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A REVIEW OF THE SQUIRRELS OF EASTERN NORTH
AMERICA.

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The present paper is intended to review briefly all the squirrels of the genera *Sciurus* and *Sciuropterus* known to occur in North America east of the great plains. It is based principally on material in the collection of E. A. and O. Bangs, but in addition to this my friends, Dr. C. Hart Merriam, Mr. Gerrit S. Miller, Jr., and Mr. Samuel N. Rhoads, have kindly lent me specimens from many localities of special interest. I have also, through the kindness of Mr. William Brewster, examined all the skins in the Museum of Comparative Zoölogy at Cambridge.

The last important work on our squirrels was Dr. J. A. Allen's Monograph of the Sciuridæ published in 1877. As in the light of more modern material some of the conclusions reached in that work must be changed and a few new forms added, it seems well to review the whole group, mapping out so far as possible the geographic distribution of each species and subspecies.

While all our squirrels tend to break off very readily into geographic forms, the gray squirrel (*Sciurus carolinensis*) presents the most remarkable case, since it is impossible to recognize less than five races of this most protean species.

There is an immense range of individual color variation in some of the species, particularly in the fox squirrels. The northern gray squirrel varies much and is so subject to melanism in certain localities that the black phase is commoner than the gray. In such localities all sorts of strangely colored partially

melanistic individuals occur; on the other hand, over large areas of country the black phase is unknown. The red squirrel is not subject to melanism. I have heard of black individuals, but have never seen one. Local albinistic races or families are, however, not uncommon. One of these colonies is near Denver, Ind., from whence I have a curious series presenting every degree of albinism.

The flying squirrels do not vary individually to an extent worth notice.

The earlier writers were much troubled and confused by our squirrels, and as a consequence some of the species have an appalling array of synonyms. Professor Baird, in 1857, did a splendid piece of work, considering the scanty material he had, in doing away with most of the superfluous names, and Allen, twenty years later, put on a few finishing touches.

List of Species and Subspecies of Sciurus and Sciuropterus Inhabiting Eastern North America.

Name.	Type locality.
<i>Sciurus niger</i> Linn.....	Southern South Carolina.
<i>ludovicianus</i> Custis.....	Red River of Louisiana.
<i>ludovicianus vicinus</i> subsp. nov.....	White Sulphur Springs, W. Va.
<i>carolinensis</i> Gmelin	Carolina.
<i>carolinensis leucotis</i> (Gapper).....	Region between York and Lake Simcoe, Ont.
<i>carolinensis hypophæus</i> Merriam	Elk River, Minn.
<i>carolinensis fuliginosus</i> (Bachman) ..	New Orleans, La.
<i>carolinensis extimus</i> subsp. nov.	Miami, Florida.
<i>hudsonicus</i> Erxl.....	Hudson Strait.
<i>hudsonicus loquax</i> subsp. nov.....	Liberty Hill, Conn.
<i>Sciuropterus sabrinus</i> (Shaw).....	Severn River, James Bay.
<i>silus</i> sp. nov.....	Top of Katis Mtn., above White Sulphur Springs, W. Va.
<i>volans</i> (Linn.).....	North America.
<i>volans querceti</i> subsp. nov.....	Citronelle, Citrus Co., Florida.

Genus SCIURUS Linnæus.

Tail long and bushy; ears well developed, sometimes slightly tufted; feet adapted for climbing, the anterior having four digits and a rudimentary pollex and the posterior five digits, all of which have long, curved, and sharp claws; mammæ from four to six; skull light built, with long postorbital processes; penultimate upper premolar, when present, minute; diurnal.*

* Substantially taken from Flower and Lydekker, *Mammals Living and Extinct*, London, 1891.

Sciurus niger (Linn.). Southern Fox Squirrel.

1758. *Sciurus niger* Linn., Syst. Nat., ed. 10, I, 1758, p. 64 (based on Catesby's black fox squirrel); Allen, Monog. N. Am. Sciuridæ, 1877, p. 719.
 1758. *Sciurus cinereus* Linn., Syst. Nat., ed. 10, I, 1758, p. 64 (in part).
 1788. *Sciurus vulpinus* Gmelin, Syst. Nat., I, 1788, p. 147; Baird, Mamm. N. Am., 1857, p. 246.
 1802. *Sciurus capistratus* Bosc, Ann. du Muséum, I, 1802, p. 281; Bachman, Proc. Zoöl. Soc. London, 1835, p. 85; Aud. and Bach., Quad. N. Am., II, 1851, p. 132, pl. LXVIII.*

Type locality.—Probably southern South Carolina; based on Catesby's black fox squirrel.

Geographic distribution.—From the southern limit of the pine forest in Florida north to Virginia; west about to eastern Louisiana in the south, and to the foot of the Alleghany Mountains in the north.

Habitat.—Wholly confined to the great pine forest of the South Atlantic and Gulf States; breeding in trees, often building its nest in the little cypress ponds so common in this region, living principally on the ground, and climbing trees, even when pursued, with apparent reluctance and in a heavy and clumsy manner.†

S. niger is still common over the greater part of its range, but is very shy, and is seldom seen unless one has a dog trained to hunt it.

General characters.—Size, largest of the eastern squirrels; color very variable, but nose and ears always white. Feet and hands very large, the soles naked in the adult, sometimes partially covered with soft downy hair in the young. Pelage coarse and harsh.

Color.—Nose and ears always white, even in the black individuals; rest of the pelage varying individually from uniform glossy black to clay color

*I have refrained from giving any references to Gray's article on American squirrels entitled *Synopsis of the Species of American Squirrels in the Collection of the British Museum* (Annals and Magazine of Natural History, 3d series, vol. xx, 1867, p. 415), because the author seems to have had but a poor idea of the subject of which he treated, and any reference to his work must only lead to confusion. As an example, Gray puts *Sciurus niger* in F. Cuvier's genus *Macroxus*, under the name *Macroxus vulpinus* (in which genus he also puts the northern and southern gray squirrels), while he keeps the closely related species *S. cinereus* Linn. (= *S. ludovicianus vicinus* of the present paper) in the genus *Sciurus* with the red squirrels and *Sciurus aberti*, which he spells *alberti*. Gray fortunately only proposed three new names for eastern North American squirrels in this article. He renamed the northern and southern gray squirrels, calling the former *Sciurus carolinensis* var. *major* and the latter *Sciurus carolinensis* var. *minor*. The other name is *Macroxus neglectus*, from a specimen without locality, to which Gray assigns 'North America.' It is impossible to say from his description what this animal was, and it is very doubtful if it came from eastern North America.

† Its usual way of escape when chased is to run along the ground to some stump or log, upon which it climbs and waits until its pursuer comes too near, when it runs to another place of vantage, and so on. It takes to a tree only as a last resort, and then keeps to the trunk and large branches, trying to avoid detection by hiding. I believe it never jumps from tree to tree, as does its more agile and lightly built cousin, the gray squirrel.

mingled with black above (the hairs having either black tips or a black subapical band and clay-colored tips) and uniform clay color below. Tail usually mixed clay color and black (the hairs being clay color at base and tips and black in the middle) above and below. A few specimens have the under side of tail clear clay color. Top of head from white nose patch to ears usually black, even in the lightest examples. Occasional examples of a general ferruginous tone with the under side of tail rusty can be found in any large series.

Cranial characters.—Skull large and massive, developing with age conspicuous lateral ridges; rostrum long and well arched; ascending branches of premaxilla broad posteriorly, giving great breadth at the root of the zygomata; nasals broad and long, extending back of ascending branches of premaxilla; postorbital process of frontal heavy; ratio of occipitonasal length to nasal length, 30.78; penultimate upper premolar always absent in the adult. Size of an average adult skull: basilar length (basion to front of premaxilla), 64; occipitonasal length, 74.6; zygomatic breadth, 41; greatest height of cranium above palate, 22.6; greatest length of single half of mandible, 44.2.

Size.—Average measurements of fifteen adult specimens from Citronelle, Citrus Co., Fla.: total length, 638.46; tail, 304.13; hind foot, 87.81.

General remarks.—It does not seem probable that the black individuals of *Sciurus niger* are melanistic. They invariably retain the white ears and nose, and the commonest form has the back about half black, but the amount of black, as in the skunk, is very variable.

Sciurus niger retains its characters so constantly over the whole of its range and differs so markedly from the two smaller fox squirrels, *Sciurus ludovicianus* and *Sciurus ludovicianus vicinus*, that I treat it as a distinct species. Dr. Allen speaks of intermediate individuals from Virginia and Maryland, but I have never seen any such. The material at the time Dr. Allen's Monograph was written was of course very much inferior to that of today; consequently the differences between the species were not wholly apparent. Dr. Allen was, moreover, very badly off for skulls of any of the fox squirrels. I have but few specimens from localities where *S. niger* might be expected to actually interblend with either *S. ludovicianus* or *S. ludovicianus vicinus*, but such regions are small in extent, and it does not seem possible for animals as distinct as these to pass into each other suddenly.

Linnæus' *Sciurus niger*, as is well known, was based on the black fox squirrel of Catesby. Bachman applied this name to the melanistic variety of the northern gray squirrel, taking *Sciurus capistratus* Bosc for the fox squirrel. Professor Baird used the name *Sciurus vulpinus* Gmelin because Linnæus' name was given to the black variety only of the fox squirrel. Dr. Allen in 1877 restored *Sciurus niger* to its proper place, and the name has since then been generally used.

Specimens examined.—Total number, 44, from the following localities:

Florida: Hibernia, 1; Hawkinsville, 1; Citronelle, 37.

Georgia: St. Marys, 2; Columbus, 1.

North Carolina: Tarboro, 2.

Sciurus ludovicianus ludovicianus Custis. Western Fox Squirrel.

1806. *Sciurus ludovicianus* Custis, Barton's Med. and Phys. Journal, II, 1806, p. 43; Baird, Mamm. N. Am., 1857, p. 251.
 1877. *Sciurus niger* var. *ludovicianus* Allen, Monog. N. Am. Sciuridæ, 1877, p. 720.
 1822. *Sciurus rufiventer* "Geoff., Mus. Par.," Desmarest, Mamm., II, 1822, p. 332 (New Orleans); Harlan, Fauna Americana, 1825, p. 176; Schinz, Synop. Mamm., II, 1845-46. (Specimens from Missouri.)
 1823. *Sciurus macroura* Say, Long's Expd. Rocky Mts., I, 1823, p. 115 (Kansas). Name preoccupied by Erxleben for a Ceylon species.
 1825. *Sciurus magnicaudatus* Harlan, Fauna Amer., 1825, p. 178 (as a substitute for *S. macroura* Say).
 1838. *Sciurus subauratus* Bach., Proc. Zööl. Soc. London, 1838, p. 87.
 1838. *Sciurus auduboni* Bach., Proc. Zööl. Soc. London, 1838, p. 97.
 1842. *Sciurus occidentalis* Aud. and Bach., Journ. Acad. Nat. Sciences, Phila., VIII, 1842, p. 317.
 1851. *Sciurus rubicaudatus* Aud. and Bach., Quad. N. Am., II, 1851, p. 30, pl. LV.
 1851. *Sciurus sayi* Aud. and Bach., Quad. N. Am., II, 1851, p. 274, pl. LXXXIX.

Type locality.—Red River of Louisiana.

Geographic distribution.—Mississippi Valley from Louisiana north to South Dakota; east probably to about the western edge of the Alleghany Mountains; west to the plains.*

Habitat.—Mixed forest and heavier woods, extending well into the prairies along the wooded streams. Still abundant over most of its range.

General characters.—Size much smaller than *Sciurus niger* (but little greater than the northern gray squirrel); ears and nose never white; colors very variable, but much deeper and more ferruginous than in the next subspecies, *S. ludovicianus vicinus*; feet of moderate size; soles often well clothed with hairs in winter; pelage in winter soft and full, with the ears well tufted.

Color.—Very variable, ranging from wholly black to a mixed black and rufous or ferruginous, the hairs being banded above, including the tail, and clear rufous or bright ferruginous below; most intense on ears, upper side of hands and feet, and on under side of tail. Some individuals have the under parts orange, some have the upper parts a pepper and salt mixture of yellowish and black and the under parts black.

Cranial characters.—Skull much smaller than that of *Sciurus niger*, which it resembles in general massiveness, but from which it differs in having proportionally a much shorter and blunter rostrum and shorter, broader nasals; ratio of occipitonasal to nasal length, 32.11; arrangement of teeth as in *S. niger*. Size of an average adult skull: basilar length, 55.2; occipitonasal length, 64.2; zygomatic breadth, 37.4; greatest height of cranium above palate, 20.4; greatest length of single half of mandible, 40.8.

* Replaced in western Texas by a different subspecies, the small, pale *Sciurus ludovicianus limitis* (Baird). Type from Devils River, Texas.

Size.—Average measurements of fifteen adult specimens from Point aux Loups Springs, Acadia Parish, Louisiana: total length, 541.5; tail vertebræ, 252; hind foot, 73.7.

General remarks.—*Sciurus ludovicianus* is blessed with a greater number of synonyms than any other of our squirrels, owing to its enormous range of color variation, and to the fact that it occupies a large area of country. The so-called *Sciurus magnicaudatus* of Harlan, from the Missouri River region, will perhaps average a trifle smaller than Louisiana specimens, and, as a rule, is a little paler in color, but the differences are trifling and not worthy of subspecific recognition.

Specimens examined.—Total number, 44, from the following localities:

Louisiana: Point aux Loups Springs, Acadia Parish, 15; Grand Coteau, 2; Prairie Mer Rouge, 5.

Missouri: St. Louis, 3.

Indiana: Redfield,* 4; Denver, 1.

Illinois: Marion, 6; Jacksonville, 4; W. Northfield, 1.

Iowa: Sioux City, 1.

South Dakota: Richland, 2.

Sciurus ludovicianus vicinus subsp. nov. Northern Fox Squirrel.

1831. *Sciurus cinereus* Le Conte, Appendix to McMurtrie's Cuvier, 1831, p. 433; Bachman, Proc. Zool. Soc. London, 1838, p. 89; Aud. and Bach., Quad. N. Am., I, 1849, p. 145, pl. XVII; Baird, Mamm. N. Am., 1857, p. 248.

1877. *Sciurus niger* var. *cinereus* Allen, Monog. N. Am. Sciuridæ, 1877, p. 718.

1792. *Sciurus vulpinus* Schreber, Säugth., IV, 1792, p. 772. (Brought from Baltimore by Schoepf; name preoccupied by *S. vulpinus* Gmelin = *S. niger* Linn.). Not *Sciurus cinereus* Linn.

Type from White Sulphur Springs, W. Va. No. 5215, collection of E. A. and O. Bangs, ♀ old adult. Collected by Thaddeus Surber, January 29, 1896; total length, 582; tail, 282; hind foot, 75.

Geographic distribution.—From northern Virginia north, formerly to central New York and casually southern New England; west through West Virginia and Pennsylvania, probably extending some distance south in the Alleghany Mountains and higher land of Virginia and North Carolina. Now rare and local throughout its range.

Habitat.—The more heavily wooded and unsettled parts throughout its range, apparently fast becoming extirpated.†

* Town not on modern maps; name appears on labels of specimens in Museum of Comparative Zoölogy.

† The Northern fox squirrel is one of the animals that cannot withstand persecution and the clearing and settlement of the country. It is already becoming very hard to get specimens of this subspecies. Dr. B. H. Warren, Zoölogist of the State of Pennsylvania, writes me that the northern fox squirrel is practically extinct in Pennsylvania except in the counties of Dauphin and Cumberland. I can get no information of any having been taken lately in New Jersey and fear it has met the same fate in that State. There seem to be a few left in the vicinity of the city of Washington. Mr. Vernon Bailey, in his 'List of the Mammals of the District of Colum-

General characters.—Size somewhat larger than *S. ludovicianus typicus*. General color usually less ferruginous, often yellowish gray; belly usually white and only under side of tail ferruginous; soles of feet naked in summer, partially covered with hair in winter; character of pelage the same as in true *ludovicianus*.

Color.—Ears never white; nose sometimes white; usual color of upper parts a mixed black and rusty, the hairs banded with black and pale ferruginous; under parts pale ferruginous to rusty white; under surface of tail ferruginous, the hairs with often a black subapical band. Ears ferruginous and in winter well tufted.

Some specimens are much lighter in color, being yellowish gray above, with the black banding of the hairs reduced to a minimum; the belly white, and the under surface of the tail pale ferruginous. Some others have a good deal of black on the head, belly, and legs, but I have never seen a wholly black individual.

Cranial characters.—Skull rather larger than that of *Sciurus ludovicianus*; otherwise similar. Ratio of occipitonasal length to nasal length, 32.3. Size of an average adult skull (the type): basilar length, 61; occipitonasal length, 68.8; zygomatic breadth, 40; greatest height of cranium above palate, 22.2; greatest length of single half of mandible, 42.2.

Size.—Average measurements of three adult specimens from White Sulphur Springs, W. Va.: total length, 587.7; tail vertebrae, 271.8; hind foot, 73.3.

General remarks.—It seems strange that among the multitude of names given our squirrels, and especially the fox squirrels, there should be none to apply to the present subspecies. Linnæus' name *Sciurus cinereus* has passed current for a long time for this animal, but cannot possibly apply to it. Linnæus based his name on three authorities, namely:

Ray's Quadrupeds, p. 215, "*Sciurus virginianus cinereus major*."

Catesby's Natural History, II, p. 74, t. 74, "The Gray Fox Squirrel, *Sciurus cinereus*."

Kalm, 2, p. 409.

Ray says of his *Sciurus virginianus cinereus major* that it is the size of the common rabbit (of Europe) and of the same color, and that it inhabits Virginia. This brief description can apply, on account of the very large size claimed for the species, to none other than the large southern fox squirrel, *Sciurus niger* Linn.

Catesby's gray fox squirrel has been supposed by subsequent authors, Baird excepted, to be the northern fox squirrel, but such a view seems to me wholly untenable and in direct contradiction to the evidence.

bia,' records several specimens from Laurel, Md., in Dr. Merriam's collection, and states that many are shipped to Center Market from points in Virginia thirty or forty miles west of the city. The subspecies is, however, rare in most parts of northern Virginia. Lieut. Wirt Robinson has told me that in ten years' shooting in Buckingham County, Va., he got only two fox squirrels out of hundreds of squirrels killed. A few remain in the Alleghanies of West Virginia, where Mr. Thaddeus Surber got me three fine specimens in the last two years at White Sulphur Springs.

Catesby worked for the greater part of his stay in this country in a region in which the northern fox squirrel is unknown and in which the southern fox squirrel is abundant. Catesby spent one year on the coast, then went up the Savannah River to Fort Moore, about half way from the source of the river to the sea. It is true he made several expeditions into the mountains, and possibly may have seen the northern fox squirrel on some of these trips,* but if he did, he makes no mention of any such animal. He distinctly places his gray fox squirrel as an inhabitant of the coast region (a region wholly tenanted by the southern fox squirrel) by his remark that it, with the black fox squirrel, does great harm to the maize and pulse plantations of Virginia and Carolina (under descriptions of the two fox squirrels), he having previously stated that the inhabited portion of the country extended only sixty miles back from the coast (p. VIII, preface). Catesby's figure and description of the gray fox squirrel leave much to be desired, but one point upon which he was very careful in all his accounts of birds, mammals, and reptiles was size, and he distinctly states the gray and black fox squirrels to have been of about the same size (under description of black fox squirrel, Vol. II, p. 73). Judging by his work on other animals, Catesby would never have made such an assertion if he were describing the northern fox squirrel, an animal much smaller than the southern fox squirrel. Both on geographical and technical grounds it is impossible that Catesby's gray fox squirrel could have been intended for the northern fox squirrel, and his gray fox squirrel resolves itself into nothing more than the light colored phase of the southern fox squirrel, while his black fox squirrel is the black phase of the same species.

The black or nearly black individuals of the southern fox squirrel are much rarer than the light-colored ones, the proportion being about seven to one in favor of the light ones, and when the two extremes are compared they certainly look like very different animals, and are supposed so to be to this day by most southern squirrel-hunters. Catesby tells us that at first he judged the two to be one species, but finally yielded to the common notion and considered them distinct. (Under description of black fox squirrel.)

A point of some interest is that Catesby does not mention the gray squirrel (*Sciurus carolinensis* Gmelin) at all. It must certainly have been an abundant animal all about him, and it is probable that he confused it with the light-colored phase of the southern fox squirrel, perhaps thinking the ones he saw younger or smaller individuals of this kind.

Kalm gives a short but accurate description of the gray squirrel (*Sciurus carolinensis*), both as to size and color, as he saw it in Pennsylvania, and his long account of its habits, etc., refers to this species alone, he making no mention of any larger animal.

From the composite Linnæan species, *Sciurus cinereus*, Gmelin, in 1788, took out the southern gray squirrel and gave it the name *Sciurus caro-*

* It is by no means certain that the northern fox squirrel occurs in the southern Alleghanies.

linensis, thus restricting *Sciurus cinereus* Linn. to the light color phase of the southern fox squirrel, and it becomes a direct synonym of *Sciurus niger* Linn., based on the black phase of the same animal from the same locality.

The only other name that need be considered at all is *Sciurus virginianus* of Kerr's Linnæus, 1792. This name was based on the 'Cat Squirrel' of Pennant's Arctic Zoölogy, which is an indeterminable animal, said to have a very short tail and to inhabit Virginia, where the planters call it 'Cat Squirrel.' As the vernacular name 'Cat Squirrel' is invariably employed in the South for the gray squirrel, it seems likely that the animal in question was nothing more than that species. It may be well to add that Pennant's gray squirrel was a compound animal, including the gray, the southern fox, and perhaps the northern fox squirrels, but referring best to the gray squirrel, as pointed out by Professor Baird in his Mammals of North America in 1857. Professor Baird is the only author to question the standing of Linnæus' *Sciurus cinereus*. With his usual acuteness he saw that the name could not apply to the northern fox squirrel, but for some reason he retained it, probably because Le Conte, Bachman, and others had done so.

Specimens examined.—Total number, 10, from the following localities:

Pennsylvania: Carlisle, 1; Rothruck, 2; — 2.

Maryland: Prince George County, 1; — 1.

West Virginia: White Sulphur Springs, 3.

***Sciurus carolinensis carolinensis* Gmelin.** Southern Gray Squirrel;
Cat Squirrel.

1788. *Sciurus carolinensis* Gmelin, Syst. Nat., I, 1788, p. 148 (based on Pennant's Lesser Gray Squirrel from Carolina).

1877. *Sciurus carolinensis* var. *carolinensis* Allen, Monog. N. Am. Sciuridæ, 1877, p. 704.

Type locality.—Carolina.

Geographic distribution.—Austral Zone, from northern Florida north to about the lower Hudson Valley, west through the Alleghanies south of Pennsylvania to Indiana, Missouri, Indian Territory, and the edge of the plains.

Habitat.—In the South, where *Sciurus carolinensis* occurs in the same region with the southern fox squirrel, the two live in woods of very different character. The fox squirrel is exclusively an inhabitant of the flat, open 'piney woods.' The gray squirrel lives in the dense hammocks of live oak and water oak, and in the deep swamps of cypress, black gum, and great magnolia that border the streams. Farther north it is found in the forests and groves of oak, chestnut, and hickory.

Though they feed much on the ground, all the gray squirrels are highly arboreal and very active tree-climbers, springing, when occasion requires it, long distances from branch to branch.

The southern gray squirrel is in many places exceedingly abundant, but is much shot by the negroes for food, and where persecuted is very shy and seldom seen, passing the greater part of the day in hollows or

nests in the trees and feeding only in the early morning and after sunset in the evening. It is migratory to a certain extent, its migrations probably depending on the food supply.

General characters.—Size medium; colors quite constant, dark yellowish rusty above, white below; soles of feet usually naked, the heel covered with hair; ears sometimes slightly tufted in winter; pelage soft.

Color.—Upper parts dark yellowish rusty, the hairs annulated black and rusty yellow, with usually some gray-tipped hairs on upper surface of legs and arms, sides of neck, and sides of rump, giving a grayer tone to these parts, the yellowish rusty color predominating on head, middle of back, and along sides; hairs of tail dull yellow at base, then black and tipped with white; under parts white; ears yellowish white, sometimes a slight woolly tuft at base.

Cranial characters.—Skull light, developing with age only slight indications of lateral ridges; rostrum long and rather slender; nasals narrow and short, *not* extending back of ascending branch of premaxilla; zygomatica slanting backward from root and lying close to skull (not so much bowed out as in the fox squirrels and not nearly so much so as in the red squirrels); postorbital processes long and slender; penultimate upper premolar normally present in the adult. Size of an average adult skull: basilar length, 50; occipitonasal length, 58.8; zygomatic breadth, 33.2; greatest height of cranium above palate, 19.2; greatest length of single half of mandible, 36.

Size.—Average measurements of two adult specimens from St. Marys, Ga.: total length, 450.5; tail vertebræ, 212; hind foot, 60.8. Average measurements of five adult specimens from Raleigh, N. C.: total length, 461.8; tail vertebræ, 205; hind foot, 63.2.

General remarks.—*Sciurus carolinensis* has escaped synonymy in a most remarkable way. It is rather a happy accident to have the specific name restricted to this form, since it occupies a central position and covers a larger area of country than any one of the four subspecies which surround it and shade directly into it.

The most typical specimens of *S. carolinensis* come from the coast region from northern Florida to Virginia. Specimens from the higher land of North Carolina and Virginia are shading both in color and size toward the northern subspecies (*leucotis*), while those from the lower Mississippi Valley begin to approach the form of the coast of Louisiana (*fuliginosus*). *S. carolinensis typicus* extends about half way down the Florida peninsula before it wholly breaks off into the subtropical form (*extimus*).

Specimens examined.—Total number, 20, from the following localities:

Florida: Rose Bluff, St. Marys River, 1.

Georgia: St. Marys, 4; McIntosh County, 1.

North Carolina: Raleigh, 7; Statesville, 2.

Missouri: Stotesbury, 2.

Indiana: Denver, 1.

Indian Territory: Stilwell, 2.

Sciurus carolinensis leucotis (Gapper). Northern Gray Squirrel.

1830. *Sciurus leucotis* Gapper, Zoöl. Journal, V, p. 206, 1830; Bachman, Proc. Zoöl. Soc. London, 1838, p. 96.
 1792. *Sciurus cinereus* Schreber, Säugth., IV, 1792, p. 766, pl. CCXII; Harlan, Fauna Am., 1825, p. 173.
 1815. *Sciurus pennsylvanicus* Ord, Guthrie's Geog., 2d Am. ed., II, 1815, p. 292 (*nomen nudum*).
 1815. *Sciurus hiemalis* Ord, Guthrie's Geog., 2d Am. ed., II, 1815, p. 292; Rhoads, Appendix to reprint of Ord, 1894, p. 20. (Intermediate.)
 1826. *Sciurus niger* Godman, Am. N. H., II, 1826, p. 133; Richardson, Fauna Bor.-Am., I, 1829, p. 191; Bachman, Proc. Zoöl. Soc. London, 1838, p. 96; Aud. and Bach., Quad. N. Am., I, 1849, p. 261, pl. XXXIV.
 1842. *Sciurus vulpinus* DeKay, N. Y. Zoöl., I, 1842, p. 59.
 1849. *Sciurus migratorius* Aud. and Bach., Quad. N. Am., I, 1849, p. 265, pl. XXXV.
 1877. *Sciurus carolinensis* var. *leucotis* Allen, Monog. N. Am. Sciuridæ, 1877, p. 701.
 1894. *Sciurus carolinensis pennsylvanicus* Rhoads, Appendix to reprint of Ord, 1894, p. 19.

Type locality.—Region between York and Lake Simcoe, Ontario.

Geographic distribution.—Transition Zone and locally, lower edge of Canadian Zone from the Alleghanies of Pennsylvania north through New York and New England to southern New Brunswick and southern Canada; west to Minnesota.

Habitat.—Hard-wood forests and groves of oak, chestnut, and hickory. Abundant over most of the country it occupies, but local in the north, and only occurring where there are large tracts of hard wood. Often very numerous and tame in the parks of the large cities, where it is carefully protected. The northern gray squirrel is highly migratory, but the migrations probably depend wholly on food supply and occur irregularly. Sometimes a large section of country will be deserted for several years, and at other times an unusually heavy crop of beech nuts or acorns will attract the gray squirrels in enormous numbers.

General characters.—Size large; tail long and bushy; much given to melanism locally, but especially northward. Color of normal examples much lighter above than in *carolinensis typicus*, being silvery gray. Feet large, the soles sometimes covered with hair between the pads in winter.

Color.—In winter pelage, upper parts silvery gray, the hairs banded yellowish brown and black, with long white tips; the yellowish brown color often predominating on head, center of back, and upper surface of hands and feet; under parts white (sometimes a specimen will be a little rusty between fore legs or on neck or chest); hairs of tail long, yellowish at base, then black and deeply tipped with white; ears yellowish white, sometimes with woolly tufts at base. In summer the white tips of the hairs wear off, giving a more yellowish appearance to the whole upper parts, with sometimes a good deal of rusty on the back, sides, neck, and legs. Wholly black (melanistic) individuals are common at some localities, and at such places every degree between the black and gray can be found.

Cranial characters.—Skull larger than that of typical *carolinensis*, but otherwise similar. Size of an average adult skull: basilar length, 54.4;

occipitonasal length, 65.2; zygomatic breadth, 35; greatest height of cranium above palate, 19.8; greatest length of single half of mandible, 37.2.

Size.—Average measurements of five adult specimens from Liberty Hill, Conn.: total length, 505.5; tail vertebræ, 230.6; hind foot, 71.7

General remarks.—Mr. Rhoads, in the appendix to his edition of Ord (1894, p. 19), tries to bring into use Ord's name *Sciurus pennsylvanicus* for the northern gray squirrel, calling it *Sciurus carolinensis pennsylvanicus* (Ord). Ord's name is a *nomen nudum*, and has no standing in nomenclature, even if we can guess the species he meant to apply it to. Gapper's name *leucotis* is well founded and has been in current use for nearly twenty years, ever since Allen reestablished it in his Monograph of the American Sciuridæ in 1877.

About Ord's *Sciurus hiemalis* I feel some doubt. The name unquestionably was given to a gray squirrel in winter pelage, but from the locality attributed it, "Little Egg Harbor, New Jersey," the animal was probably intermediate between the southern and northern grays, and it therefore seems wiser to allow Gapper's name to stand for the northern gray squirrel.

Specimens examined.—Total number, 33, from the following localities:

Ontario: Mount Forest, 1.

Wisconsin: Madison, 1.

Minnesota: Elk River, 1.

Massachusetts: Belmont, 1; Brookline, 15; Wareham, 4; Marthas Vineyard, 2.

Connecticut: Liberty Hill, 8.

***Sciurus carolinensis hypophæus* Merriam.** Merriam's Gray Squirrel.

1886. *Sciurus carolinensis hypophæus* Merriam, Science, Vol. VIII, p. 351, April 16, 1886; Allen, Bull. Am. Mus. Nat. Hist., Vol. VI, 1894, p. 171, foot-note.

Type locality.—Elk River, Minnesota.

Geographic distribution.—The edge of the forest belt in Minnesota (a region having quite a distinctive mammalian fauna). Limits of range unknown.

General characters.—Size large, equaling that of *leucotis*. Color of upper parts rather darker than in *leucotis* and encroaching all round on under parts, leaving only a small central streak of white on belly. Soles of feet densely furred in winter between the pads, naked in summer. Ears well tufted in winter. Pelage in winter very long and full.

Color.—In winter upper parts dark iron gray, mixed with yellowish and rusty; the hairs banded, yellowish rusty and black, and somewhat tipped with white; a small irregular central streak of white on belly; rest of under parts like back; chest and under side of neck sometimes uniform yellowish brown; tail dark, the black band of hairs longer and the white tips shorter than in *leucotis*; ear tufts well developed in winter, yellowish white; in summer the general color is darker and more yellowish, owing to the wearing down of the hair.

Cranial characters.—Skull about the size of that of *leucotis*, showing no characters by which it can be separated from any of the *carolinensis* series. Size of an average adult skull: basilar length, 54.6; occipitonasal length, 63.2; zygomatic breadth, 34.6; greatest height of cranium above palate, 19; greatest length of single half of mandible, 35.4.

Size.—Average measurements of nine adult specimens from Elk River, Minn.: total length, 496.3; tail vertebræ, 220.4; hind foot, 67.2.

General remarks.—Little is known of this fine squirrel. My knowledge of it comes wholly from Dr. Merriam's description and from four specimens from the type locality, Elk River, Minn., kindly lent me by him, and ten topotypes in the Bangs collection.

One point of some interest is that the northern gray squirrel (*Sciurus carolinensis leucotis*) occasionally occurs at Elk River in considerable numbers with *hypophæus*, but has not been known to breed there, appearing only in migrations. This fact suggests the possibility of *hypophæus* proving to be a distinct species when more is known of it.

Specimens examined.—Total number, 14, from Elk River, Minn.

Sciurus carolinensis fuliginosus (Bachman). Bayou Gray Squirrel.

1838. *Sciurus fuliginosus* Bach., Proc. Zoöl. Soc. London, 1838, p. 96; Aud. and Bach., Quad. N. Am., III, 1853, p. 240, pl. CXLIX.

1895. *Sciurus carolinensis fuliginosus* Bangs, Proc. Bost. Soc. Nat. Hist., XXVI, p. 543, 1895; Rhoads, Proc. Acad. Nat. Sciences, Phila., 1896, p. 196.

Type locality.—Near New Orleans, La.

Geographic distribution.—The bayou region of the coast of Louisiana.

General characters.—Size larger than true *carolinensis*; colors rich and dark; under parts never pure white and often clear ferruginous; tail long and bushy, the hairs but slightly tipped with white; feet large, soles naked; ears with often a woolly tuft at base in winter.

Color.—Upper parts deep yellowish ferruginous, varied with black; the hairs banded, many of them having the black band extending to the tip; tail dark, the hairs yellowish ferruginous at base, then black and tipped with white, the black subapical band very broad and the white tips short; under parts varying from clear buffy ferruginous, the chin only gray, to smoky gray; line of demarkation between colors of upper and under parts always low down and irregular; ear tufts well developed, ferruginous in the examples with ferruginous under parts, grayish white in the examples with gray under parts.

Cranial characters.—Skull a little larger than that of true *carolinensis*, otherwise similar. Size of an average adult skull: basilar length, 50.6; occipitonasal length, 60; zygomatic breadth, 33.4; greatest height of cranium above palate, 19.8; greatest length of single half of mandible, 36.

Size.—Average measurements of ten adult specimens from Gibson, La.: total length, 467; tail vertebræ, 219.5; hind foot, 67.

General remarks.—*Sciurus carolinensis fuliginosus* is confined in its extreme form to the heavy swamps of the bayou region of the coast of Louisiana. Farther north in the 'prairie' regions of the same State it

begins gradually to approach *carolinensis typicus*, a large series from Acadia Parish, La., showing this tendency. Mr. Rhoads speaks of the living gray squirrels he saw in the park at Memphis, Tenn.,* and refers them to *fuliginosus*, on account of their large size and dark coloring. They are probably about like the examples from central Louisiana, which retain the large size and dark color above, but have pure white under parts, and can safely be called intermediates between *carolinensis* and *fuliginosus*, though perhaps nearer *fuliginosus*.

Specimens examined.—Total number, 37, from the following localities:

Louisiana: Gibson, Terre Bonne Parish, 13; Cartville, Acadia Parish, 3; Point Aux Loups Springs, Acadia Parish, 21. (Those from Acadia Parish not extreme.)

Sciurus carolinensis extimus subsp. nov. Everglade Gray Squirrel.

Type from Miami, Dade Co., Florida. No. 4519, ♀ young adult, collection of E. A. and O. Bangs. Collected March 12, 1895, by L. Brownell. Total length, 432; tail vertebræ, 194; hind foot, 54.

Geographic distribution.—Subtropical fauna of south Florida, northward about half way up the peninsula.

Habitat.—Everglades and oak and cabbage palmetto hammocks. Not found in the 'piney woods.'

General characters.—Size smallest of the *carolinensis* series; tail and hind foot short; color much lighter, more gray than in *carolinensis typicus*; soles naked; ears with sometimes a slight woolly tuft at base.

Color.—Upper parts yellowish gray, the hairs banded black and dull yellow, a few tipped with white (much the same color as the upper parts of *leucotis* in summer pelage); tail light colored, the hairs yellowish at base, then black and tipped with white; under parts white; ear tufts white.

Cranial characters.—Skull smaller than that of true *carolinensis*, otherwise similar. Size of an average adult skull, the type: basilar length, 47; occipitonasal length, 55; zygomatic breadth, 31.2; greatest height of cranium above palate, 18; greatest length of single half of mandible, 33.2.

Size.—Average measurements of seven adult specimens from Miami, Fla.: total length, 438.4; tail vertebræ, 190.9; hind foot, 47.

General remarks.—*Sciurus carolinensis extimus* represents in its small size, short tail, and small hind foot the extreme of differentiation of the *carolinensis* series, but differs widely from true *carolinensis*, its nearest geographical cousin, in its much grayer color. This yellowish gray color is probably highly protective, the animal spending most of its life among trees covered with the gray Spanish moss, *Tillandsia usneoides*, which its color almost exactly matches in tone.

S. carolinensis extimus is only typical in the peculiar subtropical fauna of the everglades and southern part of the Florida peninsula. Specimens from Citrus Co., Fla., are larger and darker in color and are rather nearer to true *carolinensis* than to *extimus*. The gray squirrel of northern Florida is true *carolinensis*.

* Proc. Acad. Nat. Sciences Phila., 1896, p. 196.

Specimens examined.—Total number, 8, from the following localities:

Florida: Miami, Dade Co., 7; Oak Lodge (east peninsula, opposite Micco), Brevard Co., 1; also 21 from Citrus Co. (Citronelle, 2; Blitches Ferry, 19), which are intermediates between *carolinensis* and *extimus*.

***Sciurus hudsonicus hudsonicus* (Erxleben).** Red Squirrel; Chickaree.

- 1777. *Sciurus vulgaris* ε *hudsonicus* Erxleben, Mammalia, 1777, p. 416.
- 1778. *Sciurus hudsonius* Pallas, Nov. Spec. Glir., 1778, p. 376.
- 1820. *Sciurus rubrolineatus* Desmarest, Mamm., I, 1820, p. 333 (Encyclopédie Méthodique).
- 1827. *Tamias hudsonia* Lesson, Man. Mamm., 1827, p. 231.
- 1843. *Tamias rubrolineatus* Schinz, Syn. Mamm., II, 1843, p. 48.
- 1877. *Sciurus hudsonius* var. *hudsonius* Allen, Monog. N. Am. Sciuridæ, 1877, p. 672.

Type locality.—Hudson Strait. 'Ad fretum Hudsonis.'

Geographic distribution.—Boreal North America, from Labrador to Alaska, south to Maine and the northern peninsula of Michigan, and along the tops of the higher Alleghanies to Roan Mountain, North Carolina.

Habitat.—Spruce and fir forests. Feeds largely on the seeds of conifers.

The northern red squirrel is excessively abundant in all favorable situations. In many places one can often count twenty or thirty individuals within sight or hearing at one time. Always noisy and jerky in its motions, the red squirrel is usually tame and unsuspicious. It feeds and lives both on the ground and in the trees, and is a very agile climber.

General characters.—Size smallest of the eastern squirrels; tail short, flat, and narrow; a decided difference in color and markings between winter and summer pelage; * dorsal stripe in winter chestnut rufous; sides olivaceous gray; white of underparts vermiculated with black; in summer pelage hardly distinguishable from the next subspecies by color alone; soles densely furred in winter and somewhat so in summer; ear tufts in winter, long, protruding well beyond the ear; pelage in winter very full and soft.

Color.—*Winter pelage*: Upper parts with a broad dorsal band extending from between the ears down upper surface of tail, bright chestnut rufous; sides, upper surface of legs and arms, and cheeks olivaceous gray, the hairs banded with black; upper surface of feet and hands often more yellowish; under parts grayish white, thickly vermiculated with blackish, the hairs plumbeous at base. An indistinct blackish line usually shows on sides between colors of upper and under parts. On the upper surface of the tail the hairs are clear chestnut rufous, and only a few have black rings; on the sides and lower surface they are dull yellowish at base and tips and black in the middle. *Summer pelage*: Upper parts with no dorsal stripe; a peculiar ferruginous gray with an olivaceous cast, the hairs banded with black, becoming clear ferruginous on upper surface of hands and feet, and sometimes legs and arms also; under parts white, often

* In this connection, see Allen on 'Seasonal Variation in Color in *Sciurus hudsonius*,' Bull. Am. Mus. Nat. Hist., Vol. III, p. 41, 1890.

suffused with rusty yellow; a broad black stripe along side separating colors of upper and under parts.

Cranial characters.—Skull light, developing very slight lateral ridges with age; rostrum short and blunt; nasals ending at fronto-premaxillary suture; postorbital process of frontal light and long; zygoma standing out squarely from root, and more flaring than in either the fox or gray squirrels; audital bullæ large. Penultimate upper premolar either absent or present in the adult, though more often absent, and when present very minute.

Size of an average adult skull: basilar length, 38.4; occipitonasal length, 45; zygomatic breadth, 26.2; greatest height of cranium above palate, 15.6; greatest length of single half of mandible, 26.4.

Size.—Average measurements of four adult specimens from Hamilton Inlet, Labrador: total length, 309; tail vertebræ, 120.5; hind foot, 47.75 (all four are very old adults and the averages therefore large). Average measurements of ten adult specimens from Digby, Nova Scotia: total length, 296.5; tail vertebræ, 118.2; hind foot, 45.2

General remarks.—*Sciurus hudsonicus* has but one bad synonym—the *Sciurus rubrolineatus* of Desmarest. Desmarest based his name wholly on the 'Ecureuil rouge (*species nova*)' of the French edition of Warden's Description of the United States, published in 1820. Warden described under this name a red squirrel in winter pelage, assigning it no habitat. It is the only red squirrel Warden gives, and it is impossible to say which race it belonged to. In addition to *Sciurus rubrolineatus* Desmarest gives *Sciurus hudsonius*, his description of the latter being taken from a summer specimen. It is evident that the great difference between summer and winter specimens alone led Desmarest into the belief that there are two species of red squirrels.

Sciurus hudsonicus typicus belongs to the spruce and fir belt and only extends south as far as these trees. Wherever the Transition and Canadian faunas meet, as in central New York, New Hampshire, and Minnesota, intermediates between *hudsonicus typicus* and *hudsonicus loquax* occur. Only a very short distance south, however, into truly Transition country *loquax* is found in the typical form.

Specimens examined.—Total number, 89, from the following localities:

Labrador: Hamilton Inlet, 4.

Nova Scotia: Digby, 16; Granville, 4; James River, 1; Schenacidae (Cape Breton), 6.

New Brunswick: Campobello Island, 9.

Quebec: Lake Edward, 5.

Ontario: North Bay, 8; Nepigon, 1; Peninsula Harbor, 10.

Saskatchewan: Batoche, 5.

Maine: Greenville, 5; Upton, 5.

West Virginia: White Sulphur Springs, 1.

North Carolina: Roan Mountain, 4.

Intermediates:

New Hampshire: Franconia, 2; Antrim, 1.

New York: Peterboro, 1.

Sciurus hudsonicus loquax subsp. nov. Southern Chickaree.

1815. *Sciurus carolinensis* Ord, Guthrie's Geog., 2d Am. ed., II, 1818, p. 292.
(Name preoccupied by Gmelin for the southern gray squirrel.)

Type from Liberty Hill, Conn., No. 4270, ♂ adult, collection of E. A. and O. Bangs. Collected by Outram Bangs December 24, 1895. Total length, 323; tail vertebræ, 141; hind foot, 47.

Geographic distribution.—Transition and Carolinian zones, from southern Maine and southern Minnesota to Virginia, west to the edge of the plains. Not found in the tops of the higher Alleghanies where *hudsonicus typicus* takes its place.

Habitat.—Mixed woods, groves, and in fact almost everywhere; perhaps most numerous where there are large tracts of *Pinus rigida*, the seeds of which it is very fond of. Very abundant over the whole of its range except the southern part, where it becomes rare and local.

General characters.—Size somewhat larger than *hudsonicus typicus*; tail longer; color of dorsal stripe in winter pelage usually brighter red; under parts pure grayish white, *not vermiculated*; soles and palms furred in winter, naked in summer.

Color.—*Winter pelage*: upper parts with a broad dorsal band extending from between ears down upper surface of tail, varying from bright ferruginous to orange rufous; sides and upper surface of arms and legs yellow or rusty gray, with sometimes an olivaceous cast, the hairs banded with black; under parts clear grayish white, without vermiculations, the hairs plumbeous at base; usually a black line shows indistinctly along sides between colors of upper and under parts; hairs of upper surface of tail clear ferruginous; those of lower surface and sides dull yellow at base and tip and black in middle. *Summer pelage*: Impossible to tell with certainty from summer pelage of *hudsonicus typicus*, but usually more ferruginous gray and less olivaceous gray.

Cranial characters.—Skull averaging larger than that of *hudsonicus typicus*; otherwise similar. Size of an average adult skull (the type): basilar length, 40; occipitonasal length, 46.4; zygomatic breadth, 27; greatest height of cranium above palate, 16.4; greatest length of single half of mandible, 28.

Size.—Average measurements of eight adult specimens from Liberty Hill, Conn.: total length, 318.3; tail vertebræ, 133.5; hind foot, 47.42.

General remarks.—Professor Baird, in his Mammals of North America, first pointed out the fact that northern examples of *Sciurus hudsonicus* had the under parts vermiculated with black and the southern examples did not. Dr. Allen, in his Monograph of the North American Sciuridæ, dwelt at some length on the differences between the two races, but did not separate them by name. In winter pelage *Sciurus hudsonicus typicus* and *Sciurus hudsonicus loquax* can be told apart at a glance, but in their summer coats they are not so easily distinguished; as a rule, however, *loquax* is more rusty and less olivaceous, and the difference in size between individuals of the same age is well marked, *hudsonicus typicus* being always the smaller of the two.

Specimens examined.—Total number, 56, from the following localities :

Connecticut: Liberty Hill, 11.

Massachusetts: Wareham, 24; Wayland, 1; Brookline, 1.

Indiana: Denver, 14.

Minnesota: Steel Co., 1.

Wisconsin: Waupaca, 2.

North Carolina: Magnetic City, foot of Roan Mountain, 2 (not quite typical).

Genus *SCIUROPTERUS* F. Cuvier.

Tail flat, laterally expanded, densely haired with fine hairs; an expansion of the skin of the sides extends from wrist to ankle, and when spread acts, with the flat tail, like a parachute, enabling the animal to make long, slanting descents through the air; pelage very fine and dense; skull light; audital bullæ large; end of the pterygoid process resting against audital bulla; rostrum short; occipital region slightly drooping and turned under; interorbital constriction deep and zygoma drooping to make room for the large eye; penultimate upper premolar always present; nocturnal animals.

Sciuropterus sabrinus (Shaw). Severn River Flying Squirrel.

- 1801. *Sciurus sabrinus* Shaw, Gen. Zoöl., I, 1801, p. 157.
- 1778. "*Sciuro volante majore*" Pallas, Nova Spec. Glires, 1778, p. 354 (not a scientific name).
- 1788. *Sciurus hudsonius* Gmelin, Syst. Nat., I, 1788, p. 153 (preoccupied).
- 1815. *Sciurus labradorius* Ord, Guthrie's Geog., 2d Am. ed., 1815, p. 292 (*nomen nudum*).
- 1828. *Pteromys sabrinus* Richardson, Zoöl. Journ., III, 1828, p. 519; Aud. and Bach., Quad. North Am., III, 1853, p. 202.
- 1829. *Pteromys hudsonius* Fischer, Syn. Mamm., 1829, p. 365; Baird, Mamm. North Am., 1857, p. 288.
- 1874. *Sciuropterus volucella* var. *hudsonius* Allen, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 289; Monog. N. Am. Sciuridæ, 1877, p. 655.

Type locality.—Severn River, James Bay, Canada.

Geographic distribution.—Boreal North America, south in the east to northern New York and southern New Hampshire.

Habitat.—Mixed woods and forest; nocturnal, spending the day in hollows and nests in the trees.

General characters.—Size, largest of the eastern flying squirrels; tail broad, the hairs long; hind foot large; a decided difference in color between winter and summer pelage; under side of tail washed with sooty; hairs of under parts, plumbeous at base, showing through, and giving a decidedly gray appearance to under parts; soles furred both in winter and summer, only the pads naked.

Color.—*Winter pelage:* upper parts very glossy, wood brown to cinnamon, often somewhat shaded with yellow, darkening on tail towards tip to sooty; hairs of back and sides dark plumbeous below, the merest tip being colored, the plumbeous color therefore showing through whenever the fur is the least disturbed; upper surface of feet and hands sooty gray;

cheeks gray; a black orbital ring; ears sparsely haired, dusky; under parts dirty white, the hairs plumbeous at base; under side of tail yellowish white washed with drab and sooty. *Summer pelage*: whole upper parts uniform sooty drab.

Cranial characters.—Skull large; audital bullæ small and flat (for the genus); the bone dense; nasals slightly turned up at end—pug-nosed; all the teeth, including penultimate upper premolar, large. Size of an average adult skull: basilar length, 32.4; occipitonasal length, 38.4; zygomatic breadth, 22.8; greatest height of cranium above palate, 12.4; greatest length of single half of mandible, 23.4.

Size.—Average measurements of seven adult specimens from Greenville, Maine: total length, 278.6; tail vertebræ, 130.4; hind foot, 37.6.

General remarks.—Dr. Allen, in 1874, relegated this fine species to sub-specific rank, calling it a variety of *Sciuropterus volans* (alias *volucella*), and followed the same arrangement in 1877 in his Monograph of the Sciuridæ, where he makes the statement "Grades insensibly into var. *volucella*." How or where Dr. Allen found intergrades I am at a loss to know. In reality *Sciuropterus sabrinus* and *S. volans* are two distinct species and never intergrade. Wherever their geographic ranges meet they occur together, often in the same wood, each species keeping distinct and retaining its characters as well as where far removed from contact with the other. *S. sabrinus* meets and overlaps the range of *S. volans* for a short distance, wherever the Canadian and Transition faunas meet. Dr. C. Hart Merriam found both species breeding in the Adirondack region of New York, and in his interesting accounts of the habits of these squirrels clearly shows the two to be specifically distinct, although he retained the varietal names of Allen. In the same wood lot at Peterboro, N. Y., Mr. Gerrit S. Miller, Jr., took on November 22, 1894, a fine example of *S. volans*, and on December 28, 1895, a pair of *S. sabrinus*. He has kindly lent me the specimens, which are now before me. I have both species from Hancock, N. H., but there *volans* is apparently the more common. I have yet to see a specimen that is in any way intermediate between *S. sabrinus* and *S. volans*, and if one did turn up it would be safe to consider it a natural hybrid and not an intergrade.

Specimens examined.—Total number, 24, from the following localities:

Nova Scotia: Annapolis, 3; Digby, 1.

Ontario: Nepigon, 1.

Maine: Greenville, 8; Bucksport, 2.

New Hampshire: Hancock, 1.

New York: Peterboro, 2.

Arctic America: Red River, 2; Fort Resolution, 1; Big Island, 1; Moose Factory, 2.

***Sciuropterus silus* sp. nov.** Alleghany Mountain Flying Squirrel.

Type from top of Katis Mountain, White Sulphur Springs, W. Va., at an altitude of 3,200 feet. No. 4931, ♂ adult, collection of E. A. and O. Bangs. Collected by Thaddeus Surber September 2, 1895. Total length, 214; tail vertebræ, 92; hind foot, 28.

Geographic distribution.—Limits of range unknown, probably the higher southern Alleghanies.

General characters.—Size smallest of the eastern flying squirrels; similar in general appearance to *S. sabrinus*, but darker in color; soles naked in summer.

Color.—The type (in summer, beginning to change to winter pelage): upper parts hair brown, shading in places toward isabella color; ears and upper surface of tail, feet, and hands sooty; cheeks dark gray; a black orbital ring; under parts grayish white, the hairs somewhat darker at base; under surface of tail drab, shading to sooty; soles and palms naked; the skin black.

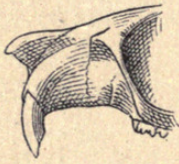


FIG. 29.—Rostrum of *Sciuropterus silus*.

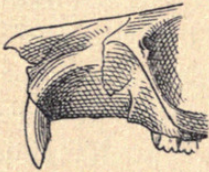


FIG. 30.—Rostrum of *Sciuropterus volans*.

Cranial characters.—Skull very small, similar to that of *S. sabrinus* in respect to the flat audital buliæ and large teeth, but differing in having the foramen ovale transversely oval instead of round. The peculiar pug-nosed effect given by the turned-up ends of the nasals is even more exaggerated than in *sabrinus*. Size of the type skull: basilar length, 25.8; occipito-nasal length, 31; zygomatic breadth, 19; greatest height of cranium above palate, 12.2; greatest length of single half of mandible, 18.6.

Size.—The type: total length, 214; tail vertebræ, 92; hind foot, 28.

General remarks.—*Sciuropterus silus* is known at present only by the type, all my efforts to get additional specimens having so far failed. Lieut. Wirt Robinson spent part of the summer of 1896 at White Sulphur Springs, W. Va., and kindly offered to get me flying squirrels. He succeeded in taking but one, a perfectly typical example of *S. volans*. It was taken at an altitude of about 1,200 feet lower than the type of *S. silus*. It is probable that the ranges of the two species overlap.

Sciuropterus silus bears no very close relationship to *S. volans*, although it is even smaller than that species. Its affinities lie with *S. sabrinus*, of which it is probably the Alleghany Mountain representative. It is, however, so very much smaller than that species and differs from it so much in other respects that I have accorded it specific rank.

Specimen examined.—The type.

***Sciuropterus volans volans* (Linn.). Southern Flying Squirrel.**

- 1758. *Mus volans* Linn., Syst. Nat., ed. 10, I, 1758, p. 63.
- 1758. *Sciurus volans* Linn., Syst. Nat., ed. 10, I, 1758, p. 64 (in part).
- 1788. *Sciurus volucella* Pallas, Nov. Spec. Glires, 1788, p. 351.
- 1818. *Pteromys volucella* Desmarest, Nouv. Dict. d'Hist. Nat., XXVII, 1818, p. 406; Aud. and Bach., Quad. N. Am., I, 1849, p. 216, pl. XXVIII; Baird, Mamm. N. Am., 1857, p. 286.
- 1828. *Sciuropterus volucella* Geoffroy, Dict. Class. d'Hist. Nat., XIV, 1828, p. 132.
- 1874. *Sciuropterus volucella* var. *volucella* Allen, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 189; Monog. N. Am. Sciuridæ, 1877, p. 655.
- 1890. *Sciuropterus volans* Jordan, Man. Vertebrates, 1890, p. 324, footnote.

Type locality.—North America (Virginia ?).*

Geographic distribution.—Transition and Carolinian zones of the east; from northern New York and southern New Hampshire south to Georgia; west to the plains.

Habitat.—Forests and groves; everywhere abundant, nocturnal, spending the day in hollow trees or nests made of bark, leaves, and moss.

General characters.—Size medium, considerably smaller than *S. sabrinus*; hind foot smaller; tail narrower and of a rather different shape, tapering off more toward the end; no decided difference in color between winter and summer pelage; hairs of under parts white to the base; soles furred in winter, only the pads naked; wholly naked in summer; palms naked throughout the year.

Color.—*Winter pelage*: upper parts drab, often shaded irregularly with russet, slightly darker on upper surface of tail, the hairs plumbeous below, only the tips being colored; upper surface of hands grayish white; upper surface of feet drab, the toes and inner edge grayish white; cheeks grayish white; a black orbital ring; ears nearly naked, the skin dusky; under parts pure white, usually washed on lower surface of tail and sometimes of legs and flying membrane with pinkish buff, the hairs white basally. *Summer pelage* not differing materially from the winter, the upper parts usually more russet, having the appearance of being due to fading and wearing rather than to a change in color; the white of under parts often soiled, and the color of under surface of tail more intense.

Cranial characters.—Skull smaller and lighter than that of *S. sabrinus*, audital bullæ larger, not flattened, the bone light and papery; nasals not so much turned up at ends; teeth, including penultimate upper premolar, lighter throughout. Size of an average adult skull: basilar length, 28.8; occipitonasal length, 34.2; zygomatic breadth, 21; greatest height of cranium above palate, 12.2; greatest length of single half of mandible, 20.6.

Size.—Average measurements of seven adult specimens from Liberty Hill, Conn.: total length, 234.5; tail vertebræ, 99.6; hind foot, 31.4.

General remarks.—*Sciuropterus volans* retains its characters, with only a slight range of individual variation, throughout the whole of the Transition and Carolinian zones, but in the lower Austral Zone begins to approach the slightly different form of peninsular Florida. A series from St. Marys, Ga., is intermediate both in cranial characters and color between *S. volans typicus* and *S. volans querceti*. In the north *S. volans* overlaps the range of *S. sabrinus* for a short distance, the two meeting wherever the Transition and Canadian faunas run into each other.

Specimens examined.—Total number, 28, from the following localities:

New Hampshire: Hancock, 3.

New York: Peterboro, 1.

* No definite type locality can be assigned the southern flying squirrel. Linnæus based his *Mus volans* on Ray, Edwards and Seba, and himself gives Virginia and Mexico as its habitat.

Ray tells us "In Nova Hispania atque etiam Virginia reperitur."

Seba does not specify where his specimen came from, though he calls it *Sciurus volans virginianus*.

Edwards says: "They are brought to us from several parts of North America and have been of late discovered in Poland."

Massachusetts: Wareham, 4; Mount Greylock, 1; Waverly, 3; Concord, 1; Waltham, 1.

Connecticut: Liberty Hill, 8.

Indiana: Denver, 1.

Missouri: Stotesbury, 1.

Maryland: Forest Glen, 1.

Virginia: Nelson County, 2.

West Virginia: White Sulphur Springs, 1.

Intermediates:

Georgia: St. Marys, 10; McIntosh County, 1.

***Sciuropterus volans querceti* subsp. nov.** Florida Flying Squirrel.

Type from Citronelle, Citrus Co., Fla., No. 2451, ♀ old adult, collection of E. A. and O. Bangs. Collected by F. L. Small, September 17, 1894. Total length, 235; tail vertebræ, 95; hind foot, 32.

Geographic distribution.—Peninsular Florida, north to southern Georgia; exact western limits of range unknown.

Habitat.—The hammocks and margins, where there is plenty of live oak and water oak; nocturnal, spending the day in hollow stumps or in nests in the thick bunches of Spanish moss.

General characters.—Very similar to *S. volans typicus*, from which it differs in having the upper parts more uniform russet, and the under parts, especially the under surface of tail, strongly washed with the same color; soles naked; audital bullæ wheel-shaped, very large and deep.

Color.—Upper parts russet, shading to yellowish drab in places; cheeks grayish white; upper surface of feet and hands sooty gray; toes rather lighter; under parts white, a good deal shaded with pinkish russet.

Cranial characters.—Skull similar to that of *S. volans*, except that the audital bullæ are much larger, more inflated, and broadly wheel-shaped (see figs. 31 and 32). Size of an average adult skull (the type): basilar length, 30.2; occipitonasal length, 34.6; zygomatic breadth, 21; greatest height of cranium above palate, 12.8; greatest length of single half of mandible, 21.4.

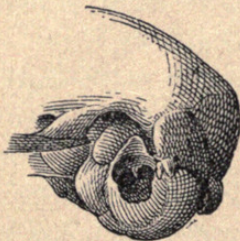


FIG. 31.—Audital bulla of *Sciuropterus volans*.

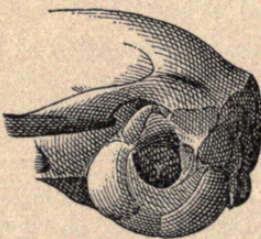


FIG. 32.—Audital bulla of *Sciuropterus v. querceti*.

Size.—Average measurements of three adult specimens from Citronelle, Fla.: total length, 237.66; tail vertebræ, 102.66; hind foot, 31.33.

General remarks.—*Sciuropterus volans querceti* passes into true *volans* in southern Georgia, a series of specimens from St. Marys, Ga., being intermediate between the two. A specimen from Powhatan Plantation, near Gibson, La., without a skull, seems referable to this form, and may thus extend its range to the coast of Louisiana.

Specimens examined.—Total number, 3, all from Citronelle, Citrus Co., Fla.

EXPLANATION OF PLATES.

All the figures are life size and were drawn by Dr. J. C. McConnell.

PLATE VIII.

- Fig. 1. *Sciurus niger* L.—♀ old adult, Citronelle, Fla. (No. 1978, Bangs coll.)
2. *Sciurus ludovicianus* Custis—♂ old adult, Point aux Loups Springs, La. (No. 2929, Bangs coll.)
3. *Sciurus ludovicianus vicinus* Bangs—♀ old adult; the type, White Sulphur Springs, W. Va. (No. 5215, Bangs coll.)
4. *Sciurus carolinensis hypophæus* Merriam—♂ old adult, Elk River, Minn. (No. 3942, Merriam coll.)

PLATE IX.

- Fig. 1. *Sciurus carolinensis leucotis* Gapper—♀ old adult, Liberty Hill, Conn. (No. 1043, Bangs coll.)
2. *Sciurus carolinensis fuliginosus* (Bach.)—♂ old adult, Gibson, La. (No. 2833, Bangs coll.)
3. *Sciurus carolinensis* Gmelin—♀ old adult, St. Marys, Ga. (No. 5141, Bangs coll.)
4. *Sciurus carolinensis extimus* Bangs—♀ adult; the type, Miami, Fla. (No. 4519, Bangs coll.)

PLATE X.

- Fig. 1. *Sciurus hudsonicus loquax* Bangs—♂ old adult; the type, Liberty Hill, Conn. (No. 4270, Bangs coll.)
2. *Sciurus hudsonicus* (Erxleben)—♂ old adult, Hamilton Inlet, Labrador. (No. 3956, Bangs coll.)
3. *Sciuropterus sabrinus* (Shaw)—♂ old adult, Greenville, Me. (No. 4962, Bangs coll.)
4. *Sciuropterus volans querceti* Bangs—♀ old adult; the type, Citronelle, Fla. (No. 2451, Bangs coll.)
5. *Sciuropterus volans* (L.)—♂ old adult, Liberty Hill, Conn. (No. 4269, Bangs coll.)
6. *Sciuropterus silus* Bangs—♂ adult; the type, top of Katis Mountain, White Sulphur Springs, W. Va. (No. 4931, Bangs coll.)



Bangs, Outram. 1896. "A review of the squirrels of eastern North America." *Proceedings of the Biological Society of Washington* 10, 145–167.

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