Weight, fat, and wing measurement variations of adult American Goldfinches in New Jersey

Kenneth W. Prescott

In this paper I summarize data from 236 adult American Goldfinches *(Carduelis tristis)* captured and measured at two inland sites in New Jersey. Of these, 86.4% were netted, trapped, and measured at Pennington between 1968 and 1971; 13.6% were netted and measured at the Miller Site, a well-known archeological site in southeast Sussex County, in a field where a large population was still involved in nesting activities and feeding young on 16, 17, and 21 August 1968. Immatures and birds of indeterminate sex are excluded from this study. Age of late summer, fall, and early winter birds was based on the degree of skull ossification observed "by eye" after wetting the skin with water. At Pennington, a laboratory table lens (25x) was used to assist in the examination of those of questionable age and at the Miller Site a hand-held magnifying glass was used. Sex of the adult goldfinches was determined by plumage characteristics, easily discernible during the spring, summer, and early fall. Winter males were identified by the glossy black and females by the duller and brownish black remiges and rectrices. Trudy Prescott assisted at both locations, processing no more than 1% of the goldfinches. Each of the birds was weighed on an Ohaus Harvard triple beam balance to the nearest 0.1 g; wing length (chord) was measured to the nearest 0.5 mm by holding the partially open wing loosely against the right-angled base of a steel millimeter ruler; fat class designations were based on visual observation of the amount of fat present in the furcular depression and birds were placed in fat classes 0 (none) to 3 (very fat). Data were divided into seasonal subsamples for analysis: Spring = March-May, Summer = June-August, Fall = September-November, Winter = December-February.

Results and discussion

Weight. Table 1 summarizes data on weights of 236 adult goldfinches. Although the difference between the extremes in weights (5.8 g) for the males is identical to that for the females, as a group, the males are heavier than the females (means, 14.14 to 13.59 g, t = 3.986., d.f. 234). The comparative mean weights for 3 of the 4 seasons (fall, winter, and spring) demonstrate that the males were consistently heavier: fall means 13.62 to 13.14 g, t = 1.611, d.f. = 11; winter means, 15.04 to 14.34 g, t = 2.181, d.f. = 51; spring means, 13.94 to 13.45 g. t = 3.311, d.f. = 143. The summer weights reverse the pattern, with female mean weight being larger than that for males (13.37 to 12.76 g, t = 1.284, d.f. = 143). Summer males had little or no fat, but 11.1% of the females were scored in fat class 3. Some females were likely carrying eggs or had enlarged ovaries. The larger amount of fat on summer females than on males undoubtedly contributed to the reversal of the male-female weight relationship.

Table 1. Weights (g) of adult American Goldfinches in New Jersey.

	No.	Median	Mean	S.D.	Range
Year					
All	236	13.9	13.90	±1.101	11.1-17.1
Males	132	14.1	14.14	±1.087	11.1-16.9
Females	104	13.5	13.59	±1.047	11.3-17.1
Fall					
All	13	13.4	13.36	±0.570	12.6-14.5
Males	6	13.6	13.62	±0.564	12.8-14.5
Females	7	13.0	13.14	±0.515	12.6-14.1
Winter					
All	53	14.7	14.78	±1.166	12.0-17.1
Males	33	15.1	15.04	±1.063	12.9-16.9
Females	20	14.2	14.34	±1.225	12.0-17.1
Spring					
All	145	13.9	13.74	±0.920	11.1-16.5
Males	86	14.1	13.94	±0.827	11.1-16.5
Females	59	13.6	13.45	±0.915	11.3-15.1
Summer					
All	25	13.0	13.20	±1.084	11.4-15.5
Males	7	13.0	12.76	±1.042	11.4-14.0
Females	18	13.0	13.37	±1.078	12.0-15.5

Table 2 gives weight data for 3058 adult goldfinches from the literature. The range in weights for 1547 males is larger than that for the 1511 females; extremes for males are also greater than for females. For this large sample of adults, the mean for males was significantly heavier than that for females, (means, 13.24 to 12.62 g, t = 31.15, d.f. = 3056). As with my New Jersey sample, both sexes averaged heavier in winter than in summer, but the males were heavier than the females in winter and the females slightly heavier in summer. Wiseman (1975:394-395, 398) found that mean weight of female goldfinches but not of males, increased in July and August. Although both sexes reached maximum mean weight of the summer in August, the female mean was 7.3% above the mean June weight, while the August male mean was only 4.9% above the annual mean weight. Data from the literature and my sample agree in that mean weights for winter males were greater than

Table 2. Weights (g) of adult American Goldfinches from the literature.

Locality	Season	N	Range	Mean	S.D.	Age/Sex	Source
Conn./Mass.	May-Sept.	6	11.4-13.3	12.15	-	ad. male	Wetherbee 1934
Conn./Mass.	July-Oct.	5	11.3-14.7	12.85	-	ad. female	Wetherbee 1934
Mass.	Winter	15	-	15.06	-	ad. male	Whittle and Whittle 1926
Mass.	Winter	9	-	14.50	-	ad. female	Whittle and Whittle 1926
Washington D.C.	June	1	-	13.3	-	ad. female	Wetmore 1936
Alabama	Feb.-March	2	13.0-14.0	13.5	-	ad. male	Stewart and Skinner 1967
Pennsylvania	January	7	13.4-16.8	14.2	1.20	ad. female	Clench and Leberman 1978
Pennsylvania	February	6	12.7-15.6	14.1	1.12	ad. female	Clench and Leberman 1978
Pennsylvania	March	74	11.8-17.1	13.6	1.00	ad. female	Clench and Leberman 1978
Pennsylvania	April	158	10.5-15.7	13.2	0.81	ad. female	Clench and Leberman 1978
Pennsylvania	May	520	10.3-16.5	12.4	0.90	ad. female	Clench and Leberman 1978
Pennsylvania	June	24	10.6-13.5	12.1	0.72	ad. female	Clench and Leberman 1978
Pennsylvania	July	15	11.6-13.4	12.5	0.60	ad. female	Clench and Leberman 1978
Pennsylvania	August	122	10.7-15.3	12.5	0.90	ad. female	Clench and Leberman 1978
Pennsylvania	Sept.	281	10.0-15.2	12.4	0.85	ad. female	Clench and Leberman 1978
Pennsylvania	Oct.	152	10.4-15.0	12.5	0.76	ad. female	Clench and Leberman 1978
Pennsylvania	Nov.	133	10.4-16.1	12.9	0.97	ad. female	Clench and Leberman 1978
Pennsylvania	January	9	13.0-15.8	14.5	0.80	ad. male	Clench and Leberman 1978
Pennsylvania	February	14	13.6-18.8	15.4	1.35	ad. male	Clench and Leberman 1978
Pennsylvania	March	142	11.5-17.1	14.2	1.05	ad. male	Clench and Leberman 1978
Pennsylvania	April	257	11.6-16.6	13.9	0.83	ad. male	Clench and Leberman 1978
Pennsylvania	May	327	10.6-17.1	12.6	1.03	ad. male	Clench and Leberman 1978
Pennsylvania	June	17	10.5-13.0	11.9	0.63	ad. male	Clench and Leberman 1978
Pennsylvania	July	11	11.1-13.0	11.9	0.47	ad. male	Clench and Leberman 1978
Pennsylvania	August	129	10.5-14.6	12.5	0.83	ad. male	Clench and Leberman 1978
Pennsylvania	Sept.	264	10.0-15.4	13.0	0.86	ad. male	Clench and Leberman 1978
Pennsylvania	Oct.	158	10.5-19.4	13.3	1.00	ad. male	Clench and Leberman 1978
Pennsylvania	Nov.	189	11.5-19.4	13.4	0.88	ad. male	Clench and Leberman 1978
Ohio	July	2	-	12.8	-	ad. male	Baldwin and Kendeigh 1938
Ohio	August	1	-	13.3	-	ad. male	Baldwin and Kendeigh 1938
Ohio	July	2	-	12.2	-	ad. female	Baldwin and Kendeigh 1938
Ohio	August	4	-	13.0	-	ad. female	Baldwin and Kendeigh 1938
Illinois	Sept.	4	-	11.9	-	ad. male	Graber and Graber 1962
Illinois	Sept.	8	-	11.7	-	ad. female	Graber and Graber 1962

those for females and that the reverse was true for summer; further, mean and median weights for all males were larger than those for all females in both data sets.

Fat. The visible fat in the furcular depression of 236 adult goldfinches was scored and the percent of each class in each seasonal period for males and females is given in Table 3. I discussed my procedures and reviewed the role of fat storage and weight increases of passerines in relation to migration in my paper on overwintering Dark-eyed Juncos *(Junco hyemalis)* (Prescott 1978). The percent for each fat class for goldfinch males and females varied only a few points. However, a comparison of spring and summer periods reveals that males were leaner than females. Combining 0 and 1 fat classes for spring, more males were lean than females (76.7 to 69.5%) and combining score classes 2 and 3, more females were very fat (30.5 to 23.3%). That the males are leaner than the females is more evident for the summer period: combining 0 and 1, and 2 and 3 fat class percents, there is a greater percentage of lean males than females (100 to 88.9%) and more females show heavier fat deposits than do males (11.1 to 0%). The males at the Miller Site were possibly more active in territorial defense and in bringing food to young at or just out of the nest than were the females, and consequently were not yet beginning to store fat. The heavier weight of summer females may be directly related to their fat content or breeding conditions. For New York, Bull (1964:437) gives egg dates for the American Goldfinch from 26 June to 24 August.

Table 3. Visible fat at the furculum of adult American Goldfinches in New Jersey expressed as percentages of individuals in each fat class.

	No.	0	1	2	3
Year					
All	236	49.2	19.5	31.3	8.2
Males	132	48.5	20.5	22.7	8.3
Females	104	50.0	18.3	24.0	7.7
Fall					
All	13	100.0	0	0	0
Males	6	100.0	0	0	0
Females	7	100.0	0	0	0
Winter					
All	553	13.2	22.6	43.4	20.8
Males	33	12.1	24.2	42.5	21.2
Females	20	15.0	20.0	45.0	20.0
Spring					
All	145	53.1	20.7	20.7	5.5
Males	86	55.8	20.9	18.6	4.7
Females	59	49.2	20.3	23.7	6.8
Summer					
All	25	76.0	16.0	8.0	0
Males	7	85.7	14.3	0	0
Females	18	72.2	16.7	11.1	0

Table 4. Wing length (chord in mm) of adult American Goldfinches from the literature.

Locality	Season	N	Range	Mean	S.D.	Age/Sex	Source
Atlantic coastal areas	Sept.-Oct.	24	66.5-73.7	70.1	-	1st winter male	Dwight 1902
Atlantic coastal areas	Spring	13	66.3-71.1	69.1	-	1st nuptial male	Dwight 1902
Atlantic coastal areas	Sept.-Oct.	16	69.6-73.7	71.6	-	2nd winter male	Dwight 1902
Atlantic coastal areas	Spring	8	68.6-72.6	70.6	-	2nd nuptial male	Dwight 1902
Atlantic coastal areas	Spring	22	66.0-70.1	68.1	-	1st winter female	Dwight 1902
Atlantic coastal areas	Spring	9	66.5-68.6	67.8	-	1st nuptial female	Dwight 1902
Atlantic coastal areas	Spring	4	67.8-69.6	68.6	-	2nd winter female	Dwight 1902
Atlantic coastal areas	Spring	7	66.0-71.1	68.3	-	2nd nuptial female	Dwight 1902
Unknown	?	18	70.61-75.18	72.6	-	ad. male	Ridgway 1901
Unknown	?	13	65.79-70.87	68.6	-	ad. female	Ridgway 1901
Conn./Mass.	May-Sept.	6	68.25-73.00	71.5	-	ad. male	Wetherbee 1934
Conn./Mass.	July-Oct.	5	68.25-71.25	69.7	-	ad. female	Wetherbee 1934

My fat class data do not agree wholly with the generally accepted explanation that migrants store fat in preparation for and expend it during migration. That 100% of the goldfinches were class 0 in the fall suggests that these birds, presumed to be migrants, had used stored fat during migration. However, the low percentage of fat individuals, and high percentage of non-fat birds in summer, suggests that the adults had not yet begun to store fat in preparation for migration prior to late August. Bull (1964) gives fall migration and movement data for the New York area, which suggests that similar movements may occur in New Jersey. However, Wiseman (1975:393, 402) found no evidence for migration in the goldfinches which he studied in Cincinnati, Ohio. Helms and Drury (1960:34-36) hypothesized that both the American Tree Sparrow *(Spizella arborea)* and Song Sparrow *(Melospiza melodia)* show pre-migration "preparation" by increases in weight and fat. They found that birds taken just prior to migration were significantly heavier.

Table 5. Wing length (chord in mm) of adult American Goldfinches in New Jersey.

	N	Median	M	S.D.	Range
Year					
All	236	71.5	71.26	±0.492	61.0-78.0
Males	132	72.0	72.36	±0.381	67.5-78.0
Females	104	69.5	69.88	±0.444	61.0-78.0
Fall					
All	13	72.5	72.00	±0.662	66.0-77.5
Males	6	74.0	74.25	±0.710	70.0-77.5
Females	7	70.0	70.07	±0.467	66.0-73.0
Winter					
All	53	72.0	70.34	±0.452	61.0-76.0
Males	33	72.0	72.41	±0.334	68.0-76.0
Females	20	70.0	69.98	±0.544	61.0-73.0
Spring					
All	145	71.5	71.43	±0.435	67.0-78.0
Males	86	72.0	72.25	±0.376	67.0-78.0
Females	59	70.0	70.23	±0.412	67.0-78.0
Summer					
All	25	69.5	69.38	±0.435	65.5-73.5
Males	7	72.0	71.29	±0.367	69.0-73.5
Females	18	69.0	68.64	±0.370	65.5-72.0

Fat scores suggest that goldfinches arrived at my station in the fall in a lean condition and soon began to store fat. During winter, the combined fat classes 2 and 3 included 63.7 and 65.0% of males and females respectively. In spring, the combined score classes 2 and 3 for males decreased (to 23.3 and 30.5%). At the same time the frequency of combined low-fat scores (0 and 1) for males and females (76.7 and 69.5%) was approximately twice that for winter. These data suggest that goldfinches I measured in spring had either arrived at my station after using stored fat or had not completed fat storage for further movement northward.

Wing Length. Table 4 gives wing measurements from the literature for 145 adult goldfinches. The males had longer wings than females (means, 70.90 to 68.35 mm, t = 9.486, d.f. = 143). Table 5 gives wing measurements for my 236 adults. The males had significantly longer wings than females (means, 72.36 to 69.88 mm, t = 45.090, d.f. = 234), and this was so for each of the four seasonal periods (fall, means, 74.25 to 70.07 mm, t = 12.705, d.f. = 11; winter, means 72.41 to 69.98 mm, t = 19.918, d.f. = 51; spring, means, 72.25 to 70.23 mm, t = 32.063, d.f. = 143; summer, means, 71.29 to 68.64 mm, t = 15.868, d.f. = 23). The range of wing lengths from the literature for both males and females is markedly smaller than that for mine. These data also indicate that the adult male goldfinches have longer wings than adult females. Wiseman (1975:395) also found that mean wing length of female goldfinches in his sample was significantly shorter than that for the males.

Summary

The weight, fat class, and wing measurements of 236

adult American Goldfinches captured at two inland New Jersey sites were analyzed and compared with data from the literature. Males in both data sets were significantly heavier and had longer wings than females. Goldfinches examined in this study did not completely follow the general pattern of beginning migration in a fat condition and arriving with little or no fat; although the fat condition of spring and fall birds fits the hypothesis, August birds were at variance. Whether or not the birds processed were actually migrants or the result of local movements from breeding areas to an over-wintering area is not clear.

Literature cited

Baldwin, S.P., and S.C. Kendeigh. 1958. Variations in the weight of birds. *Auk* 55:416-467.

Bull, John. Birds of the New York area, 1964, Harper and Row, New York.

Clench, M.H., and R.C. Leberman. 1978. Weights of 151 species of Pennsylvania birds analyzed by month, age and sex. Bull. Carnegie Mus. Nat. Hist., No. 5.

Dwight, J. Jr., M.D. 1902. Individual, seasonal and geographical changes of the American Goldfinch *(Astragalinus tristis)*. *Auk* 19:149-164.

Graber, R.R., and J.W. 1962. Weight characteristics of birds killed in nocturnal migration. *Wilson Bull.* 74: 74-88.

Helms, C.W., and W.H. Drury, Jr. 1960. Winter and migratory weight and fat field studies on some North American buntings. *Bird-Banding* 31:1-40.

Prescott, K.W. 1978. Weight, fat class and wing measurements of living Dark-eyed Juncos *(Junco hyemalis)*. *Inland Bird Banding News* 50:163-183.

Ridgeway, R. 1901. The birds of North and Middle America. U.S. Natl. Mus. Bull, No. 50, Part 1:109-111.

Stewart, P.A., and R.W. Skinner. 1967. Weights of birds from Alabama and North Carolina. *Wilson Bull.* 79: 37-42.

Wetherbee, Mrs. K.B. 1934. Measurements and weights of live birds. *Bird-Banding* 5:55-64.

Wetmore, A. 1936. The number of contour feathers in Passeriform and related birds. *Auk* 53:159-169.

Wiseman, A.J. 1975. Changes in body weight of American Goldfinches. *Wilson Bull.* 87:390-411.

Whittle, C.L., and H.G. 1926. Some bird weights. *Northeastern Bird-Banding J.* 2:33-36.

Department of Art, University of Texas, Austin, Texas 78712

Age determination of female American Goldfinches

Robert P. Yunick

The usual sources of information on age and sex determination of passerines, such as the *Bird Banding Manual* (1976, U.S. Fish and Wildlife Service) and M. Wood's *A Bird-Bander's Guide to* Determining Age and Sex of Selected Species (1969, The Pennsylvania State University, University Park), do not offer reliable plumage criteria for determining the age of female American Goldfinches *(Carduelis tristis)* beyond the pre-basic molt. However, a technique described by L. Svensson (1975, *Identification Guide to European Passerines*, Naturhistoriska Riksmuseet, Stockholm) for the closely related European Goldfinch *(Carduelis carduelis)* appears to apply to male and female American Goldfinches.

Svensson illustrates for many species how the relatively pointed shape of the outer two rectrices separates the hatching-year/second-year (HY/SY) individuals from the after-hatching-year/after-second-year (AHY/ASY) individuals whose outer two rectrices are more rounded. In the American Goldfinch, the males are easily segregated by their darker flight plumage and the bright yellow lesser coverts of the AHY/ASY group and the greenish-brown lesser coverts of the HY/SY group. Using these covert differences to separate these two male age groups, one can learn to recognize the pointed rectrix shape of the HY/SY group and the rounded shape of the AHY/ASY group, and apply this distinction in shape to females following the pre-basic molt.

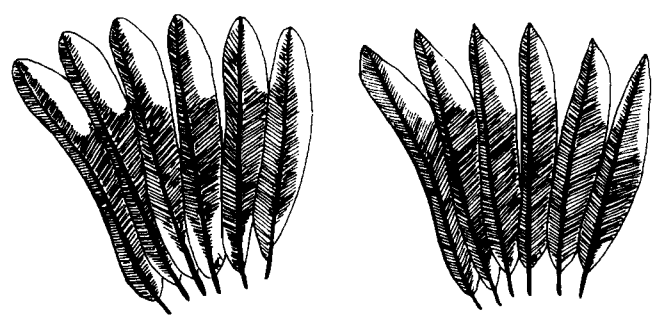

Figure 1. Left: Rectrix shape of AHY/ASY American Goldfinch after pre-basic molt. Right: Rectrix shape of HY/SY American Goldfinch after pre-basic molt. Both drawings from March specimens.

The differences in the rectrix shape for the two age groups of American Goldfinches are shown in Figure 1. I found rectrices two through five to be the most helpful for determining this difference in shape. In addition to this difference, the more pointed HY/SY rectrices tend to show greater wear at the edges in winter and spring because they are two to three months older than the same plumage of the AHY/ASY group.

This technique should be attempted only on dry rectrices which have not been disarranged through capture or holding. To insure uniformity of shape, I have found it sometimes helpful to gently smooth the dry feathers through my thumb and forefinger.

1527 Myron Street, Schenectady, NY 12309