Weight, Fat, and Wing Measurement Variations During Migration and Over-wintering of White-throated Sparrows in New Jersey

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This paper is the last in a series concerned with an analysis of measurements taken of selected birds captured, banded and measured during migration at a coastal and an inland banding station and those over-wintering inland in New Jersey as well as comparison of measurements made by others as found in the literature. The purpose of the studies is to determine if differences in measurements exist between inland and coastal migrants and, where appropriate between closely related species. My findings for migrating and over-wintering birds in New Jersey were summarized in papers on the Tree Sparrow (*Spizella arborea*) (*Prescott 1976*), Dark-eyed Junco (*Junco hyemalis*) (*Prescott 1978*), Ruby-crowned Kinglets (*Requlus calendula*) (Prescott 1980a), Golden-crowned Kinglets (*Requlus satrapa*) (*Prescott 1980a*), Yellow-rumped Warblers (*Dendroica c. coronata*) (*Prescott 1981*), Gray Catbirds (*Dumetella carolinensis*) (*Prescott 1982*), and adult American Goldfinches (*Carduelis tristus*) (*Prescott 1983*).

During a 5-year period (1967-1971) I recorded the weight (g), fat class (0-3) and wing length (mm), of White-throated Sparrows (*Zonotrichia albicollis*) captured during the fall (26 September - 25 October) and spring (31 May) at coastal Island Beach, New Jersey and fall (5 October - 30 November), winter (3 December - 23 February) and spring (1 March - 3 May) at Pennington, New Jersey. I weighed, measured and scored fat for 287 White-throated Sparrows, 252 at Pennington, New Jersey and 35 at Island Beach, New Jersey (however, fat measurements were not recorded for all sparrows. My sub-permittee, Trudy Prescott, assisted at both locations, but processed only about one percent of the sparrows. All individuals were banded and processed within 5-20 minutes after capture. They were weighed on an Ohaus Harvard Trip Beam Balance scale to the nearest 0.1g; wing length (chord) was measured to the nearest 0.5mm by holding the partially opened wing loosely against the right-angle base of a steel millimeter ruler; and fat class designations were scored based on visual observation of the amount of fat present in the furculum according to a scale of 0 (none) to 3 (very fat). Age of fall birds was based on the degree of skull ossification observed "by eye" after wetting the skin with water, and birds were designated HY (birds of the year) or AHY (at least one year old). White-throats of questionable age are not included in this study. When necessary, a laboratory table lens (25X) was used to assist in determining the degree of skull ossification. I did not determine sex of the sparrows.

Results and Discussion

Weight. Table 1 summarizes data on weights of 287 HY and AHY white-throats processed at Pennington and Island Beach. The mean weights for HY and AHY sparrows at inland Pennington are larger than those taken at the coast and the heaviest birds were those taken at Pennington. In all respects the coastal birds were lighter. Comparing AHY white-throats at both sites for the fall season (August-November), Pennington 48, Island Beach 6, with mean weights of 26.03g and 22.10g, t = 3.45, d.f. 52, the inland adults taken during migration are heavier but not significantly so, than those taken at the coast. This finding agrees with the hypothesis discussed by Murray and Jehl (1946:261) who found that the selected species of coastal migrants at Island Beach were lighter in average weight than those for inland migrants. They suggested that the coastal birds were captured and processed after nocturnal, over-water flights, and had flown longer than had the inland migrants concluding that the coastal migrants had had a greater expenditure of energy and use of stored fat than did those migrating over land. Comparing HY white-throats at both sites for the fall season, we find that the inland HY birds are similarly heavier than those captured at the coast: Pennington 83, Island Beach 28, with mean weights of 26.64 g and 23.92 g, t = 4.941, d.f. 109. In the present sample, both the HY and AHY White-throated Sparrows were heavier in average at the inland sites, as in Murray and Jehl's finding.

Table 1. Weights (g) of migrating and over-wintering White-throated Sparrows.

Areas	N	Median	Mean	S.D.	Range
Pennington & Island Beach					
All	287	27.5	27.41	±3.137	17.7-40.7
HY	133	27.3	26.70	±2.876	18.0-32.6
AHY	154	27.8	27.91	±3.361	17.7-40.7
Pennington					
All	252	28.0	28.05	±2.835	20.0-40.7
HY	105	27.9	27.89	±1.992	21.4-32.6
AHY	147	28.2	28.14	±3.237	20.0-40.7
Island Beach					
All	35	23.8	23.76	±2.986	17.7-29.0
HY	28	23.8	23.92	±2.975	18.0-29.0
AHY	7	22.1	23.11	±3.874	17.7-27.5

Comparing HY and AHY white-throats taken in the fall at Pennington, the HY birds have a larger mean weight, 26.64 g than that for the AHY, 26.03 g, but they are not significantly heavier, t = 1.405, d.f. 129. Although the sample is small, the mean weight of 28 HY white-throats at Island Beach is larger than that for the 6 AHY birds, they are not significantly heavier: 23.92 g and 22.10 g, t = 1.309, d.f. 32. Placing the weights recorded in the literature (Table 2) into three seasonal groups of fall (August-November), winter (December-February) and spring (March-May) and including weights given by authors as fall, winter or spring, the data are: Fall, 4,429 individuals with a range in weights of 19.0 g (recorded for August and November) to 34.5 g (October - November) with the range of means of 22.5 g (September) to 30.85g (October-November); Winter, 115 birds ranging from 24.1g (February) to 36.8 g (winter), with the range of means of 24.7 g (February) to 36.8 (winter); Spring, 1,080 individuals ranging from 21.2 g (May) to 35.4 g (April) and the range of means of 26.2 g (March) to 31.5 g (spring). The range of weights and range of means indicate that over-wintering white-throats are heavier as a group than for the fall and spring birds and indicate that the spring birds are heavier, as group, than are those taken in the fall. Comparing the weights of 418 April with 259 May birds, the former have a range of weights of 26.3 - 30.4g and range of means 27.2 - 29.8 g and the latter a 21.2 - 33.7 g in range of weights with the range of means 25.8 - 28.5 g. Apparently, the May birds were lighter than those taken in April. These weights, at both coastal and inland sites, agree with the general trend discussed by Helms and Drury (1960) and Helms and Smythe (1969) that weights of migrants are lighter in mid-winter than in the fall and early spring.

Table 2 gives weight data for 7,141 white-throats from the literature. For AHY birds, the range in weights is 19.0 g - 36.0 g; for 160 AHY males, the range (20.75 g - 36.8 g) is larger than that for 115 AHY females (23.0 - 29.5 g); and the range for HY sparrows (19.3 - 37.1 g) is greater than that for the adults. The lightest recorded weight (19.0 g) is that reported both by Clench and Leberman (1978) for an AHY bird (sex?) taken in November and an unaged bird (19.0 g) reported by Murray and Jehl (1964) also taken in the fall (August - October). The heaviest weight (36.8 g) is that recorded by Nice (1938) for a winter male. Of 2,339 AHY white-throats reported in the literature, 115 were females with a range in weights of 23.0 - 29.5 g and 160 males ranged in weights from 20.8 - 36.8 g. These data indicate that AHY birds were heavier than the HY sparrows and that AHY males were heavier than the AHY females. Comparing seasonal weights recorded in the literature with those at Pennington and Island Beach, data from all three groups agree that the fall birds are lightest; however, while average weights of both Pennington and Island Beach white-throats are heaviest in the winter, there is a slight reduction in the spring. The weights given in the literature indicate that the average weight of spring sparrows is the heaviest of the three seasons. Becker and Stack (1944) found that the average weight of spring white-throats taken by him were heavier than those for the fall, with a significant difference in weight since it is more than three times the probable error c.23 g and .18 g for the two groups he compared. The spring weights recorded in the literature do not agree with the trend suggested above by Helms, et. al.

Table 2. Weights (g) of migrating and over-wintering White-throated Sparrows from the literature.

Locality	Season	N	Range	Mean	S.D.	Age (Sex)	Source
Mass.	Sept.	1	—	22.5	—	AHY	Broun 1933
Mass.	?	47	—	27.15	±0.14	?	Helms and Lambert 1980
Mass.	?	11	—	28.68	—	?	Whittle 1927
Mass.	Nov.	1	—	30.0	—	AHY	Whittle 1930
Mass.	April-May	7	22.5 - 32.0	27.36	±2.77	AHY	Whittle 1930
Mass.	Oct.-Nov.	5	27.5 - 34.5	30.85	±6.84	?	Whittle 1930
Mass./Conn.	April-May	4	23.02 - 32.5	28.67	—	AHY	Wetherbee 1934
Mass./Conn.	Sept.-Nov.	376	24.2 - 29.62	27.26	—	HY	Wetherbee 1934
Maine/Ohio	Fall	10	—	27.9	±3.15	?	Hartman 1946
New Jersey	Aug.-Oct.	341	19.0 - 33.7	23.7	±2.1	?	Murray and Jehl 1964
Wash. D.C.	Oct.	2	24.4 - 27.9	26.15	—	?	Wetmore 1936
Georgia	Oct.	4	—	26.0	—	AHY male	Odum 1949
Georgia	Oct.	7	—	24.9	—	AHY female	Odum 1949
Georgia	Nov.	18	—	27.0	—	AHY male	Odum 1949
Georgia	Nov.	11	—	25.8	—	AHY female	Odum 1949
Georgia	Dec.	10	—	27.0	—	AHY male	Odum 1949
Georgia	Dec.	5	—	26.1	—	AHY female	Odum 1949
Georgia	Jan.	23	—	28.9	—	AHY male	Odum 1949
Georgia	Jan.	11	—	26.8	—	AHY female	Odum 1949
Georgia	Feb.	24	—	28.7	—	AHY male	Odum 1949

(continued ►)

Table 2 Continued.

Locality	Season	N	Range	Mean	S.D.	Age (Sex)	Source
Georgia	Feb.	18	—	27.7	—	AHY female	Odum 1949
Georgia	Mar.	13	—	28.1	—	AHY male	Odum 1949
Georgia	Mar.	12	—	26.2	—	AHY female	Odum 1949
Georgia	Apr.	46	—	29.8	—	AHY male	Odum 1949
Georgia	Apr.	30	—	27.2	—	AHY female	Odum 1949
Georgia	May	15	—	26.5	—	AHY female	Odum 1949
Alabama	Jan.	1	—	29.4	—	AHY	Stewart & Skinner 1967
Alabama	Mar.	1	—	25.0	—	AHY female	Stewart 1967
Alabama	Apr.	1	—	28.0	—	AHY male	Stewart 1967
Ontario	Fall	4	—	26.3	—	?	Hussell and Lambert 1980
Pennsylvania	—	?	—	26.5	—	?	Poole 1938
Pennsylvania	Sept.	88	19.5 - 28.2	24.2	±1.65	HY	Clench and Leberman 1978
Pennsylvania	Oct.	1220	19.3 - 32.6	25.5	±2.06	HY	Clench and Leberman 1978
Pennsylvania	Nov.	306	20.3 - 37.1	26.8	±2.74	HY	Clench and Leberman 1978
Pennsylvania	Dec.	3	26.3 - 29.2	27.8	—	HY	Clench and Leberman 1978
Pennsylvania	Jan.	10	20.7 - 34.3	28.2	±3.78	AHY	Clench and Leberman 1978
Pennsylvania	Feb.	2	24.1 - 25.3	24.7	—	AHY	Clench and Leberman 1978
Pennsylvania	Mar.	20	22.2 - 34.1	26.8	±3.55	AHY	Clench and Leberman 1978
Pennsylvania	Apr.	232	22.0 - 35.4	27.7	±2.39	AHY	Clench and Leberman 1978
Pennsylvania	May	163	21.2 - 33.7	25.8	±2.45	AHY	Clench and Leberman 1978
Pennsylvania	Sept.	29	22.0 - 27.9	24.2	±1.36	AHY	Clench and Leberman 1978
Pennsylvania	Oct.	1061	19.9 - 33.1	25.7	±2.10	AHY	Clench and Leberman 1978
Pennsylvania	Nov.	59	19.0 - 32.2	27.1	±2.35	AHY	Clench and Leberman 1978
Pennsylvania	Dec.	1	—	28.5	—	AHY	Clench and Leberman 1978
Michigan	?	375	19.1 - 34.5	27.2	—	?	Becker & Stack 1944
Michigan	Fall	30	21.5 - 29.5	25.6	±1.8	?	Becker 1944
Michigan	Fall	111	19.1 - 31.5	25.0	±2.2	?	Becker 1944
Michigan	Spring	102	24.5 - 34.5	29.3	±2.0	?	Becker 1944
Michigan	Spring	132	22.4 - 34.2	27.8	±2.1	?	Becker 1944
Ohio	Sept.-Nov.	35	23.2 - 28.5	25.16	—	? male	Nice 1932
Ohio	Sept.-Nov.	49	21.0 - 27.3	24.3	—	? male	Nice 1932
Ohio	Sept.-Nov.	44	23.2 - 28.9	26.2	—	male	Nice 1938
Ohio	Oct.	6	27.5 - 30.8	29.2	—	male	Nice 1938
Ohio	Sept.-Oct.	51	21.0 - 27.8	24.1	—	female	Nice 1938
Ohio	Oct.-Nov.	24	22.3 - 29.2	26.0	—	female	Nice 1938
Ohio	Fall	3	27.4 - 31.1	29.3	—	male	Nice 1938
Ohio	Winter	8	30.5 - 36.8	35.0	—	male	Nice 1938
Ohio	Spring	5	27.7 - 32.8	31.5	—	male	Nice 1938
Ohio	Fall	5	25.1 - 28.1	27.0	—	female	Nice 1938
Ohio	Spring	1	—	27.5	—	female	Nice 1938
Ohio	Sept.	118	—	25.1	—	?	Baldwin and Kendeigh 1938
Ohio	Oct.	151	—	26.3	—	AHY	Baldwin and Kendeigh 1938
Ohio	Oct.	233	—	25.5	—	HY	Baldwin and Kendeigh 1938
Ohio	Oct.	745	—	26.1	—	?	Baldwin and Kendeigh 1938
Ohio	Nov.	12	—	28.2	—	?	Baldwin and Kendeigh 1938
Ohio	?	26	20.75 - 29.5	24.79	—	AHY	Stewart 1937
Ohio	?	21	20.75 - 29.5	24.78	—	AHY male	Stewart 1937
Ohio	?	5	23.0 - 27.0	24.8	—	AHY female	Stewart 1937
Illinois	Apr.-May	106	22.6 - 31.2	27.3	—	AHY	Wolfson 1954
Wisconsin	April	109	26.3 - 30.4	28.7	—	AHY	Wolfson 1954
Wisconsin	May	81	27.9 - 29.5	28.5	—	AHY	Wolfson 1954

Fat. The visible fat in the furcular depression of 285 white-throats taken at Pennington and Island Beach was scored and the percent of each class (0 = non, 3 = very fat) is given in Table 3. In my paper on over-wintering Dark-eyed Juncos (*Junco hyemalis*) (Prescott, 1978), I discussed my procedures and reviewed the role of fat storage in relation to migration. Comparing the fat content of white-throats scored at Pennington and Island Beach, the coastal birds have a higher percentage of class 0 and a lower percentage of class 3 than the inland sparrows, both for HY and AHY birds. This leaner condition correlates directly with the weight data which gives a heavier weight for the inland birds than those captured on the coast. Compiling the fat class scores for the three seasonal groups at Pennington and combining classes 0 + 1, 2 + 3 for both HY and AHY sparrows, we find: Fall, AHY 48% (0 + 1) and 52% (2 + 3), 44% and 56% for HY; winter, AHY 10.8% (0 + 1) and 89.2% (2 + 3), HY 34.8% and 65.2%; AHY birds in the spring were 55.7% and 44.3%. At Island Beach for the Fall season, both adults and immatures were leaner: AHY, 83% (0 + 1) and 16.7% (2 + 3), HY, 57.1% and 42.9%. For the fall season, the inland sparrows have higher percentage of fat class 2 + 3, both AHY and HY, than those measured at the coast. At Pennington, both adults and immatures have a markedly higher percentage of fat (2 + 3) for the winter season than for the fall unexpectedly, for the small sample of spring sparrows more (11.4%) are in the lean (0 + 1) group than in the fatter (2 + 3) group. Odum, et. al., found that white-throats examined following kills at a Florida Gulf coast tower at the very southern edge of the wintering range at the gulf coast, were proved to be the leanest birds killed at the tower in October-November.

Table 3. Visible fat at the furculum of migrating and over-wintering White-throated Sparrows as expressed as percentage of individuals by fat class.

		*FAT CLASS			
	N	0	1	2	3
Pennington & Island Beach					
All	285	29.82	15.09	22.46	32.63
HY	131	31.30	13.74	29.01	25.95
AHY	154	28.57	16.24	16.88	38.31
Pennington					
All	250	27.60	14.80	22.80	34.80
HY	103	29.13	12.62	30.10	28.15
AHY	147	26.53	16.32	17.69	39.46
Island Beach					
All	35	45.72	17.14	20.00	17.14
HY	28	39.28	17.86	25.00	17.86
AHY	7	71.42	14.29	0.0	14.29

*o = 1, 1 = little, 2 = moderate, 3 = very much.

Wing Length. Table 4 gives wing measurements of 447 white-throats from the literature. The range given by Wetherbee (1934) 56.5 - 83.55 mm for April-May sparrows contains the shortest and longest measurements of the sample and their mean length, 76.85 mm is the longest. Lengths reported by both Nice (1932) and Ridgway (1901) give longer wing length for the males than for the females. Table 5 gives wing lengths (chord in mm) of 287 white-throats measured by me at Pennington and Island Beach. My measurements show little variation in wing length between coastal and inland sparrows. Comparing wing lengths of all my HY and all AHY white-throats, the 154 adults have longer, but not significantly so, wing lengths than the 133 immatures means 73.92 to 73.56 mm, t = 5.556, d.f. 285.

Table 4. Wings length (in mm) of migrating White-throated Sparrows from the literature.

Locality	Season	N	Range	Mean	S.D.	Age (Sex)	Source
Mass.	Sept.	1	—	71.0	—	AHY	Broun 1933
Mass./Conn.	Apr.-May	4	56.5 - 83.25	76.85	—	AHY	Wetherbee 1934
Mass./Conn.	Sept.-Nov.	376	71.75 - 78.25	75.07	—	HY	Wetherbee 1934
Ohio	Fall	30	73.0 - 76.5	75.1	—	? male	Nice 1932
Ohio	Fall	36	66.0 - 73.0	70.03	—	? female	Nice 1932
?	?	?	72.39 - 77.22	74.68	—	AHY male	Ridgway 1901
?	?	?	69.6 - 73.15	71.12	—	AHY female	Ridgway 1901

Table 5. Wing Length (chord in mm) of migrating and over-migrating White-throated Sparrows.

	N	Median	Mean	S.D.	Range
Pennington & Island Beach					
All	287	74.0		±0.550	66.5-79.5
HY	133	74.0	73.56	±0.548	66.5-78.5
AHY	154	74.0	73.92	±0.547	67.0-79.5
Pennington					
All	252	74.5	73.86	±0.533	66.5-79.5
HY	105	74.5	73.71	±0.538	66.5-78.5
AHY	147	74.0	73.96	±0.530	67.0-79.5
Island Beach					
All	35	74.0	73.0	±0.638	67.0-78.0
HY	28	74.0	73.0	±0.586	67.0-78.0
AHY	7	74.0	73.0	±0.862	68.5-78.0

Summary

During a 5-year period at New Jersey Inland and coastal sites, 287 White-throated Sparrows were measured and values recorded for weight, wing and fat class. These are analyzed and compared with data found in the literature on 7,141 white-throats. For my New Jersey sparrows, those taken inland were heavier, both AHY and HY, than those taken at the coast which agrees with the Murray and Jehl hypothesis (1964) that inland birds taken during migration are heavier than those captured at the coast. My findings also agree with the general trend discussed by Helms et. al. (1960, 1969) that weights of migrants are higher in mid-winter than in the fall and early spring and these data indicate that the inland birds, both AHY and HY, had a higher percentage of fat than those taken at the coast and this is a positive correlation with weights of the sparrows taken at both sites. For the winter season, the inland sparrows were fatter than those measured in the fall and spring. In certain seasons it would be difficult to determine if many individuals were migrants or arrivals from adjacent over-wintering areas. Seasonal data given here are thought to reflect general conditions of weight and fat for immatures and adults.

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(Inland)

Bill Deformity in a Pearly-Eyed Thrasher from Montserrat, West Indies

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The causes of bill deformities in birds have been summarized in an excellent review by Pomeroy (Brit. Birds 55:49-72, 1962). Causes include genetic mutations, disease, accident, poor nutrition, and, in caged birds, an absence of bill-filing substrates (e.g., stones, coarse bark). In wild birds, however, bill deformities are most often associated with injury to the bill. Easterla and Todd (Auk 88: 677$\frac{L}{N}$678, 1971) reported such an apparent injury in a free-living Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) from Clay County, Missouri. The blackbird apparently had suffered a fractured mandible (dentary), resulting in a longitudinal fissure and jagged broken edge. The injury allowed unchecked growth and abnormal development of the rhamphotheca (horny sheath covering the bony mandibles).

In the passerine family Mimidae (mockingbirds, thrashers, and allies) at least two eastern North American species with deformed bills have been reported. Allard (Auk 47: 93, 1930) reported a Catbird (*Dumetella carolinensis*) with an upturned maxilla, while more recently Post (Chat 49: 20$\frac{L}{N}$21, 1985) reported a Brown Thrasher (*Toxostoma rufum*) with a long decurved bill, the mandible apparently having suffered a previous fracture. A similar bill injury in a West Indian mimid, a Pearly-eyed Thrasher (*Margarops fuscatus*) from Montserrat, is reported herein.

The Pearly-eyed Thrasher was captured during studies on Montserrat from 15 May to 2 August, 1984. During 19-21 May 1984, we sampled the bird community in the Centre Hills at a site known locally as Jubilee Heights in a secondary hygrophytic forest at an elevation of about 450 m. On the morning of 20 May 1984, we captured and banded (1433-78863) a Pearly-eyed Thrasher with an abnormally long (length 42.84 mm), decurved bill (Fig. 1). Upon examination of the deformed bill, we found that about half of the distal portion of the mandible had been severed, leaving a jagged edge to the remaining mandibular base. The maxilla extended about 20 mm beyond the truncated mandible. The tomia (cutting edges) of the bill appeared normal from the base of the feathers distally to the fractured portion of the mandible, forming a smooth commissure (line along which the mandibles meet). Beyond the broken mandible, however, the tomia of the maxilla were less distinguishable. The sides of the maxilla were growing inward, giving the maxilla an almost tubular appearance.

Figure 1. Pearly-eyed Thrasher with deformed bill.