

whenever there is a condition approaching asphyxiation. It seems as though these pharyngeal movements reappear in the highest forms when the want of oxygen becomes overwhelmingly great, as if there were an organic memory of the means by which, in the dim past, the want was supplied.

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DESCRIPTION OF A NEW SUBSPECIES OF THE COMMON EASTERN CHIPMUNK.

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THE common chipmunk or striped squirrel of Eastern North America was first mentioned, so far as I have been able to ascertain, by Sagard-Théodat in his *Histoire du Canada* ("Vol. v, p. 746"), published in 1615. In 1743 Mark Catesby gave an unmistakable description of it, accompanied by a recognizable colored plate.¹ He called it *Sciurus striatus*, which name was adopted by Linnæus in the tenth edition of his *Systema Naturæ*, published in 1758. The specific name *striatus*, after enduring the vicissitudes to which scientific nomenclature is so often subject,² was reëstablished by Baird in 1857, and has since enjoyed undisputed recognition on this side of the Atlantic.

It is a little singular that thus far no one seems to have suspected the existence of two distinct subspecies of chipmunk in Eastern North America, particularly when it is remembered that no less than five geographical races of the Western species have long been recognized.

It is true that Professor Baird, nearly thirty years ago, stated that a chipmunk from Essex county, in Northeastern New York,

¹"SCIURUS STRIATUS. *The Ground Squirrel*. This is about half the Size of an English Squirrel, and almost of the same Colour, except that a Pair of black Lists, with a yellowish white List between them, extend almost the Length of the Body on both Sides; also a single black List runs along the Ridge of the Back. The Eyes are black and large, the Ears rounding, the Tail long, flat, and thick set with Hairs, which are much shorter than those of other Squirrels. These Squirrels abide in the Woods of *Carolina*, *Virginia*, &c. Their Food is Nuts, Acorns, and such like as other Squirrels feed on. They being brought up tame, are very familiar and active." (*Natural Hist. of Carolina*, etc., by Mark Catesby, Vol. II, 1743, p. 75).*

² For more than half a century our animal was confused with the Asiatic, but it is not the purpose of the present paper to enter into a discussion of the complicated synonymy of these species, already very fully elaborated by Allen. (*Monographs of North American Rodentia*, 1877.)

“is considerably grayer, and the black lines of the back have no brownish margin. In a specimen from Washington [D. C.], the chestnut tints are darker than described above” (North American Mammals, 1857, 294). But his material was not sufficiently extensive to enable him to appreciate the constancy and significance of the differences noted.

Allen, in his most valuable paper on Geographical variation in color in North American squirrels, said: “The increase in intensity of color from the north southward” is well illustrated in “*Tamias striatus*, representatives of which from the southern parts of New York and Pennsylvania are much more highly colored than are those from Northern New England and the British Provinces” (Proc. Bost. Soc. Nat. Hist., xvi, 1874, 4). Later, however, the views above expressed seem to have undergone some modification, for the same author observes: “The very large number of specimens before me indicate that the present species preserves great constancy of coloration. * * * Specimens from Southern localities are considerably brighter colored than those from more Northern sections, and average a little smaller. The difference, however, in either respect, is not very great” (Monographs of North American Rodentia, 1877, 784-785).

The examination of more than two hundred specimens has led me to differ with Mr. Allen in his last expressed views. His remarks concerning the deepening of color southward might have been stated more strongly, and still fall within the limits of truth.¹ In respect to size, if the body as a whole was meant, my measurements of upwards of one hundred specimens in the flesh do not show the Southern animal to be the smaller, and the largest individual that has fallen under my notice came from Monticello, Mississippi. If, however, we turn to the extremities, the case is different, for the length of both fore and hind feet is greater in northern than in southern specimens, as shown in the accompanying tables:

¹ Mr. Allen's views, as above enunciated, were based upon the examination of upwards of one hundred and fifty specimens; still, it is but fair to state that the great majority of these specimens came from Northern localities, and were either typical of the Northern form or intermediate between it and the Southern. He had but four skins from so far south as Washington, D. C., and had not seen a single individual from the Carolinas.

MEASUREMENTS OF FEET, SHOWING DECREASE IN SIZE FROM THE NORTH
SOUTHWARD.¹

Locality.	Manus.	Pes.	Condition when measured.
Locust Grove, New York (average of 28).....	22.11	36.17	In the flesh.
Sing Sing, New York (average of 8).....	21.71	34.77	“ “
Washington, D. C. (one specimen)	20	34	“ “
Charleston, S. C. (one specimen).....		34	Skin ²

It must be remembered that the above measurements of New York specimens are averages. The largest manus from the Adirondack region measures 23^{mm}; the largest pes 38^{mm}. The smallest manus from the Lower Hudson measures 20^{mm}; the smallest pes 34.

In the summer of 1884, Dr. A. K. Fisher, at my request, sent me several chipmunks from Sing Sing, New York, in the valley of the Lower Hudson. On placing them alongside my own series from the Adirondack region I was at once struck with the marked differences between them, and was convinced that they were subspecifically separable. This opinion was confirmed the following year by the acquisition of an adult female from the mountains of North Carolina, kindly presented to me by Mr. William Brewster, who killed it in the town of Sylva, Jackson county, North Carolina, May 30, 1885. This individual, for two reasons, may be regarded as the type of *striatus* proper: First, because it came from the same general region from which Catesby's probably came (and it will be remembered that Linnaeus's diagnosis was based on Catesby's description and figure); and, second, because it is representative of a phase of pelage most remote from that of the Northern animal. This skin (No. 1450 Mus. C. H. M.) is very much darker than the darkest Washington example I have seen, and the ferruginous of the rump is restricted in extent, and is overcast by the liberal admixture of black-tipped hairs. There is an obscure dark spot at the end of the nose above, and another at the posterior angle of each eye. The eyelids are buff, and the color of the lower lid can be traced backward, though becoming very faint, to the lower margin of

¹ The measurements here given, as well as all others which appear in this paper, were taken by myself with dividers; all were made with the utmost care, and a large proportion were verified by duplicate measuring.

² All measurements from skins were taken in the following manner: The feet were dipped in hot water, and then wrapped with wet cotton-wool and left for several hours until the joints became flexible, so that the toes could be straightened readily.

the auditory meatus. There is an indistinct dark line above the light line of the upper eyelid, and a broad, but not well defined, dark stripe below the light under eyelid, extending from a point anterior to the eye to a point just below the posterior base of the ear, where it becomes lost in the grizzled rusty-brown of the sides of the neck. Below this stripe, the side of the face is fulvous. The crown is dark rust-brown intermixed with a large quantity of black hairs, and the same color extends over the anterior half of the inner surfaces of the ears, the posterior half being light fulvous or buff. There is a small light spot behind the base of each ear. The shoulders and back between the lateral stripes are very dark grizzled iron-gray, with a sprinkling of buff or yellowish. The dark stripes are not perfectly clear black, and their ferruginous borders are not well defined. The median stripe extends from the occiput nearly to the root of the tail. The light stripes are dark buff intermixed with dark-tipped hairs. The sides are buffy-fulvous well sprinkled with black-tipped hairs. The rump, hips, and backs of the hind legs are dark rusty-brown. The upper surfaces of the feet are ferruginous. The upper side of the tail is blackish, edged with hoary; the under side, deep hazel (almost chestnut), bordered with black and edged with hoary. This rich hazel of the under tail extends continuously forward over the anal region to the genitals, where it terminates abruptly without shading off into the surrounding white. The under parts, from the mouth to the genitals, are clear buffy-white.

Through the kindness of Mr. William Brewster, Curator of Mammals and Birds in the Museum of Comparative Zoölogy at Cambridge, Mass., and of Mr. F. W. True, Curator of Mammals in the United States National Museum, I have been enabled to examine the chipmunks contained in these collections. I am indebted also to Mr. William E. Saunders for the loan of a specimen from London, Ontario, Canada. These specimens, together with my own (which in numbers exceed all the others combined), constitute a very complete series of the Eastern animal from the region between Canada on the north and Washington, D. C., on the south.

Comparison of representatives from the extremes of this range brings to light the following differences: The crown in typical Northern specimens varies from pale to bright rusty-fulvous, while in typical Southern examples it is dark rust-brown.

The nape and the back between the median and first lateral black stripes are clear ash-gray in the Northern animal, while in the Southern these parts are dark iron-gray, more or less mixed with grizzly. In specimens from the Mississippi Valley, the same parts show a sprinkling of yellow-tipped hairs.

The light lateral stripes are white, or but faintly tinged with buff in typical Northern specimens, while in typical *striatus* from the South they are strongly washed with buff, which color often deepens to pale fulvous posteriorly, and is further obscured by the admixture of a number of dark-tipped hairs. The sides vary from the palest buff (as in specimen No. 1200) or buffy fulvous in the Northern to dark fulvous in the Southern form. Northern specimens show a slight sprinkling of black-tipped hairs, which increase in number from the north southward till in typical *striatus* the admixture of these hairs very materially darkens the sides of the animal. In typical Northern examples, the pale buff of the sides fades so gradually into the white of the belly that no sharp line can be drawn between them; while in typical *striatus*, on the contrary, a very clear line of demarkation separates the two, the (comparatively) dark sides contrasting strongly with the buffy-white of the under parts, even when these parts are suffused with fulvous—which fact is due to the absence of black-tipped hairs from the belly.

The upper side of the tail is much lighter in Northern specimens than in *striatus* proper, though the hoary edging is more conspicuous in the Southern. This difference in appearance is due to the fact that the black subapical portion of each hair is much broader in the latter than in the former, and the subbasal fulvous portion proportionately narrower. The result is that in the Northern animal the pale fulvous zone shows through, while in the Southern the corresponding zone is mostly concealed by the overlying black. In typical Northern specimens the under side of the tail is buffy or buffy-fulvous, fading in the anal region into the white of the belly; while in typical *striatus* the under side of the tail is deep hazel, which color extends forward around the anus to the genitals, where it ends abruptly without shading off into the surrounding parts.

The dark spot above the tip of the nose is usually indistinct and sometimes wanting in Northern specimens, while as a rule it is well marked in those from the South. The facial markings, on

the other hand, are more distinct in the Northern than in the Southern animal. These markings, however, vary so much in individuals in respect to clearness of definition that they may be dismissed as unimportant in the present connection.

In brief, it may be said that the Northern animal differs from the Southern in the clearness and lightness of its colors, the black stripes remaining much alike in both; or, conversely, that the Southern is characterized by an intensification of all the colors, resulting in the darkening of the entire upper surface.

Richardson, in 1829, seems to have been first to describe the Northern form, though he did not suspect it to differ from the Southern. Believing that the specific name *striatus* belonged to the Asiatic animal, and assuming the American to be distinct, he called the latter "*Sciurus (Tamias) Lysteri*. (Ray.)," but was wrong in supposing that Ray had named it before him. Baird expressed the matter in a nutshell when he said, "This author [Richardson] quotes Ray as the authority of this name, but it is, in fact, his own—Ray only referring to the species as *Sciurus a Clar. Dom. Lyster observatus*" (North American Mammals, 1857, p. 295).

Richardson's account of the animal he had in view admits of no question as to its exclusive applicability to the present form, and his plate (plate xv), though uncolored, is equally unmistakable. Furthermore, he distinctly states that his specimen came from Penetanguishene, which is on the north-east arm of Lake Huron, a region which, theoretically at least, ought to furnish most typical examples. His description was taken from "a recent male specimen, killed in April at Penetanguishene." The portion of it relating to color runs as follows:

"*Colour*.—The dorsal aspect of the head is covered with yellowish-brown hairs, which are mixed with a smaller number of black ones. There is a black spot near the tip of the nose. The eyelashes are black, the eyelids white; there is a dark-brown streak between the eye and the ear, and a broad, yellowish-brown stripe extends from the nose, under the eye, to behind the ear, deepening in its middle to chestnut-brown. The anterior part of the back is hoary-gray, from a mixture of black and white hairs. The rump, hips and exterior surfaces of the thighs are of a bright orange-brown color, mixed with a few black hairs. A dark dorsal line commences at the occiput, and reaches to within an inch of the tail. This line is brownish at its commencement, but deepens to black posteriorly. There are also, on each flank, two black lines, which commence behind the shoulders, extend to the hips, and are separated by a moderately broad white stripe. All these stripes are more or less bordered with brown. The sides, beneath the stripes, present a mixture of gray and very light brown. The fur, covering the throat, chin, belly, and inner surface of the extremities, is longer and thinner than that on the dorsal aspect, and

is white throughout its whole length. The fur on the upper parts of the body forms a smooth coat, and is blackish-gray at its roots. There is no defined line of separation betwixt the colors of the back and belly." (Fauna Boreali-Americana, Richardson, 1829, pp. 182-183.)

Hence it is clear that Richardson's name *lysteri* must be adopted as the subspecific name of the Northern animal.

Following are diagnoses of the two races:

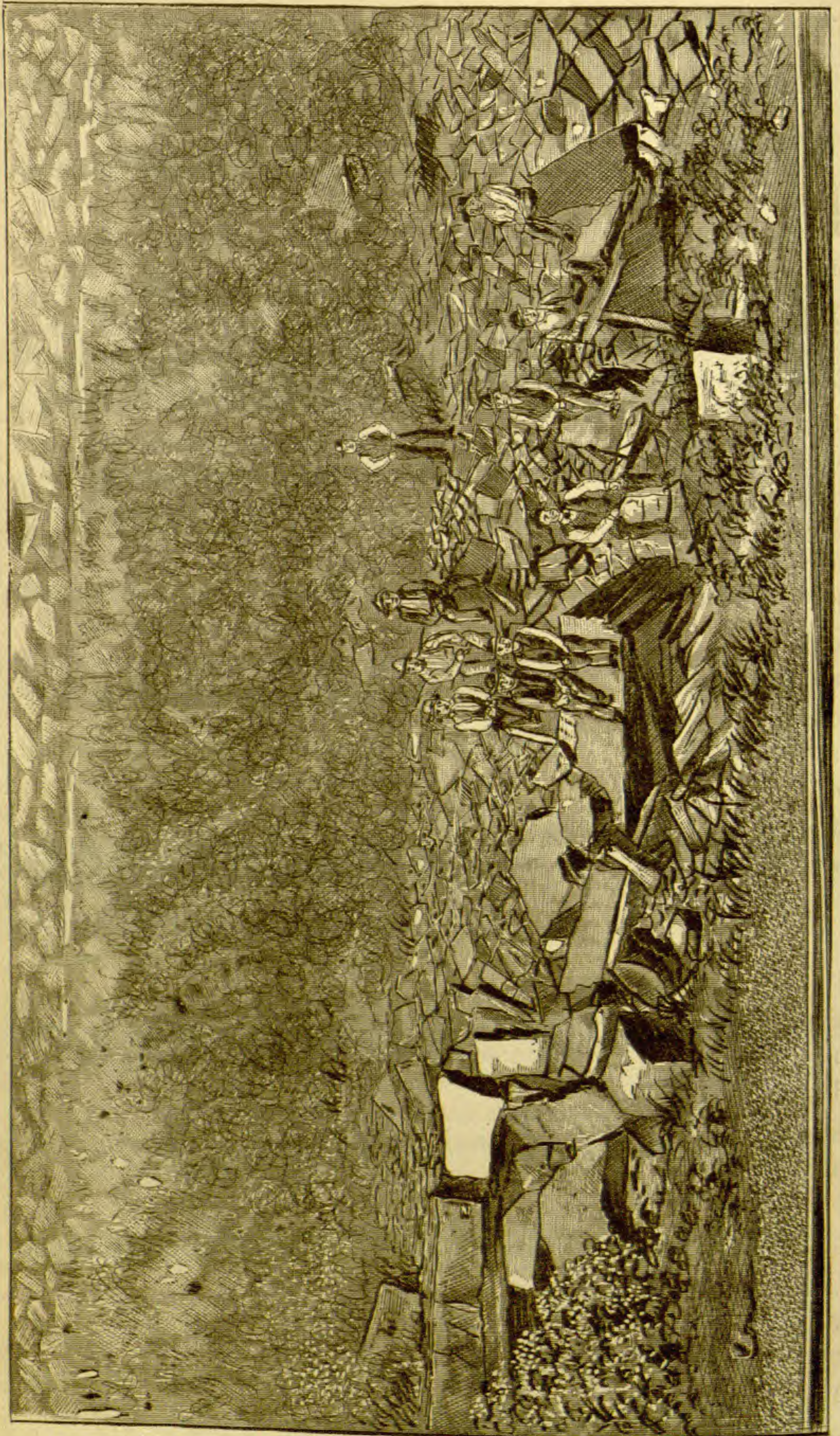
TAMIAS STRIATUS TYPICUS.—Manus, 20 to 21^{mm}; pes, 34 to 35^{mm}; crown, rusty brown or grizzled brown; nape and back nearly to rump iron gray, sometimes mixed with grizzly; rump, dark ferruginous, sometimes almost chestnut; sides, russet fulvous, passing into ferruginous over the hips, and mixed with a variable quantity of black tipped hairs, the fulvous (losing its black hairs and becoming paler) sometimes encroaching upon the buffy white of belly and occasionally meeting irregularly along the median line below, but always leaving a well-defined line of demarkation between the sides and belly; light lateral stripes strongly suffused with buff and sometimes tinged with fulvous posteriorly; under surface of tail, mesially, dark fulvous to hazel, often very deep.

Habitat.—Valley of the Lower Hudson and Long Island, New York; New Jersey; and southward in the highlands to the Carolinas and Georgia.

TAMIAS STRIATUS LYS TERI (sub-sp. nov.).—Manus, 21.5 to 22.5^{mm}; pes, 36 to 37^{mm}; crown, rusty fulvous, sometimes very pale; nape and back nearly to rump clear ash gray; sides, pale buff, fading into white of belly without leaving any sharp line of demarkation between them; light lateral stripe nearly white, at most but faintly washed with buff; under surface of tail, mesially, pale buff to tawny buff.

Habitat.—Mountains of Pennsylvania; Adirondack region of New York; Northern New England; Eastern Canada north to the Gulf of St. Lawrence, and in the interior north to James's Bay, Hudson's Bay.

Coupled with the foregoing external characters, which serve to separate the Northern from the Southern animal, are certain cranial peculiarities which are equally constant and distinctive. Publication of these differences is deferred until a better series of skulls of the Southern form can be obtained. It may be stated here, however, that the brain case is a little broader in typical *striatus*, while the length of the molar series of teeth is greater in *lysteri*.



Ledge of Triassic slate and sandstone at Weehawken, N. J., yielding fish remains.