A STUDY OF PURPLE FINCH WINTER WEIGHTS

BY FRED D. BARTLESON, JR. AND OVE F. JENSEN

THIS paper is a report on the data collected by Mrs. Jensen during the winter stay of Purple Finches (*Carpodacus purpureus*) at her banding station in Chapel Hill, North Carolina, from December 16, 1946, to April 12, 1947. During this time over 1300 weights of 494 individual Purple Finches were recorded. Each bird was banded and weighed when trapped, and time of trapping was recorded. It was thought that it might be interesting to compare the results of this study to the findings of Baldwin and Kendeigh (1938), who analyzed the weights of a large number of birds of various species, but recorded only 11 weights of the Purple Finch.

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SEX AND AGE DIFFERENCES

The data on weights were analyzed to make comparisons between males and females and between adults and immature birds. All weights were valued equally whether or not more than one weight came from a single individual, regardless of temperature and other factors. Since the plumage of adult females is indistinguishable from the first winter plumage (Dwight, 1900), it was not surprising to find that nearly two-thirds of the banded birds were brown females and immature males. Pink males made up only one third of the sample. The weights of the females and immatures were plotted against their frequencies on a graph. This was "fitted" to a normal curve (formula from Simpson and Roe, 1939) and tested by chi-square in order to determine whether or not the populations were homogeneous. The curve obtained was normal and bell shaped, with no indication of bimodality. The calculated "P" value or probability that the actual data differed from the bell shaped curve was about 0.60, which strongly suggests that the weights of the immature and adult female Purple Finches are, for all practical purposes, the same.

The weights of the males then were analyzed and were found to have no significant differences in mean, standard deviation and variation from the weights of females and immatures (Table 1). Since no differences in the weights of any of these three groups could be found, the groups will be considered as one in the remainder of this study. Although the weights of these groups of birds were apparently the same during the period studied, it is quite possible that the males and females differ significantly during the breed-

TABLE 1

WINTER WEIGHTS OF PURPLE FINCHES (IN GRAMS)

Sex	No.	Extreme	Mean	σ	"t"	P.	V.
Females and First-year Males	906	21.0–32.0	26.06	1.752	.1045	.92	.067
Adult Males	394	19.5–31.0	26.01	1.687			.065

σ—standard deviation of means. "t"—calculated significance of differences of means. P.—probability. V.—coefficient of variation. (Formulae from Simpson and Roe, 1939)

ing season, and the immatures most certainly differ from the adults for at least the first few months after hatching.

HOURLY VARIATION

As an expected result of utilization of food and defecation at night, the early morning weights of these finches were comparatively low. The rate of increase in weights was rapid for the first few morning hours and then slowed down until about noon (Fig. 1). This phenomenon was also noted in Goldfinches (*Spinus tristis*) by Stewart (1937). Another increase in Purple Finch weights was noted in the early afternoon hours. By a little after 3:00 p.m. the Purple Finches had reached their maximum mean weight of 26.8 grams. This is a gain of 3.5 grams from the average for 6:00 a.m. or an increase of 13.5 per cent of the average daily weight. Nice (1937) found that the highest weights in Song Sparrows (*Melospiza melodia*) were reached somewhat later in the afternoon. After 3:00 p.m., there was a sudden drop in the mean, amounting to 1.4 grams within the next two hours. The remaining 2.1 grams were lost sometime during the night. Even though the lowest weight may be reached before 6:00 a.m., the rate of weight loss certainly must be rapid.

The main difference between our results and those of Baldwin and Kendeigh (1938:429) is that, whereas they found the maximum weight in the late afternoon or early evening, we found it occurring in mid-afternoon. The differences here may possibly be attributed to the relatively shorter length of day during the winter, or to the fact that the great majority of Purple Finches were observed to stop feeding in the middle of the afternoon and to leave the station area sooner than other species.

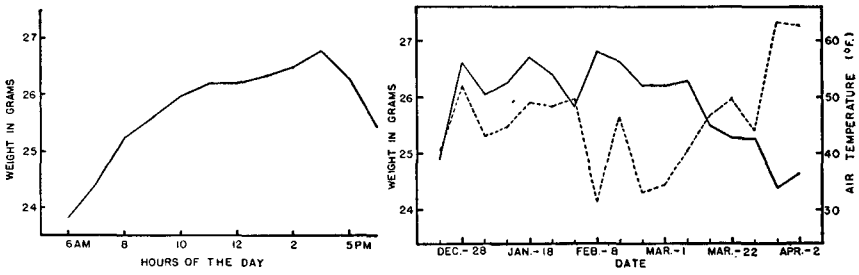

FIG. 1.—Hourly variations in mean weight of Purple Finches.

FIG. 2—Weekly variations in air temperature (Fahrenheit) and body weight of Purple Finches. Broken line indicates temperature. Unbroken line indicates weight.

WEEKLY VARIATION

In examining the variations of weight during weekly periods, it was seen that there tends to be an increase in weight from the last of December to early February. After this time, the birds became progressively lighter until they left the area sometime in the first two weeks of April. There are two weeks which do not fit this trend. The first was the last week in December, in which the body weight was nearly a gram higher than would be expected. There were only ten records for this period, which might account for the discrepancy. The second period which did not show the expected result was the first week in February. During this period, when it probably should have been the highest, the weight was about a gram lower than expected. The cause of error here was probably not due to the number of weights (73) recorded. In this particular week the daily temperatures were relatively high in comparison to those recorded during the rest of the period of the study, often reaching 75° F. This would tend to support the view held by Baldwin and Kendeigh (*op. cit.*:449) that at high temperatures the body weight of birds decreases.

From the work of Wolfson (1945) on Oregon Juncos (*Junco oreganus*) and Odum (1949) and Odum and Perkinson (1951) on White-throated Sparrows (*Zonotrichia albicollis*), one would think that the Purple Finches would have tended to gain weight, due to fat deposition, in preparation for their spring migration. This does not appear to have been the case in the Purple Finches studied. The lowest average weights were recorded during the last two weeks preceding migration. However, it is quite possible that the birds left the station just before migration and put on weight elsewhere, or added the weight very suddenly.

Correlation of Weight and Temperature

The temperature data for the Chapel Hill area, which were received through the courtesy of the United States Weather Bureau, were plotted on the same graph with body weights. The results appear quite confusing (Fig. 2). Data from the first few weeks show an almost perfect positive correlation. For every increase or decrease in air temperature there was a corresponding increase or decrease in body weight. The data for the remainder of the period of this study, however, show both positive and negative correlations intermittently.

In order to see if there were any association between the temperatures and weights observed, a contingency table was devised and tested by chi-square. The resultant X^2 value obtained was 588.1, with four degrees of freedom. The differences between the observed and expected frequencies, therefore, could not have arisen by chance. Thus, it follows that there is significant association between the weights and temperatures.

A coefficient of correlation ("r") test was used then to determine just what this association was. An "r" value of plus or minus 1.0 indicates complete positive or negative correlation, as the case may be, whereas an "r" value of zero indicates that there is absolutely no correlation. The "r" value found in this case was –.543. To answer the question, "could this deviation of 'r' from zero have arisen from chance?", a significance of difference test was used. The "t" value of 22.8 obtained necessitates the conclusion that the difference between the coefficient of correlation value obtained and zero is significant. Thus, there is an inverse, or negative, correlation between body weight in Purple Finches and air temperature.

Summary

(1) The winter weights of 1300 Purple Finches at Chapel Hill, North Carolina, were compared with previous work on weight variation in passerines. (2) Over the period of study, no significant differences in weight among adult males, adult females, and immature birds were found. (3) The highest hourly weight occurred shortly after 3:00 p.m. (4) Average weekly variation in weight showed an increase from the last of December to the first week in February, and then a gradual decrease until the finches left the area in their spring migration. (5) An inverse, or negative, correlation was found between air temperature and body weight.

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DEPARTMENT OF BIOLOGY, UNIVERSITY OF FLORIDA, GAINESVILLE, FLORIDA, AND MAPLE CITY, MICHIGAN, APRIL 26, 1954