

VARIATION IN THE INTRODUCED ENGLISH SPARROW

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In studying variation in the Galapagos finches, Geospizinae (Lack, in press), it was thought desirable to have some bird of similar size and habits for comparison. Accordingly, the English Sparrow (*Passer domesticus domesticus*) was selected, since at the same time one could test the interesting evolutionary point of whether or not it had changed significantly since its introduction into the United States. Three measurements were taken: the culmen from the nostril to the tip of the bill, the depth of the closed bill, and the standard wing measurement. Only males with black throats were measured. The depth of the bill was not measured in specimens in which the bill would not close properly. The wing was not measured in molting or worn specimens. The table gives the number of specimens measured, and the mean and standard deviation for each of these measurements. In deference to standard taxonomic procedure, I also give the maximum and minimum measurements, but in the present investigation they have little significance. The standard deviation is, of course, a much better means of estimating the variability.

Acknowledgments.—This study would not have been possible without the large series of *Passer domesticus* in the Museum of Vertebrate Zoology, Berkeley, assembled through the initiative of the late Dr. Joseph Grinnell. The latter was fully aware of the importance of collecting extensive material of this species, and he seems to have been the only worker to have acted on this. It is particularly unfortunate that more material is not available from the eastern states for the early years when the species was rapidly increasing, and it is to be hoped that material will be collected from areas to which the species has spread only very recently for comparison at some future date when the population has become stabilized. This particularly applies to the southern part of California, where there is some evidence that the species is changing.

I have also to thank the following museums for allowing me to measure their specimens: Los Angeles, San Diego, California Academy of Sciences (San Francisco), Museum of Comparative Zoology (Cambridge), United States National Museum (Washington), University of Michigan, Field Museum (Chicago), and American Museum of Natural History (New York). The majority of the European specimens were in the Rothschild collection now housed with the last-named museum.

Localities.—Almost all the English specimens were collected in the southern counties, a very few in the midlands and in the north. Most of the German specimens were collected at Augsburg, Bavaria. The heading "eastern states" includes specimens from New York, Connecticut, Rhode Island, New Jersey, Massachusetts, Pennsylvania, Washington, D. C., Virginia, and Maryland. The specimens from the three last regions were first treated separately, but were grouped with those from the other eastern states when it was found that they showed no significant differences from them in mean or standard deviation. For the "mid-western states" I selected three states from which large series were available, namely, Minnesota, Illinois and Wisconsin. "Southern California" includes the counties of Madera, Fresno, Tulare, Inyo, San Bernardino, Ventura, Los Angeles, Orange, Riverside, San Diego and Imperial, and with these are included specimens from Lower California, Mexico. Originally specimens from Lower California, and also specimens from extreme southern California (San Diego, Imperial, Riverside, Orange, and Los Angeles counties) were treated separately, but it was found that they showed no significant differences in mean or standard deviation from each other or from those of the other counties in the southern half of California listed above, so all were

grouped together. Specimens were measured from a few other states, particularly South Carolina and Colorado, but the series were hardly adequate, and they apparently resembled specimens from other parts of the United States (omitting southern California) and so were not included in the table.

Specimens from the eastern states were collected chiefly in the last fifty years, those from the mid-western states mostly in the last forty years, and those from Berkeley mainly between 1910 and 1917. In all cases this was after the initial period of rapid increase. Birds from southern California were collected mostly after 1916, those from Lower California from 1925 to 1928.

Only a geographic comparison of specimens was made. The question of whether city specimens differ from those of the countryside was not investigated, as sufficient material was not available from the same geographic region.

Measurements of Male *Passer domesticus*

Locality	Bill length (from nostril)			Depth of bill			Wing		
	Number	Mean, standard deviation	Range	Number	Mean, standard deviation	Range	Number	Mean, standard deviation	Range
England	122	9.28 σ .37	8.5-10.8	97	8.69 σ .35	7.9-9.5	109	75.7 σ 1.85	71-80
Germany	35	9.44 σ .36	8.7-10.2	30	8.86 σ .26	8.3-9.2	37	77.8 σ 1.91	74-81
Eastern states	109	9.44 σ .44	8.6-11.3	77	8.73 σ .30	7.8-9.4	107	77.2 σ 1.59	73-81
Mid-western states	79	9.51 σ .44	8.4-10.4	69	8.87 σ .28	8.0-9.3	77	77.6 σ 1.50	74-82
Berkeley, Calif.	91	9.37 σ .40	8.2-10.3	88	8.74 σ .29	8.0-9.4	77	76.7 σ 1.46	74-80
Southern Calif., Lower Calif.	70	9.70 σ .54	8.5-11.0	66	8.93 σ .31	8.4-9.5	67	77.2 σ 1.67	74-81
Honolulu	14	9.82 σ .30	9.4-10.4	14	8.71 σ .32	8.2-9.2	15	78.1 σ 1.60	76-81

Discussion of results.—It seems generally to be assumed that the sparrows introduced to America all came from England. This is not so. Most came from England, but Gentry (*The House Sparrow at Home and Abroad*, 1878, p. 34) records some brought from Germany, and though nearly all of these died, a few individuals survived, so perhaps (but not certainly) this stock persisted and interbred with the English birds. As pointed out by Kleinschmidt, German specimens average rather larger than English ones, but Witherby (*Handbook of British Birds*, vol. 1, 1938, p. 157) shows this is not sufficient to justify the separation of *P. hostilis*. Omitting for the moment the specimens from southern California, the table shows that American specimens average rather larger in both bill and wing than English ones, but, while this might mean that the original English birds had changed slightly, this cannot be considered proved since the American birds are not larger than German birds. Actually, the American specimens come much closer in average to the German population than to the English, despite the fact that at least the great majority of the original stock was English.

As regards bill length, the birds from the southern part of California and from Lower California average significantly larger than those from the other American localities, while the depth of bill is also great. They are also larger than the average for German specimens, so some evolution must have occurred, and it is interesting that this has been in the direction of the so-called "Allen's rule" which states that extremities (bill, legs) are longer in regions of warmer temperatures. The difference is only small, and further series ought to be collected from this region now, for comparison in the future. The wing does not show a corresponding increase in size. It may be noted that the subspecies of *P. domesticus* in India average rather smaller, not greater, in culmen length than European birds, which is against Allen's rule.

A small series from Honolulu averages slightly larger still. This might be because the original introduced specimens were atypical. Alternatively, as in southern California, some evolution may have occurred after arrival.

While the populations of southern California and Honolulu are slightly different, what the table chiefly demonstrates is the amazing stability of the introduced *P. d. domesticus*. In spite of an enormous expansion in numbers with, one would have thought, a reduced intensity of selection pressure, and in spite of subjection to most varied climatic conditions, *P. domesticus* in much of the United States shows no significant differences in either mean or standard deviation for bill and wing as compared with European birds. On theoretical grounds, one might have expected a rapidly expanding population to show greater variability in characters than a stable one, but the American *P. domesticus* measured are not more variable than the European birds, except perhaps for the bill length of specimens from southern California. (However, there are no adequate series available of specimens collected during the period of most rapid expansion, that is, in the years immediately following colonization, except in the case of southern California, where specimens have been collected a few years after the bird established itself.)

Bumpus (Biol. Lect. Marine Biol. Lab. Wood's Holl 1896-1897, p. 6) showed that the eggs of American *P. domesticus* are significantly different in mean size from eggs taken in England. He did not compare them with German specimens, and therefore his conclusion that evolution had actually occurred cannot be accepted until German specimens have been checked. He also found the American eggs to be much more variable than British ones, a conclusion which is unlikely to be affected by comparison with German material. This greater variability was what the writer had expected to find, but did not, in regard to bill and wing size of American as compared with European birds. A similar study ought to be carried out on European and American Starlings (*Sturnus vulgaris*) because in this species one can be certain of getting a large series in an area where rapid expansion is now taking place.

Correlation coefficients have seldom been worked out for birds, and accordingly the following results for the Berkeley population of *P. domesticus* may be of interest.

	Number measured	Coefficient of correlation
Wing: bill from nostril	76	+ .067
Wing: depth of bill	73	- .026
Bill from nostril: depth of bill	87	+ .155

The table shows there is no significant correlation between wing and bill; there is possibly a slight correlation between bill length and depth of bill, but the figure is not significant. This is in marked contrast to some of the larger geospizine species (Lack, in press), which show high positive correlations.

SUMMARY

1. Introduced *Passer domesticus* in America are remarkably stable in wing and bill measurements.

2. They show no significant differences from European specimens in averages for bill or wing except in southern California, where the bill averages slightly larger. There also are no differences in variability (standard deviation), except possibly for bill length in southern California.

3. There is no correlation between wing and bill, and no, or at most a very small, correlation between bill length and depth.

Toines, South Devonshire, England, June 7, 1940.