Alexander Wilson lived forty-seven years of intense earnestness. The expression of his life has enriched the world not only through his ornithological work, but also through his character, so strong in its purpose that it became indomitable through hardships and suffering. His work on birds grows in value with the years, and the old churchyard of Gloria Dei will be a Mecca because it holds the grave of Alexander Wilson.

Sioux City, Iowa.

NOTES ON A COLLECTION OF HAWKS FROM SCHUYLKILL COUNTY, PENNSYLVANIA

BY GEORGE MIKSCH SUTTON

Illustrated with diagrams by Leo A. Luttringer, Jr.

On October 19 and 20, 1927, the writer visited the region of Drehersville, Schuylkill County, Pennsylvania, for the purpose of observing a remarkable migration of hawks which had been reported by Game Protector Archie C. Smith of Lavelle, Pennsylvania, as occurring at certain points along Blue Mountain. A study of the local aspects of the migratory movement of these birds will appear in a subsequent paper after further investigations have been made. Interesting data were gathered, however, concerning the weight, food, and plumage of the birds collected and it seems advisable to present this material separately.

On October 17 Mr. Smith and certain sportsmen from Drehersville, Pottstown, and Reading, secured, among other birds of prey which were not saved, eighteen Sharp-shinned Hawks (*Accipiter velox*). On October 19 four Goshawks (*Astur atricapillus*) were secured. On October 20, while on Blue Mountain, we collected five more sharp-shins. On October 22 several gunners accompanied Mr. Smith to a point along the mountain past which the hawks flew in numbers, and secured, in a remarkably short time, a total of ninety sharp-shins, sixteen Goshawks, eleven Cooper's Hawks (*Accipiter cooperi*), thirty-two Red-tailed Hawks (*Buteo borealis borealis*), and two Duck Hawks (*Rhynchodon peregrinus anatum*).

Specimens were taken from 8 A. M. until almost 5 P. M., but unfortunately no data were preserved as to just when individuals were secured so that we cannot correlate our information on stomach contents with the time of day the specimens were taken, and cannot say, therefore, at just what periods migrating hawks are likely to spend time in capturing prey and eating their meals. It would seem from the evidence at hand that prey is captured actually *en route* and that

pauses are made only as the taking of prey justifies them, although it is likely that food is taken, if possible, early in the morning, before the day's flight has begun.

Sharp-shinned Hawk

Of the one hundred and thirteen sharp-shins collected twenty were females, and ninety-three were males; all were in adult plumage save ten, eight males and two females, which were wholly in the brown, mottled plumage of the immature bird. Most of these birds, while in excellent physical condition, were not particularly fat; and the stomachs of half of them held food though most of them, at the time they were shot, had not filled themselves to capacity. It is thought that the females were actually less numerous than the males on the days these birds were collected; it may be that they were flying higher, however, and therefore did not so often come within gun-range.

The weight of the birds varied somewhat, of course, with the amount of food they had eaten. Males which had nothing in their stomachs or crops averaged under 4 ounces in weight, the lightest specimen weighing a fraction over 3 ounces, the heaviest, almost 4⅛ ounces. Males whose stomachs held food weighed a little more than those whose stomachs were empty, the lightest being 3¼ ounces, the heaviest 4¾ ounces. The females were considerably heavier. Females whose stomachs were empty ranged in weight from 6 ounces to almost 8 ounces, while those whose stomachs contained food ranged from a little over 6 ounces to 8½ ounces, with an average of approximately 6⅜ ounces. In no case were the stomach and crop packed to capacity with food. According to our data the average female sharp-shin. therefore, weighs about 2½ ounces more than the male. Audubon gives the weight of the male as 3½ ounces; of the female 7½ to 8¼ ounces.

All the sharp-shin stomachs held remains of small birds. This species evidently eats its prey in rather small mouthfuls, and plucks its victims fairly well, before or while eating, even though the necessity for haste during migration may cause the birds to be less tidy in swallowing food at this season than otherwise. In most cases bills and feet of the birds, along with most of the bones, aside from the sternum and the cranium, were eaten, the feet always, apparently, being swallowed entire. Mandibles, in three cases, were found joined together as though the front of the head had been swallowed in one piece. In only one case had large feathers been swallowed: a female sharp-shin had plucked four of the rectices of a Myrtle Warbler and swallowed the tail bones with the remaining eight feathers attached.

There was considerable evidence that these hawks capture as much prey as they can eat, and perhaps more. Six individuals contained more than one species of bird, and one, a female, had eaten three small birds, apparently at one time, if we may judge from the stage of digestion which was apparently about the same in all three. We found no evidence that sharp-shins cast up pellets of indigestible matter, though they probably do so.

The largest species which the sharp-shin had killed were the Robin and Rusty Blackbird. There was not a trace of fur or mammalian bones. Insects which were found may be attributed to the small birds whose gizzards had been swallowed entire; bits of vegetable matter doubtless were of similar origin. Since the remains of Robins were found in both male and female sharp-shins it may be inferred that, in spite of the difference in the size of the sexes, they are equally savage and powerful in dealing with their prey. The females, however, often had their crops proportionaltely fuller than did the males, as though they habitually gorge more often than do their daintier, smaller-boned mates.

Fifty-one of the sharp-shin stomachs were empty; in the other sixty-two stomachs were found the remains of twelve Song Sparrows (*Melospiza melodia melodia*), nine Myrtle Warblers (*Dendroica coronata coronata*), six Slate-colored Juncos (*Junco hyemalis hyemalis*), five Golden-crowned Kinglets (*Regulus satrapa satrapa*), five Hermit Thrushes (*Hylocichla guttata faxoni*[1]), three Tree Sparrows (*Spizella arborea arborea*), three Fox Sparrows (*Passerella iliaca iliaca*), three Black-poll Warblers (*Dendroica striata*), three Robins (*Turdus migratorius migratorius*), two Downy Woodpeckers (*Dryobates pubescens medianus*), two Towhees (*Pipilo erythrophthalmus erythrophthalmus*), two Winter Wrens (*Nannus troglodytes hiemalis*), two Brown Creepers (*Certhia familiaris americana*), two Ruby-crowned Kinglets (*Corthylio calendula calendula*), one Prairie Horned Lark (*Otocoris alpestris praticola*), one Rusty Blackbird (*Euphagus carolinus*), one Goldfinch (*Astragalinus tristis tristis*), one Henslow's Sparrow (*Nemospiza henslowii susurrans*), one White-throated Sparrow (*Zonotrichia albicollis*), one Cape May Warbler (*Dendroica tigrina*), one Chickadee (*Penthestes atricapillus atricapillus*), one Olive-backed Thrush (*Hylocichla ustulata swainsoni*), and five held the feathers of species we could not satisfactorily determine.

[1]It is the general policy of the WILSON BULLETIN to follow, in the matter of nomenclature, the A. O. U. Check-list and its official supplements.—Ed.

Most interesting of these items was, perhaps, the Henslow's Sparrow, not alone because it is rare in Pennsylvania, but because it is a very retiring species of the open fields which we would not expect the sharp-shin normally to catch. Evidently the Chickadee, in spite of its abundance in the autumn woods, is not often caught, and the Myrtle Warbler and Song Sparrow probably furnish a large proportion of the food of the migrating sharp-shins while they are in this region.

The eight specimens which were obviously immature, in brown, mottled plumage, showed no evidence of molt. There were no clear, gray feathers among the brown of head or back, and the remiges and rectrices evidently had not even started to drop out. Evidently the dropping of the feathers of this first winter plumage does not begin during the period of the fall migration.

The apparently adult individuals, on the other hand, with but few exceptions, showed evidence of a certain immaturity, chiefly in the brownish, worn rectrices, in the occasional rusty-edged upper tail coverts, lesser wing coverts and scapulars, and in the outermost rectrix, which was, in length, shape, and pattern, often different from the other rectrices. It now appears to me that most of these birds were of about the same age; whether they were young of the previous year emerging into a plumage somewhat more perfect than that of their first breeding season, or fully adult birds more than two years old, with their old plumage so faded a brown as to have the appearance of immaturity, is open to question. It is known that the plumage of the immature bird during its first winter is invariably brown, and rusty-edged; but I find no definite data regarding the first adult plumage, which may be different in minor details, from subsequent plumages.[2]

In only two of the mature birds were the outermost rectrices obviously new, and in these specimens the barring of the outer rectrix was virtually the same as that of the adjacent feathers. Since in all the other apparently mature birds the outer rectrix either had a pattern distinctly different from that of the adjacent feather or was noticeably different in length and shape from the other rectrices; and since the barring of these worn outer rectrices inclined toward that of the first winter plumage, we are led to believe that most of these birds were two years of age, molting into their second winter plumage which is not complete, it would seem, before the birds reach their winter range; and that but two of the birds were in fully adult plumage, molting into the high plumage of the coming breeding season. If this be true

[2]Forbush says: "highest plumage may require another year or more" [after the post-juvenal molt]. Birds of Massachusetts and other New England States, Volume II, 1927, p. 105.

it is interesting indeed to note that the outermost rectrix of the two-year old bird drops out *after* the migration has been performed, whereas the adult bird molts this rectrix presumably before migration starts.

It seems strange that the molting of the outer rectrix in the two-year old should differ from that of more mature birds; yet some purpose at present unknown may be served by such process.

It appears, furthermore, that in many of the two-year old birds the old, outermost rectrix which has not dropped out is noticeably longer than any of the fully developed *new* rectrices. (See Fig. 3). This suggests that the tail of the year-old and two-year old may actually be longer than it is in the third year. The molts which lead up to a fully adult plumage, therefore, tend toward a reduction of number of bars on the outermost rectrix, and to an actual shortening of the tail. The two fully adult males in the series had tails of exactly the same length as that of the average fully-developed *new rectrices* in the two-year old birds.

If it be true that two-year old birds do not molt the outer rectrix before or during migration we may infer that these old feathers are just as efficient as new ones.

Among the birds which I believe to have been two years old, there was a noticeable parallelism of the molt in wings and tail. Specimens in which the primaries were not fully molted had, without exception, tails in which two or more feathers were short. As a rule only the outermost primary was underdeveloped; in such specimens the rectrices adjacent to the outermost were often short. If the two or three outer primaries were not fully developed the rectrices were, as a rule, of variable length, from two to six of them usually being short. While the feathers apparently were developing at about the same rate on both sides of the tail there was often considerable difference in length of opposite pairs.

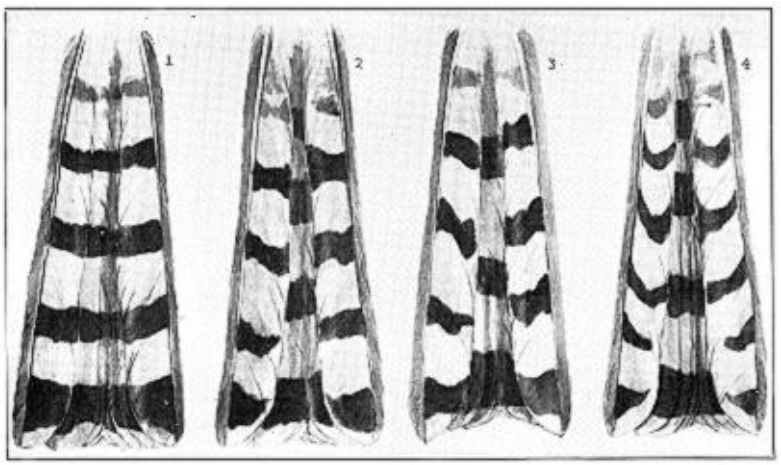
It was noticeable that the actually though not relatively longer tails of the females usually had more bars than those of the males. It is not easy to understand why the sexes of a species, otherwise so similar in color pattern, should find it necessary to differ in this respect. There were usually five distinct bars on the outermost rectrix of the two-year old males; on the outermost rectrices of the females there were usually six distinct bars. None of the females, according to our belief, was more than two years of age.

In most specimens the barring of the rectrices was bilaterally symmetrical. But in some specimens the barring was asymmetrical, in

others the bars were peculiarly or incompletely formed, and in some the fully developed opposite outer rectrices were of different length.

The tails of year-old and two-year old female specimens were *all* somewhat rounded, as in the Cooper's Hawk. This roundness was evident in but three of the male specimens, whereas the tendency toward furcation which was evident in many of the male specimens was not evident in any of the females.[3]

If we are right in our supposition that most of these birds were two years old, then the preponderance of birds of this age is interesting. One might expect to find a large proportion of young of the year



FIGURES 1-4

during any fall migration. Perhaps these young move in a body largely at another period of the fall, however; or perhaps mortality among juvenals is greater than we realize, and the two-year old birds are actually more abundant during the fall migration than birds of other ages.

The average lengths, in inches, of the two fully adult males were: tarsus, 1.41; wing, 6.69; tail, 5.24; of the two-year old males: tarsus, 1.43; wing, 6.59; tail, 5.33; of the one-year old males: tarsus, 1.38; wing, 6.5; tail, 5.27 (the year-old males are all small individuals, apparently). The two-year old females measure: tarsus, 1.54; wing, 7.92; tail, 6.29; the year-old females: tarsus, 1.56; wing, 7.87; tail, 6.51.

[3]Forbush states that the tail of the sharp-shin is "very rarely slightly rounded." *Op. cit.*, II, page 104.

Cooper's Hawk

All of the eleven Cooper's Hawks were adult, seven being males and four, females. Females of both the sharp-shin and Cooper's Hawk seem to have been noticeably less abundant than the males. The males whose stomachs were empty weighed from slightly under 12 ounces to a little less than 13 ounces; those whose stomachs contained food, from a little more than 11 ounces to almost 13½ ounces, with an average weight of over 12½ ounces. The females, on the other hand, weighed over a pound in every case, the one specimen with an empty stomach weighing 1 lb. 4 oz., while those with food in their stomachs ranged from 1 lb. 2 oz. to 1 lb. 6½ oz., with an average weight of a little over 1 lb. 4 oz. Average females, according to our data, therefore weigh about 8 ounces more than average males, and the average male Cooper's Hawk weighs about twice as much as the average female sharp-shin.

It is at once evident from our limited investigation that the larger Cooper's Hawk captures much heavier prey than does the sharp-shin. Four of the stomachs were empty. Each of the stomachs containing food held the remains of but one creature which had been captured, save one which held two birds. One stomach held the hind quarters of a Gray Squirrel (*Sciurus carolinensis leucotis*); two, Song Sparrows; two, Robins; one, the head and breast of a Bob-white (*Colinus virginianus virginianus*); and one a Fox Sparrow, with another small bird the species of which was not determined. Both the Gray Squirrel and Bob-white had been captured by female hawks.

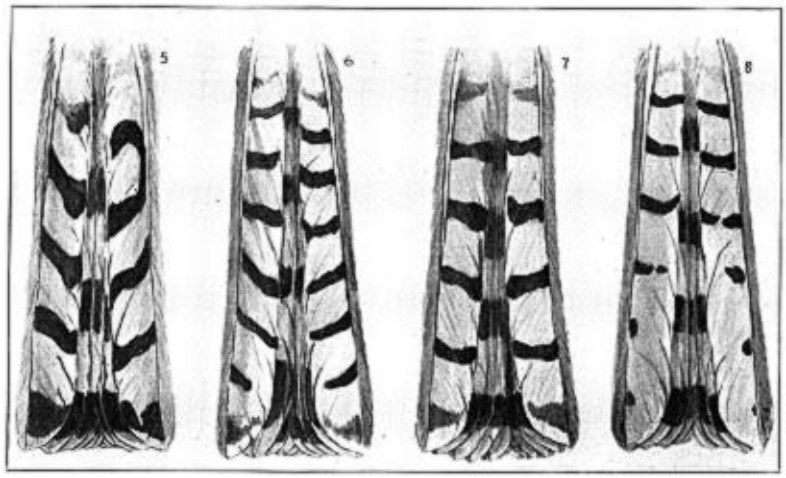
The series of Cooper's Hawks showed little variation in color; three males were so richly colored and heavily barred below that a band across the breast presented the appearance of an almost solid color area. The females were, in every instance, less intensely colored than the males.

In no specimen was the molt of either the primaries or rectrices complete. As a rule the outermost primary was but partly developed. In most specimens this feather was well out of the sheath, save in two, where the tip was not yet exposed. The outermost rectrices had not, in any case, been dropped, though all the other tail feathers were new, and most of them of full length. These outer rectrices did not have the appearance of old, worn feathers, but they had a slightly paler coloration, the barring was noticeably different and not so intense as in the rest of the tail, their tips were different in shape from the other more rounded rectrices, and their length in some cases varied so much from what might normally be expected, that I assume the feathers to

be part of the former plumage, and perhaps of the first adult plumage, as in the sharp-shin.

Molting of the rectrices evidently does not take place in a systematic fashion, for new feathers occurred anywhere, usually adjacent to the outer feathers, or in the middle of the tail. If the unmolted outer feather in these specimens is of the first adult plumage, then it is interesting to observe that its comparatively square tip approximates that of the average sharp-shin tail feather, and therefore suggests the possible development of this species from an ancestor similar to the smaller bird.

The average length, in inches, of the male specimens were: tarsus, 1.8; wing, 9.11; tail, 7.6; of the females: tarsus, 1.98; wing, 10.51; tail, 8.86.



FIGURES 5-8

GOSHAWK

The twenty Goshawks, four males and sixteen females, were all fully adult. The males ranged from 1 lb. 4 oz. (empty) to 2 lbs. 3 oz. (stomach filled) with an average weight of 1 lb. 13½ oz. The weight of the females varied considerably, some of those with empty stomachs weighing much more than others which had crops fairly full. Those which had no food in their stomachs weighed from 2 lb. 1 oz. to 2 lb. 8 oz. with an average of 2 lb. 4½ oz. Those which had eaten food ranged from 2 lb. 3 oz. to 2 lb. 12 oz. with an average of 2 lb. 8¼ oz. The average weight of all females was 2 lb. 6⅓ oz. Female Goshawks therefore, weigh about 9 ounces more than the males.

The Goshawk, heavy and powerful as it is, evidently does not hesitate to capture large quarry. Ten of the stomachs were empty. Four of these stomachs were of birds shot early in the morning, apparently before they had had opportunity to capture food. Males and females captured equally large prey. Two stomachs held Ruffed Grouse (*Bonasa umbellus umbellus*); one, a Gray Squirrel; one, a Cottontail Rabbit (*Sylvilagus floridanus transitionalis*); one, a Red Squirrel (*Sciurus hudsonicus hudsonicus*); two, Chipmunks (*Tamias striatus lysteri*); and one, an adult White Leghorn Chicken. The feet of the two grouse had been swallowed entire.. Very few feathers were found, however, and the tails of the squirrels had evidently been rather carefully plucked before they were eaten. The Goshawk swallows proportionately larger mouthfuls than either the Sharp-shinned or Cooper's Hawk.

The plumage of most of these specimens was at first glance complete. It was found, however, that in most of the tails many of the rectrices were old, though their tips were in remarkably good condition. Most of the new rectrices were of full length, as though the dropping and complete growth of one rectrix took place before the molting of the next feather. The first or second distal primaries in nine specimens were not fully developed.

Much variation in the markings of the underparts was noticeable. One male, small in size, was very evenly colored, the breast and belly being finely barred and streaked with such soft tones as to give the appearance, almost, of a solid color. Two of the females were rather heavily streaked on the breast.

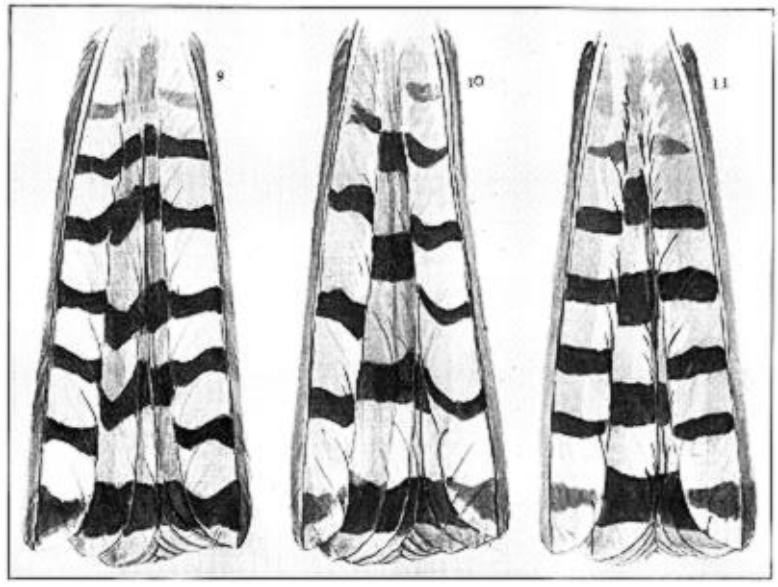
Not much variation occurred in the barring of the rectrices. The outer rectrix was usually but faintly barred, principally toward the tip, the other rectrices being barred but not in so definite a manner as in the Sharp-shinned and Cooper's Hawks.

The smallest male's measurements, in inches, were: tarsus, 1.95; wing, 11.94; tail, 8.5; the largest male's: tarsus, 2.22; wing, 12.8; tail, 9-12; the average measurements of the males were: tarsus, 2.1; wing, 12.47; tail, 8.89. The smallest females' measurements were: tarsus, 2.16; wing, 12.37; tail, 9.22; the largest female's: tarsus, 2.43; wing, 13.87; tail, 11.13; the average measurements of the females were: tarsus, 2.28; wing, 13.54; tail, 10.46.

Red-tailed Hawk

The thirty-two red-tails were chiefly adult, there being but three immature birds, one of which had virtually completed the dropping of the barred rectrices of its first year's plumage. The average weight

of the males was 2 lb. 1 oz.; of the females, 2 lb. 6 oz. Of the three immature birds one was a male weighing 1 lb. 3 oz. (stomach empty), and two were females, weighing 2 lb. 2 oz. and 2 lb. 6 oz. respectively, the stomachs of these specimens being fairly well filled. Of the twenty-nine adults fifteen were males and fourteen females. The adult males ranged in weight from 1 lb. 13 oz. (with empty stomach) to 2 lb. 4 oz. (much food). Males without food in their stomachs averaged 2 pounds. The females ranged from 2 lb. 5 oz. (one with stomach empty; two with some food) to 2 lb. 13 oz. (stomach empty), those without food in their stomachs averaging 2 lb. 7 oz. The heaviest female, referred to above, was a thin but very heavy-boned individual with magnificent plumage. Average female red-tails weigh 7 ounces more than the males, according to these data.



FIGURES 9-11

That the character of the food of the red-tail is very different from that of the sharp-shin, Cooper's Hawk, and Goshawk, was apparent upon examination of the first stomach, which chanced to hold two Short-tailed Shrews. Twelve stomachs were empty; in the twenty stomachs which held food were eleven Field Mice (*Microtus pennsylvanicus*), four Short-tailed Shrews (*Blarina brevicauda talpoides*), three Red-backed Mice (*Evotomys gapperi gapperi*), three Chipmunks, three small Garter Snakes (*Thamnophis sirtalis sirtalis*), two Red

Squirrels, one Winter Wren, one Song Sparrow, one Hermit Thrush, one Gray Squirrel, one Brown Rat, one half-grown White Leghorn Chicken, one large grasshopper, two crickets, and one large beetle of the family *Elateridae*. Such an array of food items in only twenty-two stomachs is noteworthy. Only seven of these stomachs held but one item; the others had a variety in each. If the above stomach contents are at all normal the red-tail captures about five harmful or unimportant organisms to one economically valuable one. There is evidence from the above diagnosis of stomach contents that the red-tail during migration does not confine its hunting to the open fields, though it probably has a tendency to do so. The Red-backed Mice and Winter Wren, at least, probably required pursuit in heavily wooded areas. The three snakes are interesting since it was so chilly at Drehersville during our stay that no snakes were about; yet the hawks had somehow found them, probably north of Schuylkill County. The red-tail apparently swallows more feathers and hair with its prey than do the preceding species; and the probability is that the pellets of indigestible material which it ejects are correspondingly larger. The red-tail has a tendency to bolt its food. The mice and shrews, snakes, and other smaller items were swallowed almost entire; the Chipmunks had been torn into four or five pieces.

The immature male specimen, while in good feather, was quite small, having the following measurements (inches): tarsus, 2.16; wing, 13.12; tail, 7.62. The two immature females varied considerably in size and color, one having only six of the barred rectrices of the immature plumage remaining in the tail. The average lengths of the immature females were (inches): tarsus, 2.25; wing, 14.25; tail, 8.9.

The most noticeable feature of the plumage of the adult birds was the almost uniformly perfect development of the primaries in specimens where the tail was only partly molted. In only four specimens were primaries undeveloped, whereas in only six specimens were the tails perfectly molted. Such a state of affairs may indicate that the full development of the remiges is of much more importance to the migrating red-tails than it is to the sharp-shins; and the status of the rectrices is of comparatively small importance.

The old rectrices of fully adult birds were much paler and more frayed than the new feathers, the age of such specimens being obviously greater than two years. One specimen had such a ragged tail that the powers of flight of the individual must have been impaired.

Most of the adult specimens were normally marked. One, however, had unusually bold markings on the underparts, the lighter areas

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

*Read before the Chicago Ornithological Society, April 19, 1927.