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VARIATION IN THE WOOD-MOUSE, *PEROMYSCUS LEUCOPUS NOVEBORACENSIS*, IN THE NORTHEASTERN UNITED STATES

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THE variability of the characters of the wood-mouse, *Peromyscus leucopus*, seems not heretofore to have been described in detail. The present study records the amount of variation in several measurements of a number of stocks of the subspecies *noveboracensis*, from localities scattered over a considerable part of its range (Map 1). *P. l. noveboracensis* has an extensive range over most of the mainland of the northeastern United States, and it occurs also in parts of southern Canada. Related subspecies occur on islands in this region and in the southern and western states and in Mexico.

METHODS OF STUDY

The mice described in this report are mostly the descendants of breeding stocks secured at the several collecting localities. The cage-bred offspring were reared under uniform laboratory conditions at the University of Michigan in Ann Arbor, and they were all fed a uniform ration. In the spring of the year, when molt is least active, the mice were killed and the skins, skulls, and femurs prepared in a standard manner as specimens.

The several stocks of cage-bred mice are believed to be fully comparable. The environmental influences which affect the growth of the young mice have been kept as nearly uniform as possible, and all the animals have been kept in the same laboratory. The differences in the measurements of the several stocks are assumed, therefore, to be due mostly to differences in the hereditary characters of the populations at the field stations where the original stocks were secured.

The methods used in taking the various measurements and color readings have been described in a previous paper (Dice, 1932: 5–7, 19–22). The body measurements have all, except for the Sand Point wild-killed series, been taken by myself. The measurements of the bones and the tint photometer readings have been made by Reeve M. Bailey, Earl Cady, Margaret Liebe, and Palmer Sime. The statistical computations have been made by Margaret Liebe. Standard errors, rather than probable errors, are used throughout the report.

Most of the specimens used in this study are from mice of the *1-year age class,* which when killed were aged between 36 and 78 weeks. The mice of the *2-year age class* were aged when killed between 79 and 130 weeks. The *field-caught* mice were caught in the field in the spring or summer and kept in the laboratory until the following spring before being prepared as specimens. The specimens prepared from mice killed immediately after their capture are designated *wild-killed.*

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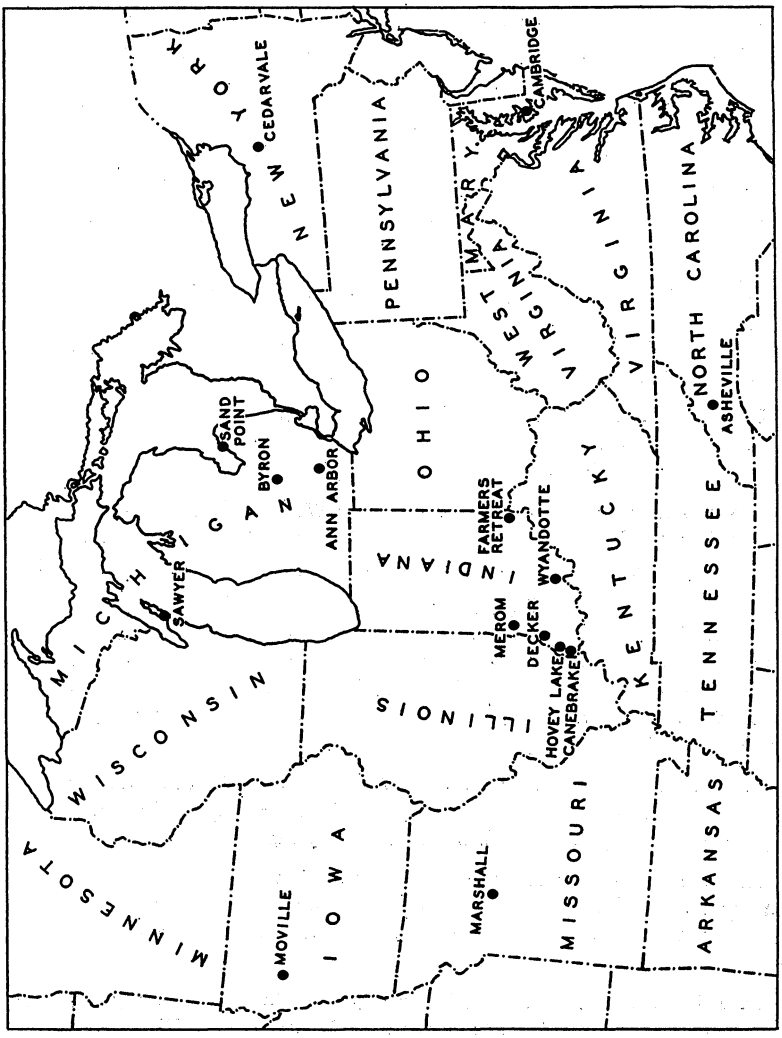
Stocks of Mice

The breeding stock of mice from each locality was collected within a small geographical area, usually less than a mile in greatest diameter. The attempt has been made to secure 5 to 12 pairs at each locality and to avoid inbreeding in the laboratory in order that the genetic variability of each wild popula-



MAP 1. Part of the eastern United States, showing the localities at which the stocks of woodmice were secured.

tion might be well represented in the cage-bred offspring. However, the original breeding stocks from a few localities were small, and some inbreeding has necessarily occurred in these weak stocks. The number of field-caught parents producing each stock is given in Table II.

The original breeding stocks from Indiana were collected in 1930 by Paul F. Hickie while he was collecting mammals for the Indiana Department of Conservation under the direction of Marcus W. Lyon, Jr. The collectors of the other mice are named in the following descriptions of the stocks:

Marshall, Missouri. The parents of the stock were received in May, 1929, from Robert K. Enders and his students. The mice were taken in a small patch of woods near Marshall, Saline County, Missouri. There was considerable inbreeding in the laboratory.

Moville, Iowa. Paul A. Moody secured the original animals near Moville, Woodbury County, Iowa, in the summer of 1925. The cage-bred mice were considerably inbred.

Sawyer, Wisconsin. In the summer of 1930 W. L. Strunk secured this stock in Sunset Forest, 7 miles northwest of Sawyer, Door County, Wisconsin. There was no inbreeding in the laboratory.

Sand Point, Michigan. Projecting into the south side of Saginaw Bay, in Huron County, Michigan, is a long sand spit known as Sand Point. Here in early May, 1931, Philip Allan collected a number of mice alive for breeding and for preparation as wild-killed specimens. The exact locality is about 8 miles in a direct line northwest of Pigeon. There was no inbreeding in the laboratory.

Byron, Michigan. The breeding stock was taken by Robert M. Bradley 2 miles west of Byron, Shiawassee County, Michigan, during June and July, 1929. The cage-bred stock was considerably inbred.

Ann Arbor D, Michigan. The D locality stock was taken by myself in a small woodlot 2 miles southeast of Ann Arbor, Washtenaw County, Michigan, in August, 1929. There was a small amount of inbreeding in the laboratory.

Ann Arbor St, Michigan. The St locality consists of two closely adjoining woodlots about 4 miles northeast of Ann Arbor, Washtenaw County, Michigan, and about a half-mile west of the village of Dixboro. The breeding stock was collected in part by Leroy C. Stegeman in 1928 and 1929, and in part by W. L. Strunk in the summer of 1929. There was a small amount of inbreeding.

Ann Arbor W, Michigan. The W locality consists of a rather large woodlot about 4 miles southwest of Ann Arbor. The original stock was taken by myself in August, 1929. Only 3 individuals of the cage-bred generation were produced through inbreeding.

Merom, Indiana. The breeding stock was collected in the Bernice Harper Briseboise Woods about 2 miles north of Merom, Sullivan County, Indiana. There was no inbreeding in the production of the cage-bred animals.

Decker, Indiana. The collecting station is at a place called Little Cypress, located about 10 miles southwest of Decker, Knox County, Indiana. There was no inbreeding.

Hovey Lake, Indiana. This lake is located in Posey County, Indiana, about 10 miles south of Mount Vernon. There was no inbreeding in the laboratory.

Canebrake, Indiana. The Canebrake locality is in Posey County, Indiana, less than 3 miles southwest of the Hovey Lake locality. There was no inbreeding in this stock.

Wyandotte, Indiana. The collecting locality is about one-fourth mile from Wyandotte, Crawford County, Indiana. Wyandotte is near the eastern edge of the county, about 4 miles northeast of Leavenworth. There was no inbreeding.

Farmers Retreat, Indiana. The breeding stock was taken in Harting Woods, about 3 miles southwest of Farmers Retreat, which is near the southwestern corner of Dearborn County, Indiana. There was no inbreeding.

Cedarvale, New York. In the summer of 1929 L. C. Stegeman secured the parents of the stock on the Chase farm in Onondaga County, New York, between Cedarvale and South Onondaga. There was a slight amount of inbreeding in the laboratory.

Cambridge, Maryland. The stock is from near Cambridge, Dorchester County, Maryland, and was secured in 1929 by Ralph W. Jackson. There was no inbreeding.

Asheville, North Carolina. A. H. Howell secured the original members of this stock near Asheville, Buncombe County, North Carolina, in 1928. There was a small amount of inbreeding.

Variation Due to Sex

The males in slightly over half of the stocks of these mice average slightly longer in body length than the females. The differences are of no statistical significance except in the stocks

from Cambridge and Ann Arbor W, in which the males of the cage-bred 1-year age class have on the average 3.05 ± 1.00 and 2.23 ± 0.71 mm., respectively, longer bodies than the females. In the combined measurements of the 1-year age class of all the stocks the males average 0.91 ± 0.31 mm. longer in body length than the females, a difference which is 2.9 times its standard error and probably significant. The indication is that the males on the average slightly exceed the females in body length.

In tail length and in ear length there seems to be no significant difference between the two sexes.

In foot length the males exceed the females slightly in most though not in all the stocks. The greatest differences are in the stocks from Ann Arbor W and Hovey Lake. In these 2 stocks the males average, respectively, 0.342 ± 0.104 and 0.649 ± 0.186 mm. longer in the hind foot than the females, the differences being 3.3 and 3.5 times, respectively, their standard errors. In the combined measurements of all the stocks the males of the 1-year class exceed the females in foot length by 0.170 ± 0.044 mm., a difference which is 3.9 times its standard error and is significant.

In weight the males of the 1-year age class exceed the females in each of the 6 stocks for which weights were taken, and in most of these stocks the sexual differences are statistically significant (Table I). The greatest difference occurs in the Sand Point stock, in which the males average 6.05 ± 2.01

TABLE I

WEIGHT OF *PEROMYSCUS LEUCOPUS NOVEBORACENSIS*

One-year class; means and standard errors in grams.

STOCK	NO.	♀	NO.	♂
Sawyer, Wis.	29	20.38 ± 0.71	36	24.97 ± 0.83
Sand Point, Mich.	16	18.69 ± 0.86	27	24.74 ± 1.13
Ann Arbor W, Mich. ...	53	18.24 ± 0.41	52	22.79 ± 0.65
Cedarvale, N. Y.	44	18.36 ± 0.46	42	22.05 ± 0.61
Cambridge, Md.	35	16.89 ± 0.20	23	21.04 ± 0.97
Asheville, N. C.	32	19.97 ± 0.59	36	21.89 ± 0.65

grams heavier than the females, a difference 3.0 times its standard error. The most significant difference occurs in the Ann Arbor W stock, in which the males average 4.54 ± 0.77 grams heavier than the females, the difference being 5.9 times its standard error. The smallest difference occurs in the Asheville stock, in which the males average 1.92 ± 0.87 grams the heavier, the difference being only 2.2 times its standard error.

In the measurements of the femur and of the skull there are no consistent sexual differences. In some stocks one sex may exceed the other in certain skeletal measurements by an amount which standing alone would be considered significant, but in some stocks the other sex may average the larger. Likewise in the tint photometer readings of pelage color, both of the dorsal stripe and of the side, the sexes seem not to differ to any significant amount.

The wood-mouse, *Peromyscus leucopus noveboracensis,* parallels the deer-mouse, *Peromyscus maniculatus* (Dice, 1932: 14, and 1933: 7) in sexual differences. In both species the males slightly exceed the females in average length of the hind foot, and the males average heavier in body weight. In the wood-mouse there is in addition an indication that the males slightly exceed the females in average body length. No sexual differences are demonstrated in the other measurements or in the tint photometer readings of pelage color. The differences between males and females in body dimensions are so slight that in comparing the characters of the stocks the measurements of both sexes from each geographical locality have been combined into a common mean.

Variation Due to Age

For the determination of possible growth after the first year of age in *Peromyscus leucopus noveboracensis* there are available only about 20 specimens of the cage-bred 2-year age class in each of 2 stocks: Cedarvale and Moville. A comparison between the body measurements of the 2-year old and 1-year old mice of these stocks (see Table II) fails to disclose any important differences correlated with age.

TABLE II

BODY MEASUREMENTS OF *PEROMYSCUS LEUCOPUS NOVEBORACENSIS*
Means and standard errors in millimeters.

STOCK	NO.	AVERAGE AGE IN WEEKS	NO. OF PARENTS	BODY LENGTH	TAIL LENGTH	HIND FOOT	EAR LENGTH
Marshall, Mo., 1-yr.	36	53	3	98.31 ± 0.67	86.57 ± 0.64	20.964 ± .131	15.997 ± .114
Moville, Iowa, 1-yr.	45	54	3	95.96 ± 0.66	84.24 ± 0.52	21.308 ± .109	15.554 ± .077
2-yr.	25	95	..	97.24 ± 1.05	83.48 ± 1.30	20.784 ± .218	15.472 ± .167
Sawyer, Wis., 1-yr.	65	46	16	97.89 ± 0.53	73.74 ± 0.57	20.524 ± .061	16.545 ± .074
Field-caught	165	..	..	98.47 ± 0.32	78.03 ± 0.32	20.085 ± .044	16.769 ± .050
Sand Point, Mich., 1-yr. ..	43	49	16	95.30 ± 0.52	77.02 ± 0.85	20.186 ± .099	17.074 ± .087
Field-caught	22	..	..	98.55 ± 0.71	78.17 ± 1.30	20.214 ± .136	17.477 ± .116
Wild-killed	66	..	..	86.29 ± 0.61	79.40 ± 0.71	20.294 ± .092	16.494 ± .086
Byron, Mich., 1-yr.	38	55	6	92.00 ± 0.57	81.00 ± 1.00	20.882 ± .103	17.197 ± .107
Ann Arbor D, Mich., 1-yr.	60	47	10	92.05 ± 0.49	81.29 ± 0.91	20.158 ± .096	16.805 ± .082
Ann Arbor St, Mich., 1-yr.	54	58	8	92.35 ± 0.70	83.72 ± 0.62	20.607 ± .082	16.652 ± .064
Ann Arbor W, Mich., 1-yr.	105	53	20	95.86 ± 0.37	80.83 ± 0.48	20.581 ± .056	16.886 ± .055
Field-caught	37	..	..	94.52 ± 0.84	86.05 ± 0.90	20.536 ± .107	17.138 ± .126
Merom, Ind., 1-yr.	20	45	10	99.70 ± 0.79	76.63 ± 0.77	20.570 ± .137	17.075 ± .142
Decker, Ind., 1-yr.	87	50	12	98.59 ± 0.47	77.06 ± 0.61	20.906 ± .077	16.364 ± .058
Hovey Lake, Ind., 1-yr. ..	44	46	10	95.05 ± 0.77	76.84 ± 0.77	20.654 ± .117	16.509 ± .076
Canebrake, Ind., 1-yr.	73	51	8	98.15 ± 0.57	80.48 ± 0.59	20.652 ± .078	16.829 ± .092
Wyandotte, Ind., 1-yr. ...	42	49	10	98.19 ± 0.59	78.07 ± 0.92	20.771 ± .093	16.879 ± .087
Farmers Retreat, Ind., 1-yr.	33	53	4	96.67 ± 0.60	79.31 ± 0.62	20.906 ± .094	17.258 ± .077
Cedarvale, N. Y., 1-yr.	86	54	6	93.40 ± 0.37	75.58 ± 0.44	20.624 ± .065	16.544 ± .061
2-yr.	20	89	..	95.20 ± 0.79	78.44 ± 1.02	20.380 ± .109	16.675 ± .139
Cambridge, Md., 1-yr.	58	55	4	94.64 ± 0.48	71.81 ± 0.44	20.725 ± .074	16.405 ± .068
Asheville, N. C., 1-yr.	67	47	6	90.20 ± 0.46	76.25 ± 0.63	20.122 ± .061	16.198 ± .085

Body length averages greater in the 2-year (79 weeks or more) old mice than in the 1-year (36 to 78 weeks) old mice in both the stocks, but the differences are small, and the greatest difference in either stock is only 2.1 times its standard error. In foot length both males and females of the 2-year old mice in both stocks average shorter than the 1-year old mice. The differences, however, are slight and range only from 0.9 to 2.1 times their standard errors, and no reduction in foot length with increasing age is indicated. There is no consistent nor significant difference in tail length nor ear length between the 2 age classes. In the measurements, also, of the femur and skull there seems to be no significant difference between the 1-year old and 2-year old mice (Table III).

In pelage color there seems to be no important difference between the 1-year old and 2-year old mice (Tables IV and V). Only in the Cedarvale stock is there a significant age difference in the tint photometer readings of the dorsal stripe for reflected yellow, the 1-year mice averaging 0.90 ± 0.23 units more than the 2-year old mice, the difference being 3.8 times its standard error. The readings for green and for peacock blue of the dorsal stripe in this stock also average greater in the 1-year old mice, and the differences for these colors are of probable significance being, respectively, 2.7 and 2.6 times their standard errors. The average readings for reflected red and for blue-violet of the dorsal stripe, on the contrary, and for all the colors of the side in this stock do not differ significantly between the age classes. In the Moville stock there is no significant difference between the age classes for any color reading. In view of the general absence of significant differences in pelage color between the age classes for most of the color comparisons of these two stocks, the significant difference for yellow in the dorsal stripe readings for the Cedarvale stock is considered unimportant.

The failure of these data to disclose any growth in the woodmouse after the first year of life does not surely prove the absence of growth after the first year, for there are few 2-year old mice available for comparison. Nevertheless, if any growth

does occur during the second year of life in this species the amount of increase in size must be relatively slight.

The correlation between body dimensions and age in the species *Peromyscus leucopus* is shown by these data to be very different than in the related species *maniculatus*. In previous studies (Dice, 1932: 13; 1933: Table I; and 1936: 55–57) it has been shown that in two subspecies, *bairdii* and *rufinus,* of the species *maniculatus* growth of most parts of the body and skeleton continues into the second year of life, and that in the subspecies *gracilis* some parts continue to grow even into the fourth year of life. In *leucopus,* on the contrary, there is no evidence that growth of any part of the body occurs during the second year of life.

Effect of Captivity

The effect of captivity on the characters of these mice can be determined in part by the comparison of the cage-bred mice with field-caught mice kept in the laboratory for a number of months before being prepared as specimens. Another useful comparison is of the cage-bred mice with wild-killed mice which have been prepared as specimens in the field or which have been kept under laboratory conditions for at most only a few days.

Measurements of field-caught mice which were kept in the laboratory for at least 6 months before being killed are available in 3 stocks: Sawyer, Sand Point, and Ann Arbor W (Tables II and III). The largest series of field-caught specimens, numbering 165, is from Sawyer. The other series are much smaller.

Wild-killed specimens are available only from one locality, Sand Point, where 66 mice were captured in early May, 1931, and the following week were prepared. These wild-killed mice are indicated by the amount of wear on the teeth to be mature animals, and all of them must have been born the previous year or before. They were prepared in exactly the same manner as our other specimens. The body measurements, however, of these wild-killed mice were made by Philip Allan

TABLE III

SKELETAL MEASUREMENTS OF *PEROMYSCUS LEUCOPUS NOVEBORACENSIS*
Means and standard errors in millimeters.

STOCK	NO.	FEMUR	MANDIBLE	CONDYLE-PREMAXILLA	CONDYLE-ZYGOMA	BULLAR WIDTH
Marshall, Mo., 1-yr.	36	17.235 ± .098	17.125 ± .054	25.569 ± .087	18.389 ± .068	11.028 ± .039
Moville, Iowa, 1-yr.	36	17.447 ± .087	17.389 ± .069	25.624 ± .094	18.517 ± .075	11.249 ± .040
2-yr.	24	17.430 ± .153	17.329 ± .113	25.488 ± .140	18.254 ± .103	11.138 ± .056
Sawyer, Wis., 1-yr.	63	16.789 ± .071	16.713 ± .049	24.938 ± .059	18.087 ± .047	10.910 ± .029
Field-caught	152	17.126 ± .054	16.595 ± .038	24.875 ± .049	18.161 ± .036	10.973 ± .024
Sand Point, Mich., 1-yr.	35	16.259 ± .102	16.034 ± .063	24.223 ± .100	17.686 ± .073	10.634 ± .036
Field-caught	19	16.853 ± .129	16.189 ± .078	24.663 ± .082	18.042 ± .063	10.828 ± .079
Wild-killed	66	16.785 ± .070	15.937 ± .060	24.275 ± .076	17.915 ± .050	10.871 ± .036
Byron, Mich., 1-yr.	36	16.809 ± .114	16.400 ± .068	24.378 ± .095	17.608 ± .062	11.063 ± .043
Ann Arbor D, Mich., 1-yr.	55	16.317 ± .073	15.880 ± .063	23.975 ± .087	17.407 ± .072	10.680 ± .044
Ann Arbor St, Mich., 1-yr.	54	16.326 ± .095	16.091 ± .060	24.404 ± .068	17.704 ± .053	10.852 ± .031
Ann Arbor W, Mich., 1-yr.	96	16.760 ± .066	16.402 ± .044	24.811 ± .058	17.882 ± .044	10.823 ± .029
Field-caught	31	17.084 ± .107	16.219 ± .076	24.635 ± .109	17.903 ± .072	10.932 ± .044
Merom, Ind., 1-yr.	18	16.733 ± .189	16.706 ± .129	25.059 ± .111	18.222 ± .100	11.078 ± .063
Decker, Ind., 1-yr.	85	16.867 ± .084	16.668 ± .048	24.830 ± .071	17.994 ± .047	11.001 ± .027
Hovey Lake, Ind., 1-yr.	44	16.427 ± .079	16.775 ± .063	24.814 ± .078	18.042 ± .060	10.902 ± .037
Canebrake, Ind., 1-yr.	73	16.832 ± .087	16.914 ± .051	25.078 ± .068	18.206 ± .052	10.972 ± .030
Wyandotte, Ind., 1-yr.	41	17.023 ± .135	16.695 ± .064	25.118 ± .096	18.127 ± .073	11.083 ± .036
Farmers Retreat, Ind., 1-yr.	31	17.003 ± .128	16.490 ± .073	24.713 ± .104	17.919 ± .090	10.987 ± .029
Cedarvale, N. Y., 1-yr.	85	16.160 ± .057	16.415 ± .045	24.718 ± .059	17.764 ± .045	10.718 ± .026
2-yr.	19	16.395 ± .124	16.584 ± .067	24.988 ± .107	17.816 ± .086	10.805 ± .059
Cambridge, Md., 1-yr.	52	16.262 ± .066	16.431 ± .044	24.684 ± .052	17.798 ± .051	10.816 ± .038
Asheville, N. C., 1-yr.	62	16.198 ± .079	16.231 ± .048	24.410 ± .070	17.587 ± .064	10.774 ± .034

and are not strictly comparable with the measurements of the field-caught and cage-bred specimens of this stock, which were made by myself. They are therefore not included in the following comparisons. The measurements of the skulls and femurs and the tint photometer readings of the wild-killed specimens were made by the same persons who measured the field-caught and cage-bred animals of this and the other stocks, and all should be strictly comparable.

In body length the Sand Point field-caught mice average 3.24 ± 0.88 mm. longer than the cage-bred mice of the 1-year age class, a difference 3.7 times its standard error and therefore statistically significant. In the Sawyer stock, on the contrary, there is no significant difference between the field-caught and cage-bred series. In the Ann Arbor W stock the cage-bred animals average slightly though not significantly the larger. The indication is that the cage-bred mice do not usually differ to an important degree in body length from the field-caught mice.

In tail length the field-caught Sawyer mice exceed the cage-bred mice of the 1-year age class by 4.29 ± 0.66 mm. Likewise the Ann Arbor W field-caught mice exceed the cage-bred, 1-year class by an average of 5.23 ± 1.02 mm. These differences are 6.5 and 5.1 times, respectively, their standard errors and are therefore highly significant. The longer tails of these field-caught mice are probably not due to greater average age than the 1-year old cage-bred mice, for there is no certain evidence that growth in tail length or any other dimension occurs in this species after the first year of age. In the Sand Point stock, on the contrary, there is no significant difference between the field-caught and cage-bred series, though the field-caught mice have on the average a slightly longer tail. In 2 stocks out of 3 there is therefore a strong indication that the cage-bred mice aged 1 year have shorter tails than field-caught mice kept for a number of months in the laboratory. In the combined averages of the 3 stocks the tails of the field-caught mice exceed those of their cage-bred descendants by 1.56 ± 0.55 mm., a difference 2.8 times its standard error and probably significant.

TABLE IV

COLOR OF DORSAL STRIPE OF *PEROMYSCUS LEUCOPUS NOVEBORACENSIS*
Mean tint photometer readings and standard errors in per cent.

STOCK	NO.	RED	YELLOW	GREEN	PEACOCK BLUE	BLUE-VIOLET
Marshall, Mo., 1-yr.	36	8.56 ± .25	7.08 ± .19	5.69 ± .13	4.75 ± .11	4.14 ± .09
Moville, Iowa, 1-yr.	44	8.59 ± .24	7.07 ± .21	5.75 ± .20	4.82 ± .17	4.16 ± .17
2-yr.	25	8.28 ± .35	6.88 ± .26	5.76 ± .22	4.92 ± .20	4.24 ± .18
Sawyer, Wis., 1-yr.	65	8.25 ± .15	6.82 ± .13	5.52 ± .11	4.74 ± .10	4.14 ± .09
Field-caught	161	8.47 ± .10	7.04 ± .08	5.80 ± .06	4.96 ± .06	4.35 ± .05
Sand Point, Mich., 1-yr.	40	12.48 ± .33	10.20 ± .24	8.18 ± .20	6.93 ± .17	6.13 ± .14
Field-caught	21	12.29 ± .53	10.14 ± .39	7.81 ± .29	6.52 ± .22	6.05 ± .20
Wild-killed	66	6.35 ± .17	5.39 ± .15	4.62 ± .14	4.12 ± .12	3.58 ± .10
Byron, Mich., 1-yr.	38	6.92 ± .16	5.76 ± .12	4.74 ± .10	4.05 ± .07	3.53 ± .08
Ann Arbor D, Mich., 1-yr.	60	8.13 ± .15	6.83 ± .14	5.50 ± .11	4.77 ± .10	4.08 ± .09
Ann Arbor St, Mich., 1-yr.	54	10.28 ± .30	8.37 ± .25	6.39 ± .19	5.54 ± .16	4.70 ± .15
Ann Arbor W, Mich., 1-yr.	104	8.46 ± .13	6.89 ± .10	5.41 ± .08	4.54 ± .07	3.80 ± .06
Field-caught	37	7.81 ± .20	6.16 ± .16	4.92 ± .13	4.05 ± .09	3.40 ± .10
Merom, Ind., 1-yr.	19	7.58 ± .24	6.37 ± .21	5.26 ± .18	4.47 ± .11	3.84 ± .11
Decker, Ind., 1-yr.	85	6.89 ± .12	5.67 ± .09	4.71 ± .08	4.04 ± .07	3.48 ± .06
Hovey Lake, Ind., 1-yr.	44	11.25 ± .35	9.36 ± .27	7.55 ± .23	6.41 ± .17	5.59 ± .16
Canebrake, Ind., 1-yr.	73	10.38 ± .24	8.64 ± .20	6.82 ± .14	5.82 ± .14	4.97 ± .11
Wyandotte, Ind., 1-yr.	42	10.64 ± .42	8.64 ± .33	6.55 ± .24	5.50 ± .20	4.76 ± .16
Farmers Retreat, Ind., 1-yr.	33	9.49 ± .36	7.91 ± .30	6.36 ± .27	5.45 ± .23	4.82 ± .23
Cedarvale, N. Y., 1-yr.	86	7.76 ± .14	6.50 ± .11	5.26 ± .09	4.42 ± .07	3.83 ± .07
2-yr.	20	6.85 ± .24	5.60 ± .20	4.70 ± .19	3.95 ± .17	3.50 ± .18
Cambridge, Md. 1-yr.	56	8.04 ± .20	6.73 ± .15	5.20 ± .10	4.34 ± .08	3.66 ± .08
Asheville, N. C., 1-yr.	68	7.29 ± .12	5.90 ± .09	4.69 ± .08	3.88 ± .06	3.34 ± .06

TABLE V

COLOR OF SIDE OF *PEROMYSCUS LEUCOPUS NOVEBORACENSIS*
Mean tint photometer readings and standard errors in per cent.

STOCK	NO.	RED	YELLOW	GREEN	PEACOCK BLUE	BLUE-VIOLET
Marshall, Mo., 1-yr.	36	18.97 ± .36	15.25 ± .27	11.75 ± .24	9.69 ± .19	8.61 ± .19
Moville, Iowa, 1-yr.	44	20.27 ± .30	16.48 ± .31	12.41 ± .28	10.36 ± .26	9.09 ± .22
2-yr.	25	19.40 ± .52	15.88 ± .40	12.24 ± .35	10.32 ± .26	9.16 ± .21
Sawyer, Wis., 1-yr.	65	19.14 ± .25	15.31 ± .23	11.57 ± .19	9.52 ± .16	8.26 ± .15
Field-caught	161	20.05 ± .15	16.41 ± .13	12.60 ± .11	10.40 ± .09	9.20 ± .08
Sand Point, Mich., 1-yr.	40	20.88 ± .35	17.25 ± .30	12.98 ± .23	10.80 ± .21	9.58 ± .20
Field-caught	21	20.29 ± .59	16.24 ± .42	12.67 ± .33	9.95 ± .28	9.14 ± .26
Wild-killed	66	16.06 ± .29	12.97 ± .23	11.09 ± .20	9.11 ± .18	8.02 ± .14
Byron, Mich., 1-yr.	38	16.84 ± .29	13.45 ± .23	10.08 ± .15	8.55 ± .14	7.47 ± .15
Ann Arbor D, Mich., 1-yr.	60	19.03 ± .23	15.18 ± .20	11.75 ± .19	9.70 ± .16	8.55 ± .16
Ann Arbor St, Mich., 1-yr.	54	19.78 ± .29	15.91 ± .26	12.06 ± .20	9.83 ± .16	8.63 ± .16
Ann Arbor W, Mich., 1-yr.	104	20.02 ± .19	15.82 ± .15	11.74 ± .13	9.46 ± .10	8.29 ± .10
Field-caught	37	19.81 ± .34	15.41 ± .30	11.19 ± .23	8.97 ± .19	7.70 ± .18
Merom, Ind., 1-yr.	19	19.53 ± .41	15.84 ± .31	11.95 ± .27	10.11 ± .28	8.90 ± .25
Decker, Ind., 1-yr.	85	17.46 ± .18	14.07 ± .15	10.58 ± .12	8.82 ± .10	7.69 ± .10
Hovey Lake, Ind., 1-yr.	44	20.70 ± .30	17.05 ± .22	13.05 ± .16	10.86 ± .15	9.68 ± .14
Canebrake, Ind., 1-yr.	73	19.08 ± .26	15.51 ± .23	11.60 ± .13	9.53 ± .13	8.32 ± .12
Wyandotte, Ind., 1-yr.	42	21.64 ± .32	17.29 ± .28	12.55 ± .22	10.19 ± .19	8.76 ± .16
Farmers Retreat, Ind., 1-yr.	33	18.33 ± .25	14.64 ± .23	11.21 ± .22	9.36 ± .21	8.27 ± .20
Cedarvale, N. Y., 1-yr.	86	19.50 ± .21	15.64 ± .17	11.71 ± .14	9.74 ± .11	8.48 ± .11
2-yr.	20	18.95 ± .31	15.10 ± .32	11.45 ± .31	9.50 ± .28	8.35 ± .27
Cambridge, Md., 1-yr.	56	18.00 ± .56	14.23 ± .21	10.48 ± .17	8.61 ± .13	7.45 ± .13
Asheville, N. C., 1-yr.	68	18.21 ± .23	14.21 ± .19	10.52 ± .15	8.44 ± .13	7.29 ± .12

In neither foot length nor ear length is there any significant difference between the field-caught and cage-bred mice in either of the 3 stocks compared.

The femurs of the field-caught animals average longer in each of these stocks than those of the cage-bred animals of the 1-year age class. The differences are significant for the Sawyer and Sand Point stocks, but not for the Ann Arbor W stock. In the combined measurements of the femur for the 3 stocks the field-caught animals exceed the cage-bred animals by 0.412 ± 0.066 mm., a difference 6.2 times its standard error and significant. The femurs of the wild-killed mice from Sand Point average 0.526 ± 0.123 mm. longer than those of the 1-year old cage-bred mice of this stock, the difference being 4.3 times its standard error and significant.

In bullar width of the skull the field-caught animals of all the stocks average slightly broader than the cage-bred animals, but in none of the stocks are the differences of certain statistical significance. In the combined measurements of bullar width for these stocks the field-caught mice exceed the cage-bred mice by 0.141 ± 0.029 mm., a difference 4.9 times its standard error and significant. The wild-killed mice from Sand Point average 0.237 ± 0.051 mm. larger than the cage-bred mice in bullar width, the difference being 4.7 times the standard error and significant.

The other measurements of the skull show no consistent and important difference between the field-caught or wild-killed and the cage-bred animals.

It is shown above that our series of wood-mice born in the laboratory have considerably shorter femurs, somewhat narrower skulls (bullar width), and probably slightly shorter tails than mice caught in the field and kept in the laboratory for a number of months, or than those killed in the field. If we assume these measurements not to be affected by the ages of the animals compared the differences must be due to life in the laboratory. Birth in the laboratory does not seem appreciably to affect any of the other measurements. Whatever the cause of the differences in certain of the measurements

between the cage-bred mice and those captured in the field the effect, if due to life in the laboratory, must be produced very early in life, for many of the field-caught mice were quite young when captured. All the stocks of mice seem to be affected by captivity in the same general direction, and the several cage-bred series are therefore assumed to be comparable with one another in their measurements.

In dorsal pelage color the Ann Arbor W field-caught mice have significantly lower average tint photometer readings than the cage-bred 1-year old mice (Table IV). In the Sand Point stock, however, there is hardly any difference in readings between the field-caught and cage-bred mice, and in the Sawyer stock the field-caught mice have higher readings than the cage-bred mice, though the differences are not of statistical significance.

In the pelage color of the side of the animal the Sawyer field-caught mice average significantly higher in tint photometer readings than the cage-bred 1-year old mice (Table V). The field-caught mice of the Sand Point and Ann Arbor W stocks, on the contrary, both have lower average readings for the side than the cage-bred mice, though none of these differences are of statistical significance.

It seems therefore that there is in general no consistent difference in pelage color between the field-caught and cage-bred mice.

The wild-killed mice from Sand Point are much darker in pelage color than either the field-caught or cage-bred mice of the same stock. This is shown by much lower tint photometer readings in the wild-killed series for both the dorsal stripe and the side for all the color screens. All the differences are very significant. Although the wild-killed mice were prepared as specimens during the first week of May at about the same date as the average of the laboratory specimens, they had been exposed to quite a different climate, for they had been outside living under natural conditions, while the laboratory animals, both the field-caught and cage-bred mice, had been living for many months in artificially heated rooms in much drier air,

and with an artificial food ration. It is possible that at some other time of the year the pelage colors of the Sand Point mice kept in the laboratory might approach or match the colors of the mice living under natural conditions. In May, however, the laboratory mice of this stock are darker in pelage color than the mice living in the field.

It should be noted that the wild-killed mice from Sand Point are very close in pelage color to the cage-bred mice from Byron. These two localities are only about 60 miles apart. The cage-bred mice from Sand Point are much paler than those from Byron and the similarity in color between the wild-killed Sand Point mice and the cage-bred Byron mice is believed to be only a coincidence.

Although the mice living in the field may not have the same pelage color, at least in May, as those kept in the laboratory, yet the cage-bred mice of each stock have pelage colors similar to those of field-caught mice which have been kept for a number of months in the laboratory. It may therefore be assumed that the cage-bred mice of the several stocks here described are comparable in pelage color. They are in fact probably more comparable than would be specimens taken in the field at different localities at exactly the same time of year, for at the different localities the seasonal pelage changes would not likely be exactly synchronous.

In none of the mice is there any indication of serious stunting or of any other important adverse effect of laboratory life on the characters of the animals. All the stocks of mice seem to be affected by birth and by residence in the laboratory in much the same manner, and the measurements and color readings of the several stocks of the laboratory-bred mice here described are therefore assumed to be comparable with one another.

Local Variation

Included among the stocks of *Peromyscus leucopus noveboracensis* here described are several from closely adjacent geographic localities. There is thus an opportunity to secure some measure of the variability of these mice within relatively

small sections of the range of the subspecies. This information is of importance in evaluating the differences between stocks coming from more widely separated localities. In the following discussion only mice of the 1-year age class are considered.

From the vicinity of Ann Arbor 3 distinct breeding stocks of these mice were collected in different woodlots. The D stock comes from about 3 miles to the southeast of the center of the city; the W stock from about 4 miles to the west; and the St stock from about 4 miles to the northeast of the city. The character of the hardwood forest is similar in each of these woodlots except that at the D station, overbrowsed by domestic stock, there is less underbrush than in the other woodlots. The soil at the St locality is more sandy than at the other two stations. The D and W stocks were each produced in the laboratory from what is believed to have been an adequate number of parents to portray the genetic variability of the wild populations, and there was no inbreeding. The St stock was produced from only 8 parents, and there was some inbreeding during the production of the cage-bred mice.

The Ann Arbor D stock differs from the W stock in having a significantly shorter body, shorter hind foot, shorter femur, shorter mandible, shorter condylo-premaxillary skull length, and shorter condylo-zygomatic distance (Tables II and III). The differences between the 2 stocks in some of these measurements are very considerable, but there is no important difference between the stocks in pelage color either on the dorsal stripe or side of the body (Tables IV and V).

The St stock differs from the W stock in having a significantly shorter body, longer tail, shorter femur, shorter mandible, and shorter skull, and is significantly paler on the dorsal stripe for all color screens. Compared to the D stock the St stock has a significantly longer hind foot, longer skull, greater condylo-zygomatic distance, greater bullar width, and paler color of the dorsal stripe for all color screens.

It is obvious from these comparisons that the stocks from the 3 woodlots near Ann Arbor differ considerably from one another in body dimensions and in pelage color. This is true in

spite of the fact that the greatest distance between any 2 woodlots is only about 8 miles. The D stock is the smallest of the 3 stocks in most body and skeletal measurements and the W stock is the largest. The St stock is in general intermediate, but the St stock exceeds the W stock in length of tail. In pelage color the D and W stocks are closely similar. The St stock is paler on the dorsal stripe than either of the other stocks, but does not differ from them significantly in the color of the side.

The 2 stocks from Posey County, Indiana, also come from closely adjacent localities. The Hovey Lake and Canebrake stations are woodlots which are not more than 3 miles apart. I am informed by Paul Hickie, who captured these mice, that these woodlots are isolated from each other by a series of open fields in which mice of this species would not be expected to occur. The woods at the Canebrake locality are of deciduous type with a sparse undergrowth of cane, but some mice were trapped in the heavier growth of cane at the edge of the woods. At Hovey Lake the trees are mainly oaks, with an undergrowth of shrubs instead of cane. The soil at both stations is black gumbo. The main difference in mouse environments between the two localities is that at Canebrake there is a somewhat thicker growth of vegetation at the surface of the ground. The number of field-caught parents used to produce each of these stocks was adequate, and there was no inbreeding in the laboratory.

The Canebrake mice significantly exceed the Hovey Lake mice in body length, tail length, femur length, and condylo-premaxillary skull length. Further, the pelage color of the Canebrake mice averages slightly darker than that of the Hovey Lake mice. On the dorsal stripe the differences in color shade, as shown by the tint photometer readings, are significant only in the blue-violet, but on the side of the body the Canebrake mice are significantly darker than the Hovey Lake mice for all color screens.

The amount of local variation from woodlot to woodlot shown by these mice both in Michigan and in Indiana is one

of the most striking results of the study. Woodlots only a few miles apart shelter mouse populations which differ to a considerable degree in a number of measurable characters.

The evidence seems good that the mice of the several woodlots described from near Ann Arbor, Michigan, and from Posey County, Indiana, represent local races or clans which are distinguished by differences in their hereditary constitutions.

The paler color of the dorsal stripe of the Ann Arbor St mice as compared to those from the D and the W stations may possibly be correlated with the more sandy soil and correspondingly paler soil color of the St station. Likewise the darker pelage color, particularly of the side of the body, of the Canebrake mice as compared with the Hovey Lake mice may possibly be correlated with the heavier surface vegetation at the Canebrake locality. Evidence is presented elsewhere (Dice and Blossom, in press) that in the southwestern deserts the pelage color of the small mammals tends to be correlated with the color of the soil of their habitats, and a similar correlation between pelage color and soil color probably occurs in all regions. No soil samples are available, however, from the stations described in this report, and the causes of the observed differences in pelage color between the several stocks of mice can only be conjectured.

The important differences in certain of the dimensions of body and skeleton between the local races of these mice living in closely adjacent woodlots are not correlated with any known differences in the environments at the several stations.

Geographic Variation

The stocks within each of the states, Michigan and Indiana, show a considerable diversity in characters. In fact, in some measurements the variation within one state may approach the whole variation shown by all the stocks of *noveboracensis* here described. This is shown more by the tint photometer readings of pelage color than by the dimensions of body or skeleton. In the tint photometer readings for reflected red

from the dorsal stripe, for instance, the Sand Point, Michigan, stock has the highest mean of all the stocks, while the stock from Byron, Michigan, practically equals the lowest mean. Likewise, in the readings of reflected red from the side of the body the Wyandotte, Indiana, stock has the highest mean, and the mean of the Decker, Indiana, stock is not significantly different from that of the Byron, Michigan, stock, which has the lowest mean of all.

In body length the Merom stock averages largest among the 17 stocks here compared, but its mean does not significantly differ from the means of some of the other Indiana stocks nor from the means of the stocks from Missouri and from Wisconsin (Table II). The Hovey Lake stock is intermediate in this measurement, its mean being less than the means of some of the Michigan stocks. The smallest mean occurs in the North Carolina stock, which differs from the smallest of the Michigan stocks, Byron, by 1.80 ± 0.73 mm., an amount which doubtfully may be significant. The stocks from Iowa, Missouri, New York, and Maryland, and several of the stocks from Michigan are intermediate in body length.

In tail length the Missouri stock averages longest, and its mean is probably significantly greater than that of the Iowa stock, the difference being 2.33 ± 0.82 mm. (Fig. 1). The mean of the Iowa stock is close to that of the Ann Arbor St stock. The Maryland stock has the shortest average tail length, and in this measurement is 1.93 ± 0.72 mm. shorter than the Wisconsin stock, which is next higher in rank. The difference in means is probably significant. The Michigan and Indiana stocks are all intermediate in tail length, but show much variation within each of the two states. The North Carolina stock has an intermediate tail length, about equal to that of the New York stock and to numerous ones of the Indiana stocks.

In hind foot length the Iowa stock averages longest, exceeding the Missouri stock by 0.344 ± 0.170 mm., which is possibly significant. Two stocks from Indiana and 1 from Michigan have nearly as long hind feet as the Missouri stock. The Sand Point and Ann Arbor W, Michigan, and the North Carolina

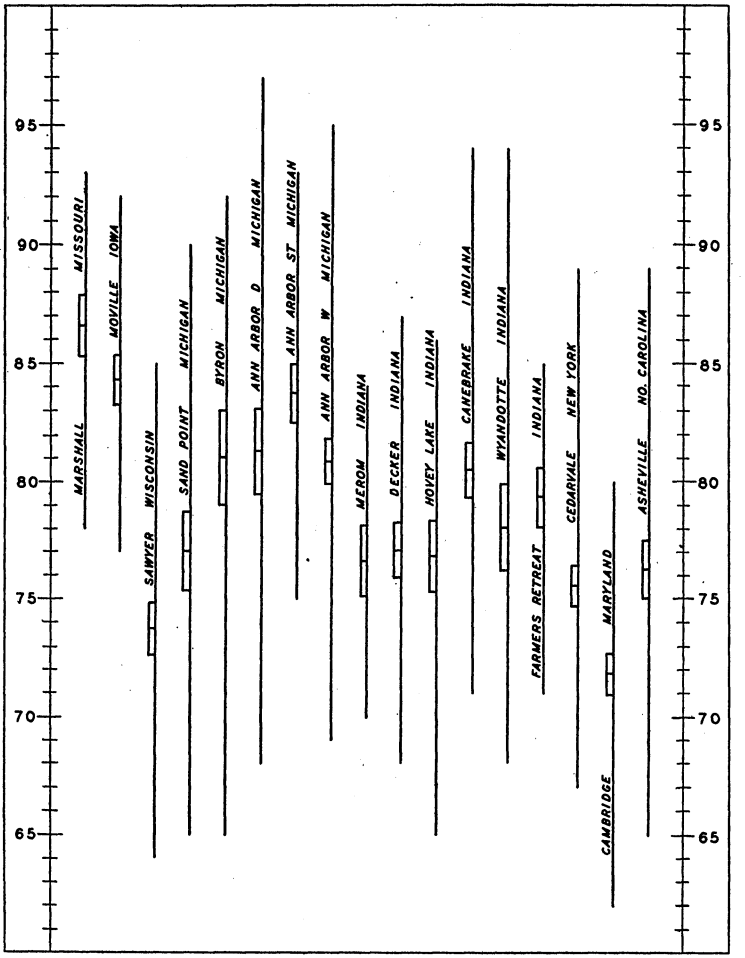


FIG. 1. Graph of variation of tail length of 1-year old *Peromyscus leucopus noveboracensis* from some localities in the northeastern United States. The graph is constructed according to the method of Dice and Leraas (1936). The rectangles drawn near the middle of each line extend twice the standard error on each side of the mean. If the rectangles of any 2 stocks do not overlap in vertical position the respective means are indicated to differ by an amount which is statistically significant.

stocks have the shortest hind feet, but their means are not significantly smaller than those of some of the other Michigan stocks.

The largest ears are possessed by some of the Michigan and Indiana stocks, but the Decker, Indiana, stock does not have a significantly larger ear than the mice from North Carolina and from Maryland. The New York and Wisconsin stocks are intermediate in ear length. The Iowa stock has the smallest ears, and its mean is significantly less than the mean of the stock from Missouri, which has the next smallest ears. The Missouri stock does not differ significantly in ear length from the North Carolina stock.

The average length of femur is greatest in the Iowa stock, but this stock does not significantly exceed the Missouri stock, which in its turn does not significantly exceed some of the Indiana and Michigan stocks (Table IV). Compared to the Farmers Retreat, Indiana, stock the mean of the Iowa stock is greater by 0.444 ± 0.155 mm., an amount which is of probable significance. The shortest average femur lengths are possessed by the stocks from North Carolina, Maryland, New York, and by the Sand Point, Ann Arbor D, and Ann Arbor St, Michigan, stocks. These several stocks do not differ in any important way from one another, nor do any of them differ statistically from the Hovey Lake, Indiana, stock. The stocks from Missouri and Wisconsin and most of the stocks from Michigan and Indiana are intermediate in femur length.

The length of the mandible averages greatest in the stock from Iowa, which differs from the Missouri stock by 0.264 ± 0.088 mm., an amount which probably is significant. The Missouri stock in its turn differs from the Canebrake, Indiana, stock by 0.211 ± 0.074 mm., an amount which also probably is significant. The other Indiana stocks, and those from Wisconsin, New York, Maryland, and North Carolina, and from Byron and Ann Arbor W, Michigan, are intermediate in mandibular length. The shortest mandibles on the average are possessed by the Ann Arbor D, and Sand Point, Michigan, stocks, which do not differ significantly in this measurement from the Ann Arbor St stock, which is next smallest.

The condylo-premaxillary length of skull averages greatest in the stocks from Missouri and Iowa. The means of these two stocks do not differ greatly from one another, but both average significantly longer than any of the other stocks. The shortest average skull length occurs in the Ann Arbor D stock, but this does not differ significantly from the Sand Point stock. The 3 stocks from Ann Arbor differ significantly from one another in this measurement, and the mean of the Ann Arbor W stock does not differ significantly from the means of some of the Indiana stocks. The means of the Wisconsin, New York, Maryland, North Carolina, and of all the Indiana stocks occupy intermediate positions in skull length.

In the condylo-zygomatic measurement of the skull the Iowa stock averages largest, but its mean does not differ greatly from the mean of the Missouri stock, and exceeds the mean of the Merom, Indiana, stock, which is next largest, by 0.295 ± 0.125 mm., which is of only possible significance. The Ann Arbor D stock has the smallest mean of the stocks here compared, but does not differ significantly from the North Carolina stock, nor from the Byron and Sand Point, Michigan, stocks. The means of those from Wisconsin, New York, and Maryland, of all from Indiana, and from Ann Arbor St and W, Michigan, are intermediate in this measurement.

The bullar width of the skull averages greatest in the Iowa stock, but this stock does not significantly exceed that from Merom, Indiana. The Sand Point, Michigan, stock has the lowest mean skull width, but this mean is not significantly less than the mean of the stocks from New York nor than that of the Ann Arbor D stock. The other stocks from Michigan, all those from Indiana, and those from Missouri, Wisconsin, Maryland, and North Carolina average intermediate in bullar width.

There are much greater differences in pelage color between the several stocks of wood-mice here described than in body dimensions, and for some color screens the highest tint photometer reading of the dorsal stripe for one stock may be less than the lowest reading for another stock, so that the curves of variation for the two stocks do not overlap (Tables IV and V).

The tint photometer readings of the dorsal stripe for reflected red average highest in the stock from Sand Point, Michigan (Fig. 2). This stock, therefore, has the palest color on the dorsal stripe of all the stocks here compared. The lowest means for this color are given by the stocks from Decker, Indiana, and from Byron, Michigan. Neither of these stocks differs significantly in mean readings from the North Carolina stock nor from the Merom, Indiana, stock. The means of the other stocks from Michigan and Indiana, and of those from Missouri, Iowa, Wisconsin, New York, and Maryland are intermediate in position.

The tint photometer readings of the dorsal stripe for the other color screens, yellow, green, peacock blue, and blue-violet, follow the same general order as for red. There are, however, slight differences in hue between the stocks. This is shown by minor differences in the sequence of the stocks in the magnitudes of the means of the readings for the several color screens.

For the side of the body the mean of the tint photometer readings for reflected red is highest in the Wyandotte, Indiana, stock, but is not significantly higher in that stock than in the Hovey Lake, Indiana, and Sand Point, Michigan, stocks. The mean of the Byron, Michigan, stock is the lowest of the stocks here compared for this color reading, but this mean does not differ significantly from the mean of the Decker, Indiana, stock. The means of this reading for the other stocks from Indiana and from Michigan and for those from Missouri, Iowa, Wisconsin, New York, Maryland, and North Carolina are intermediate in position.

For reflected blue-violet from the side of the body the tint photometer readings of the stock from Hovey Lake, Indiana, average highest, but the mean of this stock does not differ significantly from the means of the Iowa stock nor the Sand Point, Michigan, stock. The lowest mean of the readings for this color is given by the stock from North Carolina, but this mean does not differ significantly from the means of the stocks from Maryland, from Byron, Michigan, and from Decker, Indiana. Although the order of magnitude of the means for side

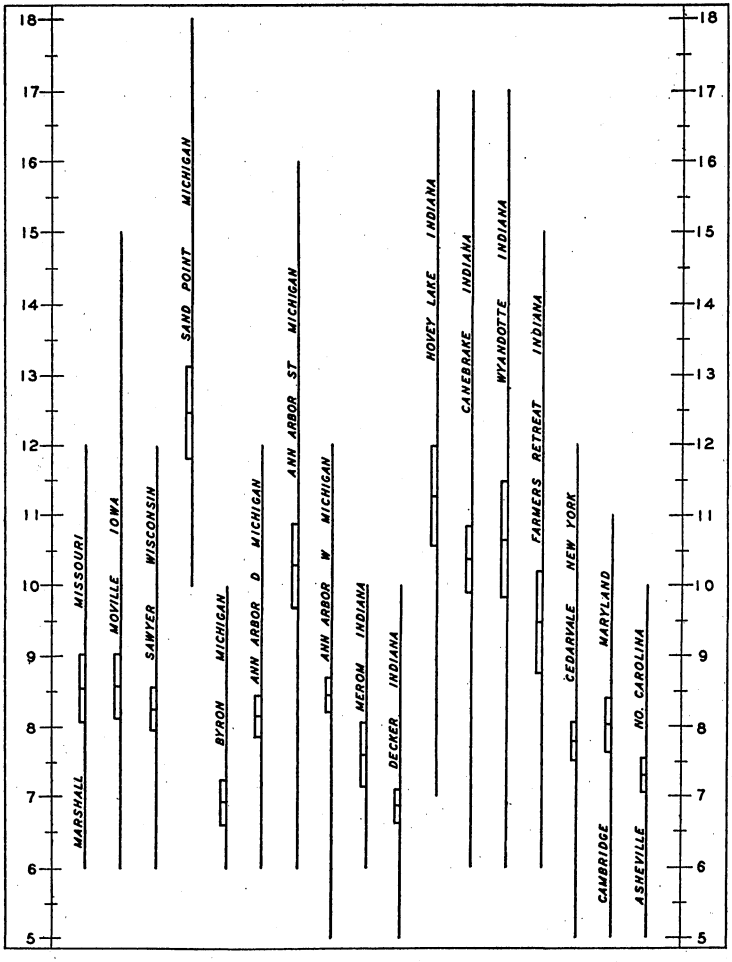


FIG. 2. Graph of variation in tint photometer readings for reflected red from the dorsal stripe of 1-year old *Peromyscus leucopus noveboracensis*. The considerable amount of local variation is well shown.

blue-violet differs slightly from the order of the means for side red, the general order of magnitude is nearly the same, due to the great similarity in hue of the several stocks.

For the other tint photometer readings yellow, green, and peacock blue, of the side pelage, the general order of magnitude for the several stocks falls between those for red and for blue-violet.

The two stocks from the most westerly localities, Iowa and Missouri, are shown above to exceed more or less in certain measurements the stocks from the more eastern states. This tendency might be taken to indicate an approach of the Iowa and Missouri stocks toward the characters of the subspecies *aridulus,* which occurs on the Great Plains, and which is said by Osgood (1909 : 123) to be larger and paler than *noveboracensis* and to have a wider braincase, larger audital bullae, and larger molar teeth. Moreover, Osgood (1909 : 119) suggests that intergradation towards *aridulus* occurs in Iowa.

The Iowa stock is, however, not outstanding among the stocks here compared for body length nor tail length. It averages large in foot length, though in this measurement its mean does not significantly exceed that of the Missouri stock. It exceeds in this measurement the means of the Byron, Michigan, and Farmers Retreat, Indiana, stocks, which are next largest, by amounts which are probably significant. In ear length the Iowa stock is significantly smaller than any other of our stocks. This might indicate for this stock smaller than usual bullae rather than the larger bullae which are characteristic of *aridulus.* The femur is long in the Iowa stock and exceeds in length the Farmers Retreat and Wyandotte, Indiana, stocks, which are next largest, by an amount which is probably of statistical significance. The mandible averages significantly longer in the Iowa stock than in the Missouri stock, which is next largest. The mean condylo-premaxillary skull length of the Iowa stock is close to the mean of the Missouri stock, and the means of both significantly exceed the means of all the other stocks. The condylo-zygomatic skull measurement, and the bullar width both average large in the Iowa stock, but the

differences from the Merom, Indiana, stock are only of possible significance. I did not measure the auditory bullae nor the molar teeth, and can therefore give no statement concerning their relative size in the Iowa stock.

The Missouri stock has a long tail, and its mean for this measurement exceeds the mean of the Iowa stock, which is next largest, by an amount which is probably significant. The Missouri stock has also a rather long mandible, and a rather short ear, the means of these measurements falling between those of the Iowa stock and those of the stocks from the more eastern states. In condylo-premaxillary skull length the Missouri stock averages close to the Iowa stock and together with that stock it significantly exceeds in this measurement all the other stocks. In the other measurements of body and skeleton the Missouri stock takes a more or less intermediate position among the several stocks here described.

It appears, therefore, that the Iowa stock significantly exceeds the stocks from states farther east in a number of measurements, and in a few of these measurements the Missouri stock occupies a position close to the Iowa stock, or intermediate between it and the other stocks. Only in tail length does the Missouri stock exceed the Iowa stock. The Iowa stock has an average larger hind foot, longer skull, longer femur, and longer mandible than most of our other stocks, but it is not outstanding in body length, nor skull width, and it has a smaller ear than any other stock. In pelage color the Iowa and Missouri stocks are intermediate among the other stocks.

Both the Iowa and the Missouri stocks were descended from a very small number of parents, and both were considerably inbred in the laboratory. It is possible therefore that neither stock well represents the characters of the populations of the respective localities. With no stock of undoubted *aridulus* available for comparison, it is impossible to be sure that the Iowa stock represents a trend toward intergradation with that subspecies, though this is a possibility.

The North Carolina stock might be expected to be somewhat intermediate toward *leucopus,* especially as Osgood (1909:

114, Fig. 2) maps the vicinity of Asheville, where our stock was obtained, as an area of intergradation between *leucopus* and *noveboracensis*. According to Osgood *leucopus* is darker in color and slightly smaller than *noveboracensis*.

Our North Carolina stock averages smallest in body length of the stocks here described, but the differences in means between this and several Michigan stocks are of rather doubtful statistical significance. The hind foot of the North Carolina mice averages small, but its mean does not differ significantly from the means of some of the Michigan stocks. The ear also of the North Carolina stock averages comparatively small, among our stocks, but its mean is not significantly different from the means of the stocks from Missouri, from Maryland, nor from one of the Indiana stocks. Furthermore, the ear of the North Carolina stock is significantly larger than that of the Iowa stock. The femur of the North Carolina stock is relatively small, but its mean does not differ significantly from the means of stocks from Maryland, New York, nor Michigan. In the other body dimensions, the North Carolina stock is intermediate.

In color of the dorsal stripe the North Carolina stock is dark, but still lower mean tint photometer readings are given by certain stocks from Indiana and Michigan. The tint photometer readings for the side of the North Carolina mice have means which are intermediate among the stocks here compared.

A tendency toward intergradation of the North Carolina stock with *leucopus* may possibly be indicated by the relatively small dimensions of its body, hind foot, ear, and femur, and its relatively dark dorsal stripe. The North Carolina stock, however, is not statistically outstanding in any measurement or color reading. Furthermore, we lack any comparable stock of undoubted *leucopus*. If a tendency toward intergradation with *leucopus* does occur in the North Carolina stock it must be relatively slight.

The only other possibility of a geographic tendency for any measurement is shown by the Maryland stock, in which the tail length averages distinctly small. In fact, the longest tails

of the Maryland stock only slightly exceed the shortest tails of the Missouri stock, which has the longest tails. Nevertheless, the mean tail length of the Wisconsin stock which is next larger in this measurement, exceeds the mean of the Maryland stock by an amount which is not of sure statistical significance. The short tail length of the Maryland stock is therefore probably only a local variation.

Although there are considerable variations in pelage color between the several stocks, there seems to be no certain geographic trend of any sort in color. The means of the tint photometer readings of pelage color for the Michigan and Indiana stocks cover a wide range of magnitude, and there seems to be as much variation in pelage color within these two states as in the whole territory from which stocks of *noveboracensis* are at hand.

The type of variation shown by the several stocks described in this study does not agree well with the conception which Osgood (1909: 115) had of geographic variation in the species *leucopus*. Osgood believed that the extreme development of *noveboracensis* occurred in New England and that there was gradual intergradation from this point toward the slightly smaller and somewhat darker *leucopus*, which he supposed reached its best development in southern Louisiana, and toward the larger and paler *aridulus*, which he supposed reached its best development in eastern Montana.

No stocks from New England, where Osgood presumes the best development of *noveboracensis* to occur, are included in this study, and all of the stocks which are here described come from areas which by Osgood are assigned to the subspecies *noveboracensis*. However, our stocks, which come from a wide extent of territory, fail to show any pronounced gradation in any geographical direction.

The lack of any pronounced trend towards geographic variation in these mice over the whole territory from Iowa to New York and from Missouri to North Carolina may be correlated with the general uniformity of climate and of vegetation over this area. In this northeastern part of the United States the

northern deciduous type of forest is dominant. Although there are differences from place to place in the occurrence of certain species of forest trees, and considerable differences in the abundance of the various hardwood species and of the associated shrubs and herbs, the general type of forest, as a home for wood-mice, seems closely similar throughout. The climate also is quite similar over the whole area, the main differences of importance to the mice being probably the longer and colder winters of the northern parts of the area, and the longer and hotter summers of the southern sections.

Summary

The males of the wood-mouse, *Peromyscus leucopus noveboracensis,* slightly exceed the females in length of hind foot, in body weight, and possibly also in body length.

No important growth in any part of the body nor skeleton nor any change in the pelage color seems to occur in this species between the first and second years of life.

Wild-killed mice from Sand Point, Michigan, prepared as specimens in early May are darker in pelage color than mice of the same stock kept or born in the laboratory and killed at the same season.

Wild-killed mice and also field-caught mice kept for a number of months in the laboratory exceed the cage-bred mice of the same stocks considerably in femur length, slightly in bullar width of the skull, and probably slightly in tail length, but laboratory life produces no serious stunting nor other important deleterious effect on the characters of the animals.

There is much local variation in this species in body proportions and in pelage color. Part of the local variation in pelage color may possibly be correlated with differences, especially in soil color, between the local environments where the several stocks of mice were trapped. The differences in body dimensions between the several local races have no obvious environmental correlation.

Stocks of these mice from various states from Iowa to New York and from Missouri to North Carolina show no certain

geographic trend in any character of size nor of pelage color. It is possible, however, that the large size in a few measurements of the mice from Moville, Iowa, may indicate an approach toward the characters of the more western subspecies *aridulus*. Likewise the small size in a few measurements and dark color of the dorsal stripe of the Asheville, North Carolina, stock may indicate an approach toward the southern subspecies *leucopus*.

The lack of any important geographic trend over the northeastern United States in the characters of these mice may possibly be correlated with the general uniformity of environmental conditions over the area covered by the northern hardwood forest.

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