# WEIGHTS OF SOME WESTERN SUBSPECIES OF HORNED LARKS

BY WILLIAM H. BEHLE

THE accumulation of weight data for birds has been a relatively late development in ornithology. This is indicated by Baldwin and Kendeigh (Auk, 55: 416–467, 1938) in their summary of the information available on the subject. It seems that much of the data pertaining to the weights of birds thus far accumulated has been contributed either by bird banders or by investigators carrying on special work, often of an experimental nature, with particular species of birds. A third source is that afforded by collectors and preparators through the practice of weighing specimens in the field and recording the data on the specimen tags. From this activity a wealth of data is to be found on specimens in institutions whose routine policy it is to weigh all specimens prepared.

Some years ago while engaged in a study of the distribution and variation of the western subspecies of horned larks (*Otocoris alpestris*) at the California Museum of Vertebrate Zoology, I tabulated all the weights available from the hundreds of skins examined, many of which I had personally collected and weighed. These data, while not nearly so complete as may be desired, nevertheless indicate sex, age, and geographic and seasonal variations in weight for the species. I have felt it worth while to place on record the data thus assembled, especially since Baldwin and Kendeigh (*op. cit.*) apparently had no data pertaining to horned larks for their summary and analysis. Furthermore, in few cases does there appear to be so much data available for different subspecies of a variable species as in the case of these western forms of this species.

The two sexes of horned larks show differences in their weights which correspond roughly with the degrees of difference between the sexes in measurements of extremities. Females, being smaller, weigh as a general rule less than males. The weights of 433 males representing nine different races and without respect to season, age or locality average 30.1 grams. The average likewise for 258 females is 27.9 grams. Thus there is a difference of 2.2 grams in favor of the males. This difference holds true for practically all of the subspecies as can be seen in the accompanying general summary tables (nos. 4 and 5).

The single exception has to do with the subspecies *arcticola*. The weights of 11 females of this race average 0.8 grams more than the weights of 27 males. Ten of the females were breeding birds; only

one was a winter specimen. There was no appreciable amount of fat on any of the birds when collected, according to the collector's notes. Of the 27 males, 23 are breeding birds and four are birds taken in winter. So far as season is concerned, then, the weights of the two sexes are somewhat comparable. One might have some justification for concluding that there is no sexual difference in body weight in this race and that the species, therefore, shows geographic variation in this character, were it not for the possibility that the females were about to lay eggs when taken and hence actually weighed more than they would have weighed at other times of the year. That the females were in the laying period is further indicated by the collector, Mr. T. T. McCabe, to whom I am indebted for the information.

A matter to be considered here is whether there are differences in body weight between the two sexes in the juvenile stage. In a series of nine juveniles taken in the White Mountains, Inyo County, California, five are males and average 25.1 grams, while four are females and average 24.7 grams. In seven juveniles of the same race from the Mono Lake region, Mono County, California, four males average 27.7 grams and three females, 26.1 grams. In the total of both cases, the ten males average 26.4 grams as against 25.4 grams for the eight females. These data suggest that the sexual difference in body weight commences to be apparent, in this one subspecies at least, in the juvenile stage.

Juveniles, as might be expected, weigh less than adults; at least this is indicated for one subspecies where data are available. Five juvenile males from the White Mountains, Inyo County, California, have an average body weight of 25.1 grams as compared to an average of 28.3 grams for ten adult males. Both juveniles and adults were taken not only at the same place but about the same time as well. Four juvenile females average 24.7 grams as against 26.4 grams for eleven adult

TABLE 1

AVERAGE BODY WEIGHTS OF MALES OF FOUR SUBSPECIES AND TWO AGE CATEGORIES

| | *Adults* | | *1st year* | |
|---|---|---|---|---|
| | *No.* | *Weight* | *No.* | *Weight* |
| *merrilli* | 8 | 30.9 | 6 | 31.1 |
| *lamprochroma* | 10 | 30.5 | 15 | 30.5 |
| *rubea* | 8 | 29.7 | 10 | 29.0 |
| *actia* | 10 | 29.9 | 4 | 28.0 |

females likewise taken at the same place and the same time. This indicates a difference in body weight between these two age categories in each sex. The juveniles furthermore were all in the same stage of development, having been taken at a time immediately preceding the commencement of the postjuvenal molt.

One might also expect some differences in body weight between first-year and adult age groups, but such does not appear to be the case. The pertinent data in this respect are summarized in Table 1, and it will be seen that the two categories have very similar weights.

That there are subspecific differences in body weights for some of the many different western races is indicated by the data in Tables 4 and 5. Comparing the total average weights, it will be seen that *arcticola* is by far the heaviest and *enertera* the smallest of the races studied. This focuses attention on a trend from heavy birds in the north to lighter birds as one goes south. This accompanies a decreasing trend in size from north to south.

Finally, there is the consideration regarding seasonal trends in body weight. The comparative data, with one exception, show no indications that the weights of females taken during the breeding season are any greater than those of winter-taken females. In the case of *arcticola,* the winter weight appears to be considerably greater, but little significance is to be attached to this since only one winter-female weight has been available. In contrast, the males are, in the majority of cases, distinctly heavier in winter than they are in summer. Since the males show pronounced seasonal fluctuations and the females do not, the females, then, have weights that show a closer approach to those of the males in the summer than they do in the winter.

In the case of the males, the increase in weight in the winter seems to be very definitely tied up with an accumulation of fat. Many specimens in the Museum of Vertebrate Zoology have the entry "fat" marked on the tags of winter-taken specimens. Similar entries are to be found in collectors' field notebooks. Less is known about the fat condition of the females. While females do not seem to fluctuate greatly in weight throughout the year, it is probable that they are actually fatter during the winter. It may be that weight fluctuations are not indicated by the data at hand because the birds collected had added weight because of developing eggs. If such were the case, one would expect a decrease in weight immediately after the egg-laying stage and the period of nesting activity, but data are lacking that would settle this point.

The question arises at this point as to whether or not the migratory

and non-migratory subspecies differ in their seasonal fluctuations of body weight. More information is at hand for *merrilli,* a migratory race, than for others of like category. By combining the weight data for two closely related, resident subspecies with adjacent ranges, *actia* and *ammophila,* enough weights by the month are available so that a basis of comparison is afforded with *merrilli.* This action seems justifiable because the two races, *actia* and *ammophila,* are of similar size and poorly differentiated, differing but slightly in the color of the dorsum.

TABLE 2

BODY WEIGHTS OF MALE *merrilli* IN CERTAIN MONTHS

| *Month* | *Number* | *Average* | *Minimum* | *Maximum* |
|---|---|---|---|---|
| June | 9 | 27.8 grams | 25.1 grams | 31.8 grams |
| August | 28 | 31.3 " | 28.5 " | 34.1 " |
| February | 7 | 34.9 " | 33.3 " | 36.2 " |

The data in Table 2 show that in the males of *merrilli* there is a pronounced increase in weight during the winter months. The yearly fluctuation, according to these data, is 7.1 grams, with the body weights averaging the heaviest in February. This is just before the spring migration which takes place in March. In the case of males of the resident races, the seasonal fluctuation is seemingly less pronounced, there being a yearly fluctuation of but 2.6 grams.

TABLE 3

BODY WEIGHTS OF MALE *actia* AND *ammophila,* COMBINED

| *Month* | *Males* | | | | *Females* | | | |
|---|---|---|---|---|---|---|---|---|
| | *No.* | *Av.* gr. | *Min.* gr. | *Max.* gr. | *No.* | *Av.* gr. | *Min.* gr. | *Max.* gr. |
| January | 5 | 27.1 | 26.1 | 28.8 | 4 | 26.1 | 21.8 | 29.7 |
| February | 8 | 29.7 | 27.9 | 32.0 | 3 | 27.3 | 25.5 | 30.0 |
| March | 9 | 27.2 | 25.4 | 29.2 | 5 | 25.6 | 24.4 | 27.2 |
| April | 4 | 27.8 | 26.5 | 29.9 | — | — | — | — |
| May | 5 | 28.1 | 26.2 | 29.1 | — | — | — | — |
| June | — | — | — | — | — | — | — | — |
| July | — | — | — | — | — | — | — | — |
| August | 18 | 29.7 | 25.5 | 31.6 | 15 | 27.0 | 23.2 | 30.4 |
| September | — | — | — | — | 6 | 26.5 | 23.4 | 29.0 |
| October | 18 | 28.2 | 23.4 | 30.6 | 20 | 27.1 | 23.9 | 32.1 |
| November | 36 | 28.7 | 25.9 | 32.0 | 31 | 26.7 | 21.4 | 33.5 |
| December | 12 | 28.5 | 21.8 | 30.5 | 8 | 27.0 | 26.0 | 29.0 |

TABLE 4

SUMMARY OF BODY WEIGHTS OF MALES OF TWELVE SUBSPECIES OF THE HORNED LARK

| | *Spring and Summer* | | | | | *Autumn and Winter* | | | | | *Total* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *No.* | *Av.* | *Min.* | *Max.* | *Range* | *No.* | *Av.* | *Min.* | *Max.* | *Range* | *No.* | *Av.* | *Min.* | *Max.* | *Range* |
| *arcticola* | 23 | 35.9 | 33.0 | 42.0 | 9.0 | 4 | 41.9 | 38.9 | 44.6 | 5.7 | 27 | 36.8 | 33.0 | 44.6 | 11.6 |
| *merrilli* | 15 | 28.2 | 26.4 | 31.8 | 5.4 | 35 | 32.0 | 27.7 | 36.2 | 8.5 | 50 | 30.3 | 26.4 | 36.2 | 9.8 |
| *lamprochroma* | 29 | 28.7 | 24.0 | 32.5 | 8.5 | 49 | 30.4 | 25.0 | 35.2 | 10.2 | 78 | 29.8 | 24.0 | 35.2 | 11.2 |
| *utahensis* | 14 | 28.4 | 26.4 | 30.5 | 4.1 | 44 | 29.9 | 24.5 | 32.7 | 8.2 | 58 | 29.5 | 24.5 | 32.7 | 8.2 |
| *sierrae* | — | — | — | — | — | 1 | 31.0 | 31.0 | 31.0 | — | 1 | 31.0 | 31.0 | 31.0 | — |
| *strigata* | 1 | 30.0 | 30.0 | 30.0 | — | — | — | — | — | — | 1 | 30.0 | 30.0 | 30.0 | — |
| *insularis* | — | — | — | — | — | 17 | 31.7 | 29.8 | 35.0 | 5.2 | 17 | 31.7 | 29.8 | 35.0 | 5.2 |
| *rubea* | 14 | 28.8 | 26.5 | 33.4 | 6.9 | 51 | 29.9 | 24.2 | 35.7 | 11.5 | 65 | 29.7 | 24.2 | 35.7 | 11.5 |
| *actia* | 27 | 28.8 | 24.3 | 33.1 | 8.8 | 52 | 28.1 | 21.8 | 30.5 | 8.7 | 79 | 28.4 | 21.8 | 33.1 | 11.3 |
| *ammophila* | 10 | 28.1 | 26.2 | 30.0 | 3.8 | 33 | 29.5 | 26.7 | 32.0 | 5.3 | 43 | 29.2 | 26.2 | 32.0 | 5.8 |
| *leucansiptila* | — | — | — | — | — | 15 | 30.2 | 27.3 | 32.1 | 4.8 | 15 | 30.2 | 27.3 | 31.1 | 3.8 |
| *enertera* | 1 | 30.0 | 30.0 | 30.0 | — | 5 | 27.2 | 24.7 | 28.2 | 3.5 | 6 | 27.7 | 24.7 | 30.0 | 5.3 |

TABLE 5

SUMMARY OF BODY WEIGHTS OF FEMALES OF TWELVE SUBSPECIES OF THE HORNED LARK

| | *Spring and Summer* | | | | | *Autumn and Winter* | | | | | *Total* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *No.* | *Av.* | *Min.* | *Max.* | *Range* | *No.* | *Av.* | *Min.* | *Max.* | *Range* | *No.* | *Av.* | *Min.* | *Max.* | *Range* |
| *arcticola* | 10 | 36.8 | 30.0 | 42.9 | 12.9 | 1 | 44.9 | 44.9 | 44.9 | — | 11 | 37.6 | 30.0 | 44.9 | 14.9 |
| *merrilli* | 3 | 29.0 | 28.0 | 30.0 | 2.0 | 21 | 28.5 | 24.4 | 33.8 | 9.4 | 24 | 28.4 | 24.4 | 33.8 | 9.4 |
| *lamprochroma* | 23 | 27.6 | 24.9 | 31.5 | 6.6 | 24 | 27.3 | 23.0 | 31.3 | 8.3 | 47 | 27.4 | 23.0 | 31.5 | 8.5 |
| *utahensis* | 7 | 27.9 | 25.0 | 29.6 | 4.6 | 23 | 27.9 | 22.5 | 31.7 | 9.2 | 30 | 27.9 | 22.5 | 31.7 | 9.2 |
| *sierrae* | 1 | 26.0 | 26.0 | 26.0 | — | 1 | 31.3 | 31.3 | 31.3 | — | 2 | 28.6 | 26.0 | 31.3 | 5.3 |
| *strigata* | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| *insularis* | — | — | — | — | — | 8 | 29.9 | 28.6 | 31.5 | 2.9 | 8 | 29.9 | 28.6 | 31.5 | 2.9 |
| *rubea* | 8 | 27.2 | 25.2 | 28.9 | 3.7 | 32 | 27.8 | 22.8 | 32.9 | 10.1 | 40 | 27.7 | 22.8 | 32.9 | 10.1 |
| *actia* | 22 | 26.9 | 23.2 | 30.4 | 7.2 | 44 | 26.1 | 21.4 | 29.7 | 8.3 | 66 | 26.4 | 21.4 | 30.4 | 9.0 |
| *ammophila* | 3 | 26.8 | 25.3 | 27.7 | 2.4 | 10 | 27.6 | 26.0 | 30.0 | 4.0 | 13 | 26.7 | 25.3 | 32.0 | 6.7 |
| *leucansiptila* | — | — | — | — | — | 2 | 28.4 | 25.6 | 31.2 | 5.6 | 2 | 28.4 | 25.6 | 31.2 | 5.6 |
| *enertera* | — | — | — | — | — | 2 | 24.7 | 22.1 | 27.4 | 5.3 | 2 | 24.7 | 22.1 | 27.4 | 5.3 |

Thus it would seem that there is greater metabolic change and winter-fat accumulation in the case of migratory subspecies than in permanently resident ones. In the combined data of *actia* and *ammophila,* there are indications of two peaks throughout the year; one in August after the termination of the nesting season; the other in February.

SUMMARY

Differences in body weight between the two sexes have been shown. These are probably correlated with sexual differences in size. There are indications that the sexual differences in weight begin to be apparent in the juvenile stage. Juveniles weigh less than adults, but first year birds seem to weigh about the same as adults. Females, it seems, show less seasonal variation in body weights than do males.

In one race, *merrilli,* which shows migratory behavior, the seasonal fluctuations are pronounced in the males which weigh heaviest in February. In contrast, the combined weight data for males of two closely related resident subspecies with adjacent ranges show less pronounced seasonal fluctuation. A difference in physiology affecting weight between resident and non-resident races is thus suggested. In the case of the resident races there are indications of two peaks; namely, in August and February. Horned larks thus appear to show variation in body weight by reason of sex, age, geographic area and season.

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## BIRD WEIGHTS AND EGG WEIGHTS

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IN 1922, Heinroth (18) published egg weights and body weights of several hundred species of birds of many orders from all parts of the world. With these data, aided by graphs, he was able to summarize the scattered observations of other ornithologists. Among the more important of Heinroth's conclusions are: (1)—large birds, in general, lay relatively smaller eggs than small birds; (2)—many groups have peculiarities of their own. Thus kiwis lay very large eggs, parasitic cuckoos very small ones, and precocial birds lay larger eggs than altricial ones of the same weight.

Julian Huxley (19) made a further analysis of Heinroth's data.