Again I refer to my notebook, July 17, 1915:

> "I have been much amused this afternoon by a young Blue Jay. It apparently was trying to learn the rhythmical call of the Blue Jay. It could make only a ludicrous gurgling raucous effort, then with seeming impatience shouted 'Jay! Jay!', moved to another perch and tried again. A young Robin went through a similar performance one day, but it was not quite so amusing."

These efforts certainly had no connection with nesting.

All of these are points for investigation and discussion.

Impelled by curiosity we observe, then we apply the faculty of reason, from which we deduce. Then again we observe and compare our observations with others. So we learn.

Impelled by our social instincts we are led to talk about our learning with others, and the natural reaction is a further desire to study.

But there are three pitfalls. We do not observe closely, we do not deduce carefully, and we do not talk accurately. As an East Indian saying reads: "Many things we think we know, more things we are told we know, and but few things *we know*."

We have standardized our color-scheme in ornithology. We have named each part of a bird's anatomy, but we have devised no symbols to convey to our associates an adequate description of bird-call and vocalization, in general.

Three different methods of recording have been tried; the graph, the dotted and dashed line, and the standard musical notation. None of these gives us, completely, pitch, quality, rhythm, melody, or time—or provide for throat, nose, lip, teeth or head tones.

Cannot some of our younger ornithologists develop this undiscovered necessity? Perhaps a new system of musical notation may be necessary—possibly the Chinese, with its center "four-square," with

four inter-notes, or the Gregorian five-tone scale. Our seven whole-tone tempered piano scale will never do, for it is not true. A large number of other scales are available. Possibly a battery of instruments must be selected. I suggest a xylophone, high pitch; the banjo, the zither, the metal piccolo, and the bassoons, to represent both column production and vibratory production.

Let me quote, in closing, from Henry Oldys, (*Auk*, Jan., 1916):

> "Adequate appreciation is not given by either naturalists or musicians to the fact that a number of problems, not inferior in importance to any to which ornithologists are devoting their energies, require for their solution careful and exhaustive study of the utterances of birds by competent musicians."

I am indebted to Mr. J. W. Magann, of Oak Park, Illinois, for the following comments on the subject of this paper:

Since the work done to make a written record of bird songs has hardly been successful, why should we not obtain a musical record of their songs? To a very limited extent this has been done. During the past two years we have seen a remarkable development in phonographs. This has largely been due to developments in radio being applied to phonograph recording and reproducing processes. The phonograph has been electrified.

I believe that it would be very much worth while if some institution or association with adequate financial support would thoroughly investigate the possibilities of the latest developments in phonograph recording in relation to the recording of bird songs. The equipment necessary would probably consist of a microphone similar to that used by every radio station, a telephone line to a convenient shelter, and in the shelter a radio amplifier and an electrical recorder.

The procedure would be to first determine the usual perch of the bird when singing. While the bird was away, the microphone could be concealed with leaves, grass, etc., and the telephone line run to the shelter. When the bird returned and started to sing, the music could be amplified until of the proper volume to be recordable. From one shelter a large number of microphones might be scattered in places where birds were known to sing.

After these authentic master records have been made, it should be very easy to insert explanations and comments so that the records may be used for instruction purposes in the schools. It would not take much more imagination to see the possibilities of the Vitaphone, which combines the motion picture and the phonograph, for the ornithological education of the school children of the future.

CHICAGO, ILLINOIS.