WINTER WEIGHTS OF SLATE-COLORED JUNCOS: A COMPARISON OF FIELD STUDIES AT TWO LATITUDES

By Richard N. Knowles

Field studies on seasonal variations in the weights of birds provide a fuller understanding of the physiology of the annual cycle. In this study, weights taken at two different latitudes are compared in order to gain insight into correlations between day-length and seasonal weight changes of the Slate-colored Junco (*Junco hyemalis*). At a lower latitude winter days are longer and the rate of change in day-length is slower than at higher latitudes. A review of the various aspects involved in the timing of the annual cycle is given by A. J. Marshall (1961).

The data for one study area were gathered by C. W. Helms and W. H. Drury, Jr. (1960) at South Lincoln, Mass. (latitude 42° 25′N) during the period from October 1957 to April 1958. For the convenience of comparison these data are reproduced here in Figures 1A (mean weights) and 1C (mean ambient temperatures).

The data for the other study area were gathered by me at Hockessin, Delaware (latitude 39° 45′N) during the period from October 1962 to April 1963. The juncos were taken with mist nets and various types of baited traps. The body weight (± 0.2g), date, hour, and ambient temperature were recorded when each bird was caught. Trapping was restricted primarily to week-ends. Mean weights for each half month (1-15, 16-30 or 31 of month) were determined separately for morning and afternoon groups, and are summarized in Table 1 and Figures 1A and 1C.

Figure 1B is a plot of the winter day-lengths. The data for these plots were obtained with the following equations. The sunrise and sunset times were interpolated from the times at 40° and 45°N published in the American Ephemeris and Nautical Almanac (Anon, 1957-8, 1962-3).

South Lincoln:

Day-length

$$= \left[40° \text{ sunset time} + 2\frac{25°}{60}\left(\frac{45° \text{ sunset time} - 40° \text{ sunset time}}{5°}\right)\right]$$

$$- \left[40° \text{ sunrise time} + 2\frac{25}{60}\left(\frac{45° \text{ sunrise time} - 40° \text{ sunrise time}}{5°}\right)\right]$$

Hockessin:

Day-length:

$$\left[40^\circ \text{ sunset time} - \frac{15^\circ}{60}\left(\frac{45^\circ \text{ sunset time} - 40^\circ \text{ sunset time}}{5^\circ}\right)\right]$$

$$-\left[40^\circ \text{ sunrise time} - \frac{15^\circ}{60}\left(\frac{45^\circ \text{ sunrise time} - 40^\circ \text{ sunset time}}{5^\circ}\right)\right]$$

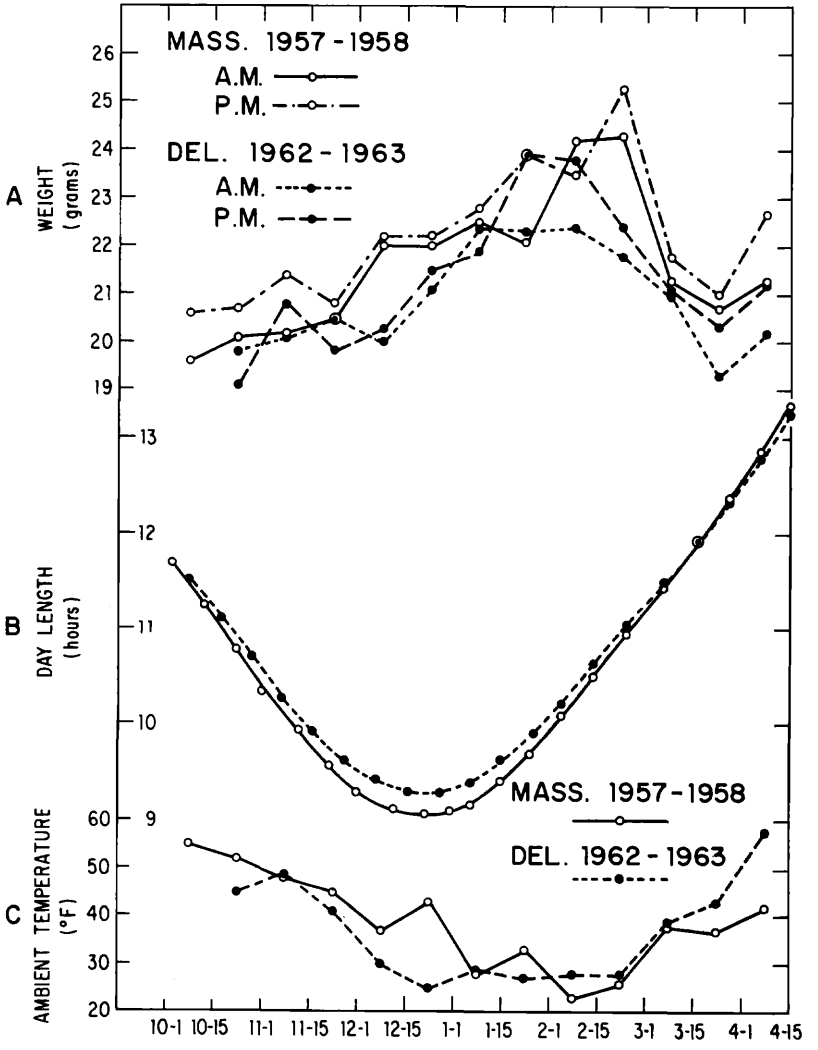

FIGURE. 1. Body weights of juncos, day lengths, and ambient temperatures for study areas in Massachusetts and Delaware.

TABLE 1. Biweekly body weights of Slate-colored Juncos at Hockessin, Del.

Date	Morning body weight			Afternoon body weight		
	n	Mean ± S. E.	range	n	mean ± S. E.	range
15-31 October 1962	9	19.8 g. ± 0.5	17.5–22.5	7	19.1 ± 0.5	17.0–21.5
1-15 November 1962	13	20.1 ± 0.4	18.0–23.0	26	20.8 ± 0.3	19.0–23.5
16-30 November 1962	5	20.5 ± 0.4	19.5–21.5	6	19.8 ± 0.1	19.0–20.5
1-15 December 1962	3	20.0	18.5–21.5	5	20.3 ± 0.8	18.0–22.0
16-31 December 1962	18	21.1 ± 0.3	18.0–23.5	30	21.6 ± 0.3	18.5–24.0
1-15 January, 1963	7	22.4 ± 0.4	20.5–23.5	8	21.9 ± 0.7	20.0–25.5
16-31 January 1963	20	22.3 ± 0.4	20.0–25.0	8	23.9 ± 0.5	22.0–25.5
1-15 February 1963	17	22.4 ± 0.3	19.5–24.5	17	23.8 ± 0.4	20.5–27.0
15-28 February 1963	14	21.8 ± 0.4	19.5–23.5	9	22.4 ± 0.3	20.5–24.0
1-15 March 1963	7	21.1 ± 0.7	18.5–23.5	1	21.0	
16-31 March 1963	7	19.3 ± 0.2	18.5–20.0	6	20.3 ± 0.5	18.5–22.5
1-15 April 1963	3	20.2	18.0–21.5	2	21.3	20.5–22.0
Σ n	123			125		

Days of equal length occur at a later date at Hockessin than at South Lincoln from the period from about 27 September to about 21 December. This is reversed for the period from about 21 December to about 20 March. Days of equal length occur at the same time at both locations only during the equinox periods.

Figure 1A shows that whereas the juncos trapped at South Lincoln were generally heavier than those trapped at Hockessin, both samples underwent a similar progression of weight changes. The weights of the juncos remained fairly constant until late November at South Lincoln and early December at Hockessin, after which an increase in weights occurred. At this time, days of equal length were occurring 6-7 days later at Hockessin than at South Lincoln (Fig. 1B). The South Lincoln birds started their winter weight increase before those at Hockessin, even though the ambient temperature at South Lincoln was higher than at Hockessin. This would indicate that either the shorter day-length, as such, or the more rapid rate of shortening of the day-lengths at South Lincoln played the dominant role in timing this phase of the annual body weight cycle.

The Hockessin juncos began a rapid, late-winter weight loss near the end of January, whereas the South Lincoln birds began to lose weight near the middle of February. Days of equal length occur about one week earlier at Hockessin than at South Lincoln at this time of year.

It is interesting to note that the South Lincoln juncos reached a higher weight maximum even though ambient temperatures at the two locations were nearly the same.

The weights of both samples of juncos reached a minimum at the same time during the second half of March. On about 20 March, the day-length was 12 hours at both South Lincoln and Hockessin. Following this minimum, the weight curves for both samples sharply increased just prior to migration.

The limited data presented here suggest a correlation between day-length and the timing of the annual cycle. In addition to this, they suggest that the rate of change in day-length influences the degree of response during this phase of the annual cycle. Juncos experiencing a more rapid rate of change in day-length tend to show larger changes in their weights than juncos experiencing slower rates of change in day-length.

LITERATURE CITED

ANONYMOUS. 1957-8, 1962-3. The American Ephemeris and Nautical Almanac. U. S. Govt. Printing Office, Washington, D. C.

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.

MARSHALL, A. J. 1961. Breeding seasons and migration. Ch. 21 *in* Biology and Comparative Physiology of Birds, A. J. Marshall (ed.) Academic Press, New York, N. Y.

P. O. Box 302, R. D. 1., Hockessin, Delaware 19707.

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