

VARIATION IN *SEIURUS NOVEBORACENSIS*

BY STEPHEN W. EATON

THE NORTHERN WATERTHRUSH is one of the New World's most widely ranging warblers. It is a characteristic breeding bird by waters associated with our boreal forests, may be seen on migration in every state of the Union, and winters as far south as Venezuela (Wetmore, 1939).

Three subspecies have been recognized by the A.O.U. Committee on Nomenclature: the nominate race, *notabilis* Ridgway (1880), and *limnaeus* McCabe and Miller (1933). Burleigh and Peters (1948) have recently described a fourth race, *uliginosus*, from Newfoundland.

This paper attempts to analyze critically the variation indicated by these trinomials and to point out severe weaknesses and misconceptions regarding them. Variation in birds may be of several types such as individual, sexual, age, and geographic. Only after a study of the first three can the fourth adequately be determined. The approach here follows that order.

## ACKNOWLEDGEMENTS

I am indebted to the following institutions and individuals in charge of collections for the loan of specimens: Carnegie Museum, Pittsburgh, 18 specimens; Cleveland Museum, 50; Museum of Comparative Zoology, 25; University of Michigan Museum of Zoology, 15; George M. Sutton, 4; U. S. National Museum, 93; Royal Ontario Museum, 51; Minnesota Museum of Natural History, 15; National Museum of Canada, 142; Museum of Vertebrate Zoology, 13; University of Wisconsin Museum, 5; American Museum of Natural History, 25; Philadelphia Academy of Sciences, 8; Louis Fuertes Memorial Museum, 37; (a total of 504 specimens examined).

For patient guidance and advice I wish to thank Professors Arthur A. Allen, William J. Hamilton, Jr., and Robert T. Clausen.

Dean Amadon, Ernest P. Edwards, Abelardo Moreno, Kenneth C. Parkes, and Ellen E. Eaton have aided in many aspects of the study. This is a portion of a thesis presented to the faculty of Cornell University in partial fulfillment of the requirements for the Ph.D. degree.

## INDIVIDUAL VARIATION

*Color of Venter.*—On the basis of the coloration of the venter, I divided the specimens into five groups—*white*, *white to medium*, *medium*, *medium to yellow*, *yellow*. For color standards, three specimens were used as comparative material—*white* by Carnegie Mus.

No. 91778, *medium* by Carnegie Mus. No. 8327, *yellow* by Mus. Comp. Zool. No. 204552. Intermediates (W-M, M-Y) were estimated, that is, no individual skin was used as a color type for these two additional color categories.

It will be seen by referring to Figure 1 that there is a great deal of individual variation in the five categories mentioned above over a very broad area from Alaska to Newfoundland.

Another variation in color of the venter is shown by twelve individuals. These specimens have a distinctly W-M or M belly with a distinctly white throat. The line of demarcation in color is abrupt.

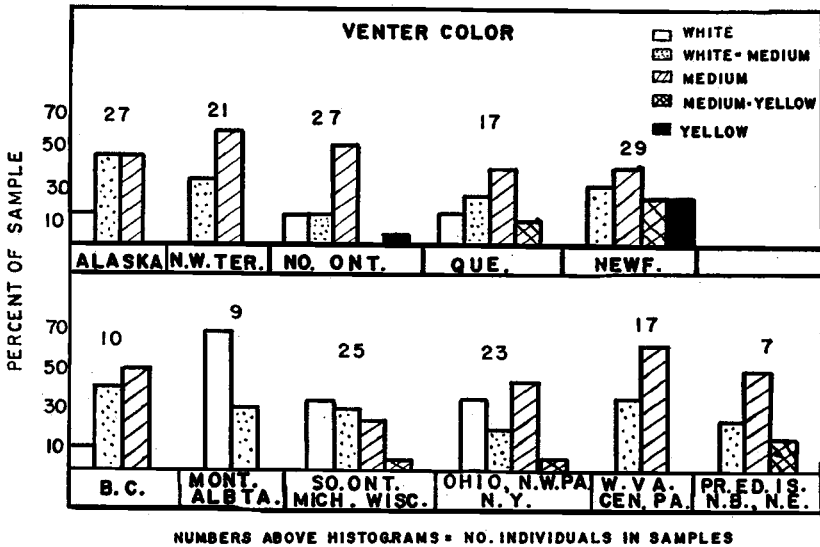


FIGURE 1. Histograms showing percentages of five categories of ventral coloration in the Northern Waterthrush. The data for males and females are combined.

The antithesis of this color pattern was found in one skin from Cockran District, Ontario; the throat of this bird was distinctly yellow and the breast white.

Nine of twelve individuals from British Columbia were heavily streaked on the venter. The same degree of heavy streaking also occurred in individuals distributed as shown below (for distribution of samples see Figure 2).

Sample Number	1	2	3	4	5	6	7	8	9	10	11
Number of heavily streaked individuals	3	1	2	0	0	9	3	3	1	0	5

*Color of dorsum.*—To study variation in dorsal color, three study skins were selected as types. One called *brownish wash* was repre-

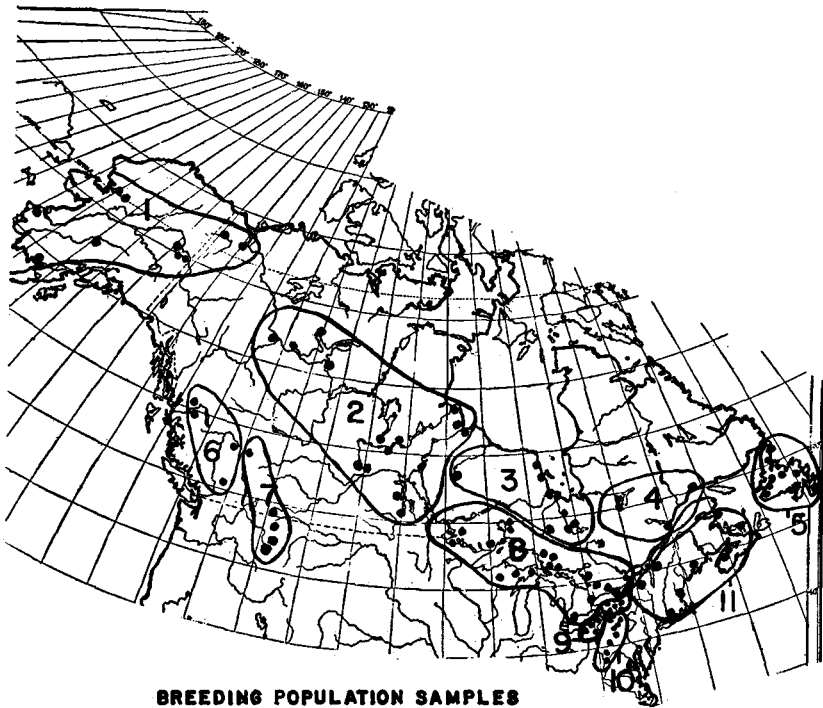
**BREEDING POPULATION SAMPLES**

FIGURE 2. Map showing localities from which June- and July-taken specimens were examined and the grouping of these localities into eleven samples: 1, Alaska; 2, Northwest Territories, Saskatchewan, and Manitoba; 3, northern Ontario; 4, Quebec; 5, Newfoundland; 6, British Columbia; 7, Montana and Alberta; 8, southern Ontario; 9, Ohio, New York, and northwestern Pennsylvania; 10, central Pennsylvania and West Virginia; 11, Nova Scotia, New Brunswick, and New England.

sented by Nat. Mus. Canada No. 30325, collected August 31, 1944, on the Canol Road of Yukon Territory. The second called *black wash* was represented by Cleveland Nat. Hist. Mus. No. 41315, collected in Tifton County, Georgia, September 15, 1941. The third called *greenish wash* was represented by S. W. Eaton No. 285, collected September 19, 1948, near Ithaca, N. Y. The criteria used in selecting these skins were that they should be less than 10 years old and birds in fresh fall plumage. No sexual differences in color were noted, so members of both sexes were used.

Birds from Alaska, Yukon Territory, Northwest Territories, Manitoba, northern Ontario, and Quebec were mostly of a brownish wash. Birds from Ithaca, New York, one from the St. John's Lake region of Quebec, and three from central Manitoba and Saskatchewan were classified as greenish or between brown and greenish. Birds from the

southern part of the breeding range in Michigan, Minnesota, Ohio, and New England were not considered because all the specimens examined from these areas were probably not very close to their breeding grounds.

Only four specimens with a black dorsum were present in the birds in fall plumage, and these were from widely scattered parts—Northwest Territories, British Columbia, northern Saskatchewan, and southern Ontario.

*Median Crown Stripe.*—This segment of the color pattern is a highly variable character. The stripe was absent in some individuals, was a short, well-defined line in others and in a few was almost in the form of a crown patch, as in the Ovenbird (*Seiurus aurocapillus*). The frequency of four classifications is shown below. (Most individuals below were collected in May, June, and July, but a few fall-taken males, females and immatures were used here.)

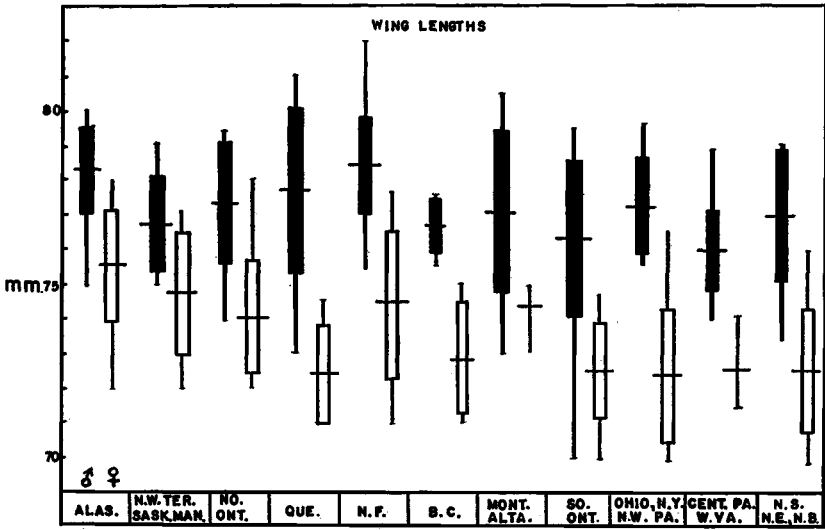
	<i>Absent</i>	<i>Linear</i>		<i>Patch-like</i>
		1 to 5 mm.	6 to 14 mm.	
Number of individuals	10	75	158	9

The color of the stripe varied from white (in white-vented birds) to a buff color (usually in medium- or yellow-bellied individuals). It is more discernible in slightly worn spring and early summer birds. In fresh fall plumage, it is almost always concealed by the distal coloration of the feathers, which is similar to the general crown and dorsal coloration. This variation showed no geographic correlation.

*Color of Superciliary.*—In general, those individuals with a white venter also had a white superciliary stripe, and conversely, those with a medium to yellow venter, a buffy one. Individuals with a white throat and medium to white belly had a white superciliary. The one individual with a medium throat and white belly had a buffy superciliary.

*Variation in Size.*—Figures 3 and 4 show individual variation of breeding birds in two measurements—wing (cord) and bill (from anterior edge of nostril to tip). Individual wing measurements varied from a low of 70.0 to a high of 82.0 mm. Bill measurements varied from 8.9 to 13.1 mm., the last measurement is that of the type of *notabilis*. Aside from this specimen, the longest bill measured 11.1 mm.

*Variation in Wear.*—Females on the breeding grounds take a greater share in raising the young and hence become more worn than males. Some extremely worn individuals show a fairly distinct collar



RECTANGLES = ONE STANDARD DEVIATION ABOVE AND BELOW MEAN

FIGURE 3. Variation in the length of the wing (chord) in the Northern Waterthrush. Sample 1 (Alas.), 15♂♂, 10♀♀; Sample 2 (N. W. Ter., etc.), 13♂♂, 10♀♀; Sample 3 (no. Ont.), 15♂♂, 11♀♀; Sample 4 (Que.), 11♂♂, 5♀♀; Sample 5 (N. F.), 19♂♂, 8♀♀; Sample 6 (B. C.), 5♂♂, 5♀♀; Sample 7 (Mont., Alta.), 6♂♂, 3♀♀; Sample 8 (so. Ont.), 20♂♂, 7♀♀; Sample 9 (Ohio, etc.), 16♂♂, 7♀♀; Sample 10 (cent. Pa., W. Va.), 13♂♂, 3♀♀; Sample 11 (N. S., etc.), 5♂♂, 6♀♀.

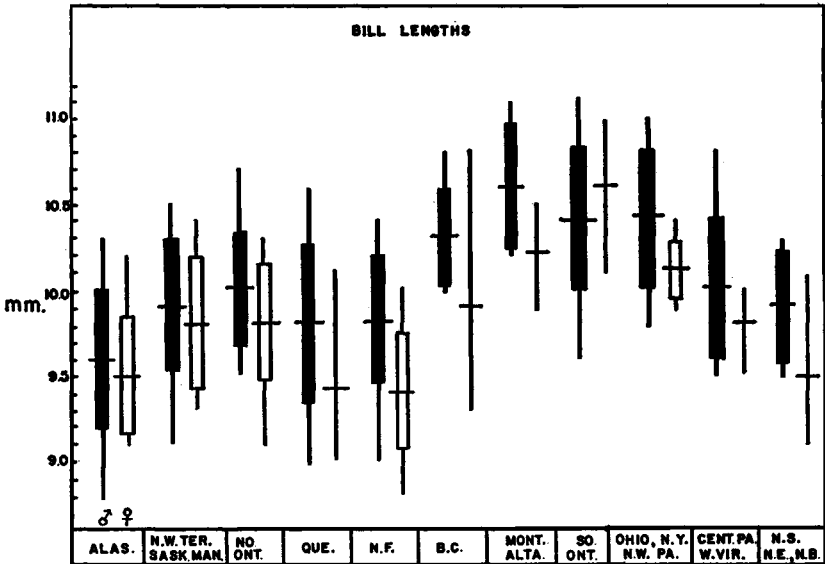


FIGURE 4. Variation in the length of the bill (nostril to tip) in the Northern Waterthrush. Number of individuals in samples same as in Figure 3.

about the neck; the feathers of this region are actually worn down to their lighter bases. The backs of worn birds often show a subtle barring owing to differential wearing of individual feathers. The tips of the feathers become jaggedly worn, and light reflecting from these produces the slight barring. The hind crown in late June birds sometimes becomes almost bare, perhaps owing to the habit, common in the genus, of scratching the back of the head with the foot.

"Foxing," especially in the older specimens in fall plumage, appears to be common.

#### AGE VARIATION AND SURVIVAL

Dwight (1900) and Ridgway (1902) fail to mention a character present in about 57 per cent of the spring and summer skins examined. This is a white-tipping of the inner vanes of from one to four outer pairs of rectrices. W. L. McAtee (1904) was the first to mention this character in the literature. He found one such specimen in the University of Indiana collection taken by David Starr Jordan, May 14, 1875. This specimen was believed to be an abnormality, but after carefully checking this character I believe it to be the normal condition of the plumage following the first post-nuptial molt.

Of 272 specimens taken in May, June, and July, 154 (56.6 per cent) had from a trace to very distinct white spots on the inner vane of the outer rectrices; in 118 (43.4 per cent) specimens no white was apparent even as a trace. There seemed to be a slight geographic variation in these percentages. Samples from Alaska, the Mackenzie Valley, Hudson Bay, and Newfoundland appeared to have these percentages reversed (more without white than with).

Another interesting fact observed in examining birds in nestling and first fall plumage was their almost complete lack of white-tipped rectrices. Of 107 birds in the first fall and nestling plumages only 11 showed white tipping. Of these 11 specimens, it appeared that 6 had tails which had been injured (or were in a partial or complete post-juvinal molt) and new feathers were coming in in a delayed sequence. Four had white on one side of the tail only; two had white-tipped tail feathers on one side, which were half the length of the other tail feathers.

From these observations (percentage of white-tipped birds in the spring and summer, lack of white tipping in the nestling and first fall plumages) the following conclusions can be deduced:

1. White-tipped rectrices normally appear with the post-nuptial molt and indicate a bird more than one year of age.
2. White-tipping in the first winter plumage is an anomalous

condition probably brought about by premature loss of the juvenal rectrices or it is the phylogenetic remnant of a previous, complete post-juvenal molt.

3. More birds in first winter plumage (less than one year old) reach the northern areas of distribution in the spring than do older birds.

In support of this Hann (1948), in a study of longevity of the Ovenbird, found that considering birds in all age classes there was a 55 per cent survival from year to year in Michigan. If the above conclusions with regard to white-tipping are correct and in field collecting random sampling of old and young birds occurs, then survival from year to year in waterthrushes is similar to that in the Ovenbird.

#### SEXUAL VARIATION

*Color.*—No sexual dichromatism was noted. This makes the study of life histories a difficult task. It might seem that song would be a good way of spotting the male in the nesting season, but caution must be used here because Hiatt (1943) collected a female Ovenbird which was singing and Todd (1940) mentioned a similar case with *Seiurus motacilla*.

*Size.*—Females average smaller in wing, tail, bill, and tarsus. In a given population the mean wing length of females usually fell below the smallest wing length of males. However, there was always considerable overlap between the sexes. Tail measurements were similarly distributed but there was less difference between the means for the two sexes. There was much less sexual variation in bill and tarsal lengths. However, in ten out of eleven samples the mean bill length of females fell slightly below the mean for males. In the one sample the mean of the females exceeded that of the males. In tarsal measurements the mean for the females always fell slightly below that for the males. During May and June Northern Waterthrushes can be readily identified to sex in the hand. The females have a brood patch and the males do not. During the nesting season and for a short period afterwards the males are greatly swollen about the cloaca; females are not. This swelling is due to the enlargement of the vas deferens just above its entrance into the cloaca (Salt, 1954).

#### GEOGRAPHIC VARIATION

The Northern Waterthrush is single brooded, is an early fall migrant, and has no prenuptial molt. Few have been collected during the breeding season in the southern and eastern parts of the breeding

range. In western New York locally breeding birds arrive from the south the last week in April, and by June 9 these birds have started their post-nuptial molt. Migrants may pass through Ithaca until the middle or end of May when some local young are hatching. Stone (1937) said, ". . . The Waterthrush is the first transient land bird to be seen in the Cape May district on southward migration." Color variation is difficult to assess in this species because of the subtle browns and yellows in suffused patterns over wide areas of the body. They may be likened in this regard to our *hylocichlas* and *empidonaces*. All of these facts account for our poor understanding of geographic variation in this species.

In studying geographic variation of size characters only June and early July birds were measured because May or late July birds might be migrants. In the analysis of dorsal coloration, birds in fresh fall plumage (July and August skins) were compared because of the lack of the prenuptial molt. Birds collected in the northern United States were not used in this color analysis unless collections were in areas where the birds were known to nest and circumstances suggested they were breeding birds.

Ventral coloration seemed to vary equally in the sexes, but the fall birds were usually yellower than the spring birds so it was decided to use only June and July skins in the analysis of this color variation.

*Wing*.—This character, if an indicator of general body size, varies in accordance with Bergmann's Rule. Birds from the northern areas of distribution had longer wings. But a look at Figure 3 will reveal that this does not become apparent until we get to Alaska in the west and Newfoundland in the east. The means of samples from New York to Montana north to Great Slave Lake vary little more than a millimeter. There was no distinct break in any region, but a gradual cline occurred from south to north. The mean of the sample from West Virginia and central Pennsylvania was only 2.3 mm. less than that of the sample from Alaska.

*Tail*.—Although more variable than the wing, probably owing to differential wear, this character showed a similar trend—increase in length from south to north.

*Bill*.—Of six characters analyzed, bill length (from nostril to tip) seemed the best correlated with geography, but individual overlap occurred in samples from all parts of the breeding range. Birds from northwestern Montana and southwestern Alberta had the longest bills and from there east to New York only a 0.3 mm. decrease in mean length occurred. From Montana north to Alaska a decrease of 1.0 mm. was found. In the east a similar trend occurred from New



York to Newfoundland. If Allen's Rule may be correctly applied to the avian bill, this variation agrees.

*Tarsus*.—From measurements obtained, though not included here, no geographic variation was noted.

*Color of Venter*.—The percentage of white-vented birds in the samples decreased from about 70 to 30 per cent from Montana to New York (Figure 1). From New York northeastward the trend is toward a yellow venter. In the northern parts of the range the percentage of white-vented birds is about 20 per cent, exclusive of the Northwest Territories and Newfoundland, where none occurred in the samples.

*Color of Dorsum*.—The sample of birds for analyzing this character was meager because only fall-plumaged (July-Aug.) birds, thought to be close to their breeding areas, were used. From the birds examined it appeared that birds from Alaska to central Quebec were similar in color—what I termed a *brownish wash*. Birds collected in the Ithaca area in July and August had a *greenish wash*. These colors, for the most part, are lost before the birds return to their breeding areas the next spring. It will be a long time before enough fresh fall specimens collected on the breeding grounds are available for study. Thus, this character, though figuring prominently in the descriptions of the past, seems least helpful in a critical examination.

#### COMMENTS ON SUBSPECIES

*Seiurus noveboracensis notabilis*.—Ridgway's type was collected on May 10, 1878, at Como, Wyoming Terr., by G. B. Grinnell. Herbert Friedmann was kind enough to send this specimen and the following measurements were obtained—bill (nostril to tip), 13.1; wing, 82.0; tail, 59.0; tarsus, 20.8 mm.; venter M-W; trace of white in tail. The bill exceeded all other specimens examined by more than 2 mm. and the wing by almost 1 mm. Here is Ridgway's description. "Similar to *S. n. noveboracensis* but larger, especially the bill; coloration of upperparts less olive (more greyish sooty), that of the underparts less yellowish, usually white, with little if any yellow tinge."

This long accepted subspecies typified by an aberrant specimen which was probably a migrant, seems unjustified. Nomenclaturally *notabilis* applies to birds from Montana to Alaska yet these two populations are at opposite ends of clines in bill and wing lengths.

*Seiurus noveboracensis limnaeus*.—McCabe and Miller (1933) selected as type a male, collected on June 8, 1930, in the Caribou district of central British Columbia. Their diagnosis is as follows; "dorsum between olivaceous black and dark grayish olive; underparts

with yellowish averaging less than in *S. n. noveboracensis* but more than in *S. n. notabilis*; wing and tail averaging small; tarsus as in *notabilis*." . . . Distribution: . . . "central interior British Columbia extending with some diminution of characters through northern British Columbia."

I examined 5 topotypes and 6 other skins from central interior British Columbia and all but three skins agreed well with this description. However, 18 specimens from widely scattered points in the breeding range of northern and eastern populations could not definitely be segregated from this group.

*Seiurus noveboracensis uliginosus*.—Burleigh and Peters (1948) have recently described this bird as the breeding bird of Newfoundland. The type, a male, was taken at Topsail, Avalon Peninsula, on June 22, 1945. This subspecies they described as the most olivaceous above and yellowest beneath of the four races; bill averaging smaller and wing longer than neighboring populations.

I have included much of their material in my analysis, and variation in size and color is summarized in Figures 1, 3, and 4. This indicates that the Newfoundland birds are the northeastern clinal extreme in bill length, wing length, and degree of yellow in the venter.

#### CONCLUSIONS

In the light of these data, which show an unusual amount of individual variation and slight trends toward geographic variation, it would seem best to treat the species as monotypic. The identification of migrants and wintering birds, unless "ultratypical," would be highly subjective.

Amadon (1949) in a discussion of the 75 per cent rule for subspecies concludes that 75 per cent of the individuals of one race must be clearly separable from all the other individuals of the other race; or 96 per cent of one population separable from 96 per cent of the other. This can not truthfully be done with this species. Here, it seems to me, is a case like that of *Erithacus rubecula*. Lack (1946) in his taxonomy of the European Robin says, "it is both simpler and more accurate to describe subspecific variations in terms of geographic trends, and to omit altogether the tyranny of subspecific names."

The temptation to describe the Alaskan population, the Montana-Alberta population and the West Virginia-Central Pennsylvania populations has presented itself, but this would lead to greater confusion and misunderstanding. The best solution I think is to treat the species as monotypic and to indicate geographic trends as shown here.

## SUMMARY

Six individually varying characters are described in the Northern Waterthrush (*Seiurus noveboracensis*).

White tipping of the inner vanes of the outer two to four rectrices appears to be typical of the postnuptial plumage. Lack of this white tipping is characteristic of the postjuvenile plumage.

Sexual variation is described.

Geographic variation is described, and in view of the clinal and rather slight nature of the variation it is suggested that the species be regarded as monotypic.

## LITERATURE CITED

- AMADON, D. 1949. The seventy-five per cent rule in subspecies. *Condor*, **51**: 250-258.
- BURLEIGH, T., and H. PETERS. 1948. Geographic variation in Newfoundland birds. *Proc. Biol. Soc. of Wash.*, **61**: 111-126.
- DWIGHT, J. 1900. The sequence of plumages and moults of the passerine birds of New York. *Annals N. Y. Acad. Sci.*, **13** (1): 73-360.
- HANN, H. W. 1948. Longevity of the Oven-bird. *Bird Banding*, **19**: 5-12.
- HIATT, R. W. 1943. A singing female Oven-bird. *Condor*, **45**: 158.
- LACK, D. 1946. The taxonomy of the robin *Erithacus rubecula* (Linn.). *Bull. Brit. Ornith. Club*, **66**: 55-65.
- MCATEE, W. L. 1904. An interesting variation in *Seiurus*. *Auk*, **21**: 488-489.
- MCCABE, T. T., and A. H. MILLER. 1933. Geographic variation in the Northern Waterthrush. *Condor*, **35**: 192-197.
- RIDGWAY, R. 1880. Revisions of nomenclature of certain North American birds. *Proc. U. S. Natl. Mus.*, **3**: 1-16.
- RIDGWAY, R. 1902. The birds of North and Middle America. *U. S. Natl. Mus. Bull.* **50**, part 2: 642-648.
- SALT, W. R. 1954. The structure of the cloacal protuberance of the Vesper Sparrow (*Pooecetes gramineus*) and certain other passerine birds. *Auk*, **71**: 64-73.
- STONE, W. 1937. Bird studies at Old Cape May. Vol. 2, D.V.O.C., Philadelphia, 832-833.
- TODD, W. E. C. 1940. Birds of western Pennsylvania. *Pitt. Univ. Press*, 538.
- WETMORE, A. 1939. Observations on the birds of northern Venezuela. *Proc. U. S. Natl. Mus.*, **87**: 246.

*Biology Department, St. Bonaventure Univ., St. Bonaventure, N. Y., February 14, 1956.*